IAS | INSTITUTE FOR ADVANCED STUDY

Report for the Academic Year
2014–2015

Table of Contents

DAN KOMODA

Report of the Chairman

Since the Institute's establishment in 1930, its independence and excellence have been almost fully reliant on philanthropy, and in 2014–15, we were fortunate to successfully complete our five-year Campaign for the Institute. Vice Chairman James Simons and his wife Marilyn and my wife Lisa and I were moved to provide a $100 million challenge grant in 2011 that brought in an additional $112 million. Trustee contributions to the Campaign were significant, among them a $20 million gift from David Rubenstein, which will support the creation of a new building to be known as Rubenstein Commons. Remarkably, more than 1,600 former Members, Friends of the Institute, Faculty, Staff, and foundations contributed.

The total $212 million given during the course of the Campaign strengthens IAS in a variety of ways. Some $149 million will be added to the IAS endowment, creating three new endowed Professorships and twelve new Membership endowments. Among these are four Memberships in the Schools of Natural Sciences and Mathematics endowed by a grant from the Schwab Charitable Fund, made possible by the generosity of Trustee Eric Schmidt and his wife Wendy, and two Memberships across the Institute's four Schools endowed by Infosys. Equally essential, $43 million provides for the current operations of the Institute.

In the last year, the Board added a number of distinguished Trustees—Narayana Murthy, Founder of Infosys Limited; Afsaneh Mashayekhi Beschloss, Founder and Chief Executive Officer of the Rock Creek Group; Jonathan Nelson, Founder and Chief Executive Officer of Providence Equity Partners; and Sandra Peterson, Group Worldwide Chairman of Johnson & Johnson. We are very grateful for the contributions of Peter Kann, who was elected Trustee Emeritus, and Cynthia Carroll and John Hendricks, who transitioned off of the Board. We were also deeply saddened by the deaths of Trustee James Schiro and Trustees Emeriti Ralph Hansmann and László von Hoffmann. They will be greatly missed and remind us of the importance of upholding the Board's strong record of exceptional service.

The Institute's role in promoting and cultivating original scholarship in the sciences and humanities is unparalleled. It is of the utmost importance to sustain the work of its Faculty and Members and to continue the great traditions of the Institute for future generations.

Charles Simonyi
Chairman of the Board

Report of the Director

The Institute for Advanced Study is one of the most exciting places in the landscape of new ideas and education. It brings together academics of the highest level, and it is a symbol, with an exceptional record of achievement, for the importance of academic freedom and basic research.

Our Faculty and current and former Members are frequently recognized for major contributions to their fields. Phillip Griffiths, Professor Emeritus in the School of Mathematics, was awarded the 2014 Chern Medal; Jonathan Israel, Andrew W. Mellon Professor in the School of Historical Studies, was recognized with the 2015 PROSE Award; and Professor Angelos Chaniotis received a 2015 Anneliese Maier Research Award to fund a series of research activities, among them the study of graffiti in Aphrodisias and the history of emotions in the Greek world.

We were delighted to announce the appointment of Jonathan Haslam, who will join the School of Historical Studies as George F. Kennan Professor as of July 1, 2015. Most recently Professor of the History of International Relations at the University of Cambridge, Jonathan is one of the world's most distinguished scholars on the history of thought in international relations.

It is with regret that Professors Danielle Allen and Dani Rodrik in the School of Social Science left the Institute for personal reasons at the end of June. The Institute is grateful for their contributions. I have the utmost confidence that the School will be rebuilt on new grounds inspired by the legacy of its

founders and by the recommendations of a special advisory committee chaired by Trustee Emeritus Harold Shapiro, former President of Princeton University. We are fortunate to benefit from the commitment and guidance of Didier Fassin, James D. Wolfensohn Professor in the School, Professor Emerita Joan Scott, and Professor Emeritus Michael Walzer in this process.

In the School of Historical Studies, we were deeply saddened by the death of Professor Emerita Patricia Crone on July 11, 2015, after a courageous fight against cancer. Patricia, who brought about lasting change in the field of Islamic studies, leaves an indelible and powerful legacy at the Institute and in the world at large. Another great loss was that of physicist Marvin "Murph" Goldberger, the Institute's sixth Director from 1987–91, who died on November 26, 2014. Murph created positive growth and change through Faculty appointments and campus building projects, among other initiatives, and his influence continues to be deeply felt here.

The Institute's work, as described in the following pages, has always been firmly rooted in the future, its current research pointing the way to deeper discoveries and breakthroughs ahead. I am immensely grateful to our Trustees, Faculty, Members, Friends, foundations, and other donors for supporting our Faculty and Members in their critical foundational research.

Robbert Dijkgraaf
Director and Leon Levy Professor

Charles Simonyi (above), Chairman of the Board of Trustees, gives opening remarks during the biannual Board meeting in May. Robbert Dijkgraaf (below), Director of the Institute and Leon Levy Professor, addresses participants of the Prospects in Theoretical Physics program with a talk, "Introduction to Topological and Conformal Field Theory," available at www.ias.edu/videos/2015/dijkgraaf-pitp.

Members on the South Lawn

The Institute for Advanced Study

It was founding Director Abraham Flexner's belief that if the Institute "eschews the chase for the useful, the minds of its scholars will be liberated, they will be free to take advantage of surprises, and someday an unexpected discovery, apparently leading nowhere, will be found to be an indispensable link in a long and complex chain that may open new worlds in theory and practice."

FROM THE DEVELOPMENT of programmable computers and the uncovering of the deep symmetries of nature to advances in societal understanding and historical practice, long and complex chains of knowledge have developed through research originating at the Institute for Advanced Study for more than eighty-five years.

Albert Einstein was one of the first in a continuous line of distinguished Institute scientists and scholars who have produced a deeper understanding of the physical world and of humanity. Yet the Institute's remarkable history does not seem to weigh heavily on current scholars and scientists. Instead, the atmosphere focuses on the present, where every twist and hairpin bend changes our view. What do we know? What do we yet need to understand? How should we try to comprehend it?

Work at the Institute takes place across historical studies, mathematics, natural sciences, and social science. Currently, a permanent Faculty of some thirty eminent academics each year award fellowships to some two hundred visiting Members, from about one hundred universities and research institutions throughout the world. The Institute's reach has been multiplied many times over through the more than seven thousand Members who have influenced entire fields of study as well as the work and minds of colleagues and students. Thirty-three Nobel Laureates and forty-one out of fifty-six Fields Medalists, as well as many winners of the Wolf and MacArthur prizes, have been affiliated with the Institute.

At the Institute, everything is designed to encourage scholars to take their research to the next level. This includes creating and sustaining an environment where Members live in an academic village of apartments, originally designed by Marcel Breuer in 1957, at the edge of the Institute's eight hundred acres of campus, woodland, and farmland. Members eat in the same dining hall, share common rooms and libraries, and carry out their work in an institutional setting where human scale has been carefully maintained to encourage the sharing of ideas, mutual understanding, and friendship.

DAN KOMODA

Each year a new intellectual mix is created by the Members, ranging from young postdoctoral fellows to distinguished senior professors, who typically stay a year but may stay up to five years and return for subsequent visits throughout their careers. A period spent as a Member is often a life-changing experience. Young scholars meet the contemporaries who, with them, will be leading figures in their field in the future. Senior Members have the time and freedom to initiate new lines of research. Freed from teaching and administration, Members are afforded opportunities for discussing their work with scholars and scientists from other fields. Here they are given the time to take advantage of serendipitous encounters at lunch, teatime, or at After Hours Conversations, an interdisciplinary program to encourage wide-ranging conversations in an informal environment.

In the 2014–15 academic year, the Institute co-sponsored with the Mathematical Sciences Research Institute the country's first National Math Festival, a three-day celebration in Washington, D.C., designed to energize public and private support for the importance of mathematics and basic science. Kristen Ghodsee, Member (2006–07) in the School of Social Science, was elected President of the Board of Trustees of the Association of Members of the Institute for Advanced Study, and Deborah Lunder succeeded Jack Kerr as Chair of the Friends of the Institute for Advanced Study.

Throughout the year, the Institute hosts a broad array of concerts, lectures, and programs for the Institute community and the public. In addition, the Institute offers numerous and varied activities for Members, Visitors, and their families—from family science talks and children's activities to play readings, jazz evenings, tennis lessons, and trips to museums and other cultural sites.

Fundamental research at the Institute furthers our grasp of a world of diverse facts, structures, ideas, and cultures. This is due in large part to the precious freedom that Faculty and Members at the Institute experience—an independence enabled by the generosity of the Institute's founders and subsequent benefactors. We share the conviction of our founders that such unrestricted deep thinking will change this world, but where and how is always a surprise.
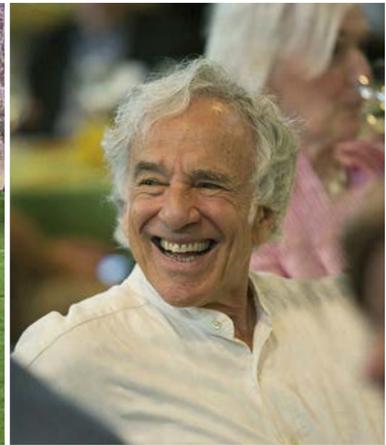
During a colloquium in honor of Professor Emerita Patricia Crone, Daniel Sheffield of Princeton University (above) discusses nativism and prophethood in the context of Āẕar Kayvān, whose principle of ṣulḥ bā hama (civility with all) influenced a movement popularly painted as an early modern forerunner of Indian secularism.

School of Historical Studies

The School of Historical Studies, established in 1949 with the merging of the School of Economics and Politics and the School of Humanistic Studies, actively promotes interdisciplinary research and cross-fertilization of ideas, thereby encouraging the creation of new historical enterprises.

THE SCHOOL OF HISTORICAL STUDIES bears no resemblance to a traditional academic history department, but rather supports all learning for which historical methods are appropriate. Its Faculty and Members embrace a historical approach to research throughout the humanistic disciplines, from socioeconomic developments, political theory, and modern international relations to the history of art, science, philosophy, music, and literature. In geographical terms, the School concentrates primarily on the history of Western, Near Eastern, and Far Eastern civilizations, with emphasis on Greek and Roman civilization, the history of Europe (medieval, early modern, and modern), the Islamic world, and East Asia. Support has been extended to the history of other regions, including Central Asia, India, and Africa.

The Faculty and Members of the School do not adhere to any one point of view but practice a range of methods of inquiry and scholarly styles, both traditional and innovative. Uniquely positioned to sponsor work that crosses conventional departmental and professional boundaries, the School actively promotes interdisciplinary research and cross-fertilization of ideas, thereby encouraging the creation of new historical enterprises.

In 2014–15, Professor **Yve-Alain Bois** spent more time than he had expected fine-tuning the first volume of his catalogue raisonné of the paintings and sculptures of the American artist Ellsworth Kelly (it went to press in March). Other such fine-tuning tasks followed: that of the three-volume catalogue of the Henri Matisse holdings of the Barnes Foundation (scheduled to be released in January 2016) and that of a multi-author dossier on the French artist Jean Dubuffet to appear in the fall issue of the journal *October*, of which he is an editor, in conjunction with an exhibition of Dubuffet's works at the Morgan Library.

Although this did not leave Bois much time for any other scholarly activity, he gave the closing remarks in the symposium "Make It New,"

FACULTY

Yve-Alain Bois

Angelos Chaniotis

Nicola Di Cosmo
Luce Foundation Professor in East Asian Studies

Patrick J. Geary

Jonathan Israel
Andrew W. Mellon Professor

Sabine Schmidtke

PROFESSORS EMERITI

Glen W. Bowersock

Caroline Walker Bynum

Giles Constable

Patricia Crone

Christian Habicht

Irving Lavin

Peter Paret

Heinrich von Staden

Morton White

devoted to contemporary painting, at the Clark Institute in Williamstown, Massachusetts, in September. In October, he gave a lecture on Ellsworth Kelly and his involvement with architecture, and he moderated a session on modern art and architecture in the symposium "L'Architettura e le Arti 1945–1970. Paragoni e Intertesti" at the American Academy in Rome. In November, he gave a talk on Dubuffet and Picasso at the Wexner Center for the Arts in Columbus, Ohio. In February, he gave a talk in conjunction with the exhibition *Monet/Kelly* at the Clark Institute. In March, he gave the annual Jaime Sabartès Lecture at the Museo Picasso in Barcelona, which he repeated in Paris at a three-day symposium organized by the Musée Picasso. And, in April, he talked at the American Philosophical Society in Philadelphia on the topic "Can a Fake Picasso Be Genuine?"

Due to the numerous editorial tasks he had to accomplish this year, Bois's publications were limited in number. They included an essay revisiting Rosalind Krauss's seminal 1979 text on "Sculpture in the Expanded Field"; an exhibition catalogue on the interaction between the work of Claude Monet and that of Ellsworth Kelly; and a study of the concept of "pseudomorphism," forged by Erwin Panofsky, and the "use and abuse of look-alikes" in art history.

At the Institute, Bois's art history seminar benefited from convergence in several interests of its participants—notably the issue of the perception of sculpture (and the positioning of the beholder) from medieval to contemporary art, and that of

the connection between texts and images. Besides several sessions devoted to discussing a trove of canonical texts on these topics, Members presented papers related to their specific projects. Member Sarah Betzer spoke about the reception of Greco-Roman sculpture in eighteenth- and nineteenth-century art (the discussion that followed was particularly interesting, given that Alex Potts, another Member and participant in the seminar, had extensively written on this topic in the past). Betzer also gave a paper about a mysterious, almost never publicly shown painting by Jean-Auguste-Dominique Ingres. Member Michael Cole spoke about a little known Renaissance artist, Sofonisba Anguissola, on whom he decided to write a monograph while at the Institute. Potts spoke about nineteenth-century naturalism and particularly the work of Max Lieberman. Member Linda Goddard spoke about Gauguin's strange (and numerous) illustrated manuscripts-as-collages and the way his integration of heterogenous material relates to his pictorial practice. And Member Vincent Debiais spoke about the representation of silence in medieval art.

The main focus of Professor **Angelos Chaniotis**'s work remains the study of epigraphic evidence and the information it provides for Greek social, cultural, and religious history. He co-edited *Supplementum Epigraphicum Graecum* LX (Leiden, 2014) and worked on his book *Epigraphic Research at Aphrodisias, 1995–2014*. His epigraphic research is now supported by an Anneliese Maier Research Award (€250,000; 2015–20). This award is given by the Alexander

von Humboldt Foundation in Berlin to internationally established researchers from the fields of the humanities and social sciences in order to promote research collaborations with specialists in Germany. In collaboration with the University of Munich, Chaniotis will use this grant to fund a series of research activities, including the edition of the *Supplementum Epigraphicum Graecum*, the publication of inscriptions and graffiti in Aphrodisias, and the study of epigraphic evidence for the history of emotions in the Greek world. Several Members and Visitors in ancient studies in the academic year 2014–15 shared similar interests in documentary evidence (inscriptions and papyri) and in the history of emotions. Subjects related to these research areas were treated both in the Ancient Studies Seminar (October 2014–April 2015) and the third Epigraphic Friday (March 13, 2015).

Continuing his research on "The Social and Cultural Construction of Emotions: The Greek Paradigm," a project funded by the European Research Council (2009–13), Chaniotis wrote and published a series of articles on the role of emotions in politics and diplomacy in Greek antiquity. He is currently putting together a collective volume (*Unveiling Emotions III: Display and Arousal of Emotions in the Greek World*) and preparing, together with Nikos Kaltsas (Athens) and Ioannis Mylonopoulos (Columbia University), an exhibition on this subject at the Onassis Cultural Center in New York.

He also worked on a book manuscript that will present a history of "The Greek World from Alexander to Hadrian" and lectured in the United States, Canada, Japan, Israel, the United Kingdom, and Greece. Many of his lectures focused on his new research on the transformations of nightlife from the fourth century B.C.E. to the fourth century C.E.; he is the convener of a conference on this subject that will take place at the Fondation Hardt in Geneva in 2017.

As a member of the Italian Comitato Nazionale dei Garanti per la Ricerca and the scientific committee "Sciences Humaines et Sociales" of the National Fund for Scientific Research in Belgium, he contributed to the evaluation of re-

Several Members and Visitors in Ancient Studies in the academic year 2014–15 shared similar interests in documentary evidence (inscriptions and papyri) and in the history of emotions. Professor Angelos Chaniotis, seen here with Member and Elizabeth and J. Richardson Dilworth Fellow Jonathan Jay Price (right), continues to study epigraphic evidence and the information it provides for Greek social, cultural, and religious history.

Nicola Di Cosmo (center), Luce Foundation Professor in East Asian Studies, continues to work on a National Science Foundation project on climate change in Mongolia. In the spring, he traveled to archaeological sites relevant to his research, among which the most important is Shimao, a 4,000-year-old massive palace located to the north of the birthplace of Chinese civilization.

search in the humanities in these countries.

In 2014–15, **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, continued to work on the National Science Foundation project on climate change in Mongolia. The focus on climate and history offered the opportunity to establish a collaborative relationship with Princeton University's workshop (and larger project) held in May 2015 on climate and Byzantine Anatolia, where he presented a paper. During the spring, he was on sabbatical leave in China, where he was hosted by New York University–Shanghai University. During the period from January to May, he established an extensive network of contacts with Chinese academic institutions and colleagues. He was invited to lecture at Fudan University, Peking University, and Nanjing University (Institute for Advanced Study). Moreover, he traveled to archaeological sites relevant to his research, among which the most important is Shimao. In all likelihood this 4,000-year-old massive palace located to the north of the birthplace of Chinese civilization will emerge as the most important archaeological discovery in China in the twenty-first century, although archaeological work is currently impeded by local social problems.

Among the other research activities to be noted is a study (submitted for publication and presented at a workshop on "Sovereignty" in Kandersteg, Switzerland) on the question of "sovereignty" in the context of the construction of Manchu power before the Manchu conquered China (Qing dynasty), arguing for a notion of sovereignty that is dynamic and determined by the nature of the political community to which it refers, rather than steeped in religious beliefs or ritual practice. Given the relevance of the Qing dynasty to the self-image of contemporary China, this study may have relevance beyond its historical period. A second project lies at the intersection of history, science, and anthropology, and posits, on the basis of climate and environmental data, that social change —such as the formation of empires, but also migration and conquest—are affected by "vulnerability" rather than "dependency" upon sedentary societies. This historical investigation may contribute to a growing discussion in social science about vulnerability, resilience, and conflict in modern societies. Moreover, Di Cosmo taught two courses at NYU–Shanghai, one of which focused on the historical relevance of scientific data, leading students to discover ways in which historians can enrich our understanding of the past through the use of science.

The academic work of Members in East Asian studies was intense and continued during Di Cosmo's sabbatical leave. The seminars (eleven) included topics ranging from environmental history (David Bello) to history of medicine (Asaf Goldschmidt), from legal studies (Teemu Ruskola) to Cold War cinema (Poshek Fu), from Einstein in China (Danian Hu) to ancient imperial rituals (Xin Luo) and funerary objects (Guolong Lai), and from Korean royal hunting (George Kallander) to the evolution of Mandarin in late imperial China (Richard VanNess Simmons), together with a focus on Tang literature (Wendy Swartz and Jinhua Jia).

Professor **Patrick Geary** continued to direct his long-term, collaborative, and interdisciplinary project that brings together geneticists, historians, and archaeologists from the United States, Germany, Italy, Austria, Hungary, Britain, and the Czech Republic to study early medieval population demographics through the analysis of ancient DNA. With co-Princi-

STUDYING THE NATURE OF THE RELATIONS that existed among Asian rulers and polities in history reveals the importance of the quest for legitimacy of rule in shaping those relations. Each ruler sought domestic and external legitimacy in accordance with the belief system of the world in which he operated and that he, at times, helped shape. In 2014–15, Michael van Walt van Praag, Visiting Professor of International Relations and International Law, started a deeper exploration into the quest of rulers for legitimacy in Inner and East Asia from the thirteenth century on, while completing work on an edited volume on Asian relations from that period to the early twentieth century. Understanding past conceptions of legitimacy helps us appreciate the differing notions of legitimacy of states and governments that exist today and that often contribute to the difficulties of resolving long-standing conflicts.

Van Walt van Praag presented some of the practical applications of the outcome of his historical research for addressing current conflicts in Asia at a number of closed-door meetings with policy- and decision-makers in Washington, D.C., and London. The positive reception of the ideas presented have now led to the formulation of an even more focused research project that will involve some thirty scholars from Asia and the West who will work on the application of van Walt van Praag's research on addressing conflicting perceptions of history in peace processes specific to the intractable Sino-Tibetan conflict.

Van Walt van Praag organized a series of seminars for the Members of the School in the field of what is loosely called "modern international relations," but which in fact covers a variety of topics of study spanning the eighteenth and twentieth centuries. This year, the presentations and discussions focused primarily on imperial policies of the Ottomans, the Qing, and the Italians and explored their interface with and interpretations of international law. World War I and the Cold War continued to be, as was the case in past years, important subjects of study by Members and therefore of debate within the group's seminars.

pal Investigator Krishna Veeramah of Stony Brook University, he has been awarded a National Science Foundation grant to continue the project. A first, preliminary study comparing the relationships between medieval and modern populations in the Piedmont region of Italy appeared in *PLOS ONE* and suggested that the continuity between the two, if it exists at all, is quite weak, thus suggesting the importance of analyzing ancient DNA in historical research rather than attempting to extrapolate from modern DNA to the populations of earlier periods. A second, general study outlining the project "Rethinking Barbarian Invasions through Genomic History" appeared in the journal *Hungarian Archaeology*. In May, his team completed the nuclear DNA capture of samples from Hungary and Italy and are now moving to the sequencing and analysis of the results. He has presented the project and its preliminary results in lectures at the University of Oslo, Queens College Belfast, and the University of Zagreb.

In addition, he published a number of essays and a collected volume with János Bak and Gábor Klaniczay, *Manufacturing a Past for the Present: Forgery and Authenticity in Medieval Texts and Objects in Nineteenth-Century Europe*, that explores nineteenth-century attempts to invent a medieval past. He continues to mentor the American Academy in Rome's Andrew W. Mellon Foundation-sponsored seminar "Framing Medieval Mediterranean Art," and he similarly served as a mentor at a Norwegian-sponsored workshop held in Istanbul on early medieval graphic signs of authority. In Tunis, he advised a French–Tunisian collaboration on the development of a collaborative history of the Western Christian and Islamic worlds in the Middle Ages. At the Humboldt Foundation Preisträger-Forum, he delivered a lecture on lordship and dominance at the end of antiquity and gave additional lectures at conferences in Paris, Bangor, Pula, and Rome. For the twentieth consecutive year, he chaired the M.A. defenses at the Department of Medieval Studies at the Central European University in Budapest.

At the Institute, he hosted a workshop on the "Transformation of the Carolingian World" as well as the S. T. Lee Lecture by Johannes Krause, Director of the Max Planck Institute for the Science of Human History, in conjunction with a workshop on "Integrating Genomics and Human History: Challenges and Opportunities."

During the last academic year, Professor **Jonathan Israel** has mainly been engaged in completing his book on the global impact of the ideas and principles of the American Revolution. The object is to demonstrate and analyze the complex influences of developments in America during the last part of the eighteenth century, especially ideological innovations, on the subsequent revolutions in France, the Low Countries, Spain, Greece, Latin America, and so forth, and on the radical reformers of the early nineteenth century in Britain, Canada, and other parts of the world.

In the aftermath of the publication of his *Revolutionary Ideas* (Princeton University Press, 2014), which won the 2014 PROSE Award for History, there have been a number of academic and public debates centering around his interpretation of the role of Radical Enlightenment on democratic ideas in the ideological battles of the French Revolution. In this connection, he has participated in debates in various periodicals and in person at the Princeton Public Library, at Brock University in Ontario, at the Telos Institute in New York, at the University of Maine in Bangor, in Rotterdam, and at the German Historical Institute in Paris. He has also given public lectures and participated in other conferences in New York, Marburg, Bath, Stockholm, Thessaloniki, Gent, Brisbane, Canberra, and Vienna. Last year's debate held at Halle, in Germany, centering around his interpretation of the Enlightenment, was published in *Concepts of (Radical) Enlightenment: Jonathan Israel in Discussion*, edited by Frank Grunert, IZEA Kleine Schriften, 5/2014 (Halle, 2014).

The workshop that Israel led during this academic year focused mainly on aspects of European history during the early modern period, including several discussion papers on France before and after the Revolution, on Spain, the Renaissance, and the Enlightenment, and on religious minorities such as the Huguenots and Dutch Remonstrants.

He also participated once more as one of the organizers of the Eighteenth-Century Studies Seminar, jointly organized by the Institute and the Princeton University history department.

In addition to several book reviews, Israel published "The Polish and Wider Central European Enlightenment—Was There a Radical Tendency?" *European Review*, vol. 23, no. 3 (2015); "The Enlightenment" in *The Encyclopedia of Political Thought*, vol. III, edited by M. T. Gibbons (West Sussex, UK, 2015); "Grotius and the Rise of Christian 'Radical Enlightenment'" in *Grotiana*, edited by H. W. Blom, vol. 35, issue 1 (Leiden, 2014); "Democratic Republicanism and One Substance Philosophy: On the Connection of the Two Disparate Concepts" in *Concepts of (Radical) Enlightenment: Jonathan Israel in Discussion*, IZEA Kleine Schriften, 5/2014 (Halle, 2014); the foreword to *Atheism and Deism Revalued: Heterodox Religious Identities in Britain, 1650–1800*, edited by Wayne Hudson, Diego Lucci, and J. R. Wigelsworth (Farnham, Surrey, 2014); "Introduction" to *Spinoza: Political Treatise*, translated and annotated by Karel D'Huyvetters (Amsterdam, 2014); and "Curaçao, Amsterdam, and the Rise of the Sephardi Trade System in the Caribbean, 1630–1700" in *The Jews in the Caribbean*, edited by Jane S. Gerber (Portland, Oregon 2014).

In 2014–15, Professor **Sabine Schmidtke** focused on the Shii (Zaydi) tradition of Yemen and Northern Iran. She co-edited *The Yemeni Manuscript Tradition* (Leiden, 2015) and worked on her three-volume book project (in collaboration with Member Hassan Ansari) "License to Transmit: The Spread of 'Mutazilī and Zaydī Thought as Documented in Ijāzas"—she hopes to complete the first out of three volumes in the coming year. In the field of Islamic theology, she completed the *Oxford Handbook of Islamic Theology* (Oxford University Press), which is scheduled for publication in early 2016, as well as the co-edited *Oxford Handbook of Islamic Philosophy*, to be published by mid-2016. In addition, she co-edited a volume on another topic of Islamic theology and law, *Accusations of Unbelief: A Diachronic Perspective on Takfīr* (Leiden, in press). She also finalized another issue of her journal

Intellectual History of the Islamicate World on the topic "New Horizons in Graeco-Arabic Studies" (co-edited with Dimitri Gutas and Alexander Treiger) and is currently preparing the next issue on "Histories of Books in the Islamicate World" (to be published in March 2016). In the field of the Arabic Bible tradition, she delivered an IAS public lecture, "Muslim Perceptions and Receptions of the Bible" (https://video.ias.edu/schmidtke-lecture), gave another lecture at Leuven University on Quṭb al-Dīn al-Rāwandī's reception of the Bible, and completed the article "The Muslim Reception of the Bible: al-Māwardī and His *Kitāb A'lām al-nubuwwa*" (in press). In addition, she began working on a collaborative project, a critical edition of the translation of the Bible into Arabic by Ḥārith b. Sinān.

Over the course of the year, Schmidtke organized two major events at the Institute. First was a colloquium in honor of Professor Emerita Patricia Crone in February 2015, consisting of two sessions on Islamic studies (with lectures by Everett Rowson, Michael Cook, and Sarah Stroumsa) and on Iranian studies (with lectures by Hassan Ansari, Kevin van Bladel, and Daniel J. Sheffield). Secondly, in collaboration with Member Amy Singer, Schmidtke organized "The Digital Ottoman Workshop" to establish a transnational digital space in which to share source materials, datasets, and scholarly work related to the Ottoman world. While both events were held at the Institute, Schmidtke co-convened two further events outside of Princeton: first, in March 2015, an international conference, "Histories of Books in the Islamicate World," which was held at the Consejo Superior de Investigaciones Científicas in Madrid, and, secondly, a one-day conference cosponsored by New York's Jewish Theological Seminary on the topic "Jewish-Muslim Polemics."

Schmidtke spent much of her time at the Institute with a large and diverse group of Members studying subjects related to the Near and Middle East, though not necessarily to Islam. The group was highly international, with Members from Iran, Israel, Ukraine, the United Kingdom, and the United States. Over the course of the year, Members met in a lively biweekly seminar (in addition to a great deal of socializing), which was also frequented by Members of the School of Social Science, Princeton University graduate students and faculty, former IAS Members, as well as occasional visitors. The main subjects studied by the group and presented in the seminars related to Islamic law (Marion Katz, Hassan Ansari), Ottoman history (Amy Singer, Nader Sohrabi), intellectual traditions (philosophy and logic) of the postclassical era (Mykhaylo Yakubovych), as well as Rabbanite Judaism (Moulie Vidas) and Arabic philology (Geoffrey Khan).

In October 2014, Professor Emeritus **Glen Bowersock** was in Paris for radio and television interviews to launch the French translation of his book *The Throne of Adulis*. Because the book addresses the history of Arab Jews in the region of modern Yemen only a few decades before Muhammad, those interviews were lively and often turned to contemporary affairs. During that time in Paris, Bowersock went to Université François-Rabelais, Tours, to speak at a conference in honor of former IAS Member Maurice Sartre on the occasion of his retirement. His lecture was devoted to an extraordinary late third-century Christian chapel discovered during work at the Megiddo prison in Israel. This chapel has mosaic inscriptions that name a Roman centurion from a nearby Roman legionary camp as the donor, and it identifies women congregants who celebrated "God Jesus Christ." This is the earliest known documentary evidence for that formulation of Christ's nature. Bowersock later presented much of this material at the University of Knoxville, along with a seminar on pagan angels and new images of them.

Bowersock showed Member Holger Afflerbach, who is a historian of the First World War, the text of a detailed diary kept at the Versailles Peace Conference by the papyrologist William Westermann, who attended as a delegate. Bowersock had photocopied this diary long ago in anticipation of finding the right person to examine it. He hopes that Afflerbach or a student may now be able to publish this work. It includes conversations with many famous people of the time, as well as sketches of some of them.

Among Bowersock's new publications were several reviews for the *New York Review of Books*, including one on cuisine in world history and another on money in the growth of the early Christian church. He also finally published a fragmentary bilingual inscription, in Greek and Nabataean Aramaic, from the North Ridge at Petra in Jordan. Recently, to his great surprise, a bilingual inscription turned up in Yemen, with texts in Nabataean and Sabaic (ancient South Arabian). Although the Nabataeans' capital was Petra, this new find shows them unexpectedly near Marib under Augustus. Earlier work of Bowersock's on a Greek graffito from a synagogue on the Yemeni southern coast proved to be of interest to Member Jonathan Price, who was working on ancient synagogues outside Palestine.

In the first year following **Patricia Crone**'s retirement in June 2014, and in the midst of battling cancer, she nevertheless

Professor Emerita Patricia Crone (right) at tea with Professor Sabine Schmidtke (center)

succeeded in publishing three new articles, including "Traditional Political Thought" in *Islamic Political Thought: An Introduction*, edited by Gerhard Bowering and published by Princeton University Press; "Problem in Sura 53" in the *Bulletin of the School of Oriental and African Studies*; and "Jihad: Idea and History" in *Cosmopolis*. A revised edition of her book *Pre-industrial Societies* also appeared in 2015, published by Oneworld, and a festschrift in her honor, *Islamic Cultures, Islamic Contexts: Essays in Honor of Professor Patricia Crone*, which examines her strong and uncompromising character as a scholar and her deep and varied impact on Islamic and Iranian studies, was published by Brill (edited by Behnam Sadeghi, Asad Q. Ahmed, Adam Silverstein, and Robert Hoyland).

Despite her ailing health, Crone also joined many of her colleagues and friends at a colloquium in her honor that was hosted by the Institute on February 25, 2015, and she continued her work on several publications that are still forthcoming. Those include an article (to appear in the *Journal of Near Eastern Studies* later this year) titled "Jewish Christianity and the Qur'an' (Part One)" and three volumes of her *Collected Studies*: "The Qur'ānic Pagans and Related Matters," "The Iranian Reception of Islam: The Non-Traditionalist Strands," and "The Ancient Near East and Islam," to be published by Brill in 2016. Sadly, these last publications will appear posthumously, following her untimely death on July 11, 2015. The Institute for Advanced Study mourns her loss.

In the 2014–15 academic year, Professor Emeritus **Peter Paret** lectured on works of art as historical documents at the Goethe Institute in Washington, D.C., and the University of Utah, gave a paper on Ernst Cassirer as historian at the Ernst Cassirer conference at Yale University, and gave a lecture on the Berlin Secession and the politics of culture at the Akademie der Künste in Berlin, in conjunction with attending the annual meeting of the Advisory Board of the Max Liebermann Gesellschaft. He published a volume of essays on cultural history, *Clausewitz in His Time* (Berghahn, 2014), in which he discusses important new documents on the development of Clausewitz's ideas on history and theory and on the relation of Clausewitz's ideas with theoretical and literary works of the time. He also published "Translation, Literal or Accurate" in *The Journal of Military History*, vol. 78, no. 3 (July 2014) and "Machiavelli, Fichte, and Clausewitz in the Labyrinth of German Idealism" in *Etica e Politica/Ethics & Politics* XVII (2015), a special issue edited by L. A. Macor. Publication of *The Second Generation*, edited by Andreas Daum et. al., which includes Paret's autobiographical essay, "External Events, Inner Drives," was delayed and will now appear early in 2016.

2014–15 MEMBERS AND VISITORS

f First Term ✦ *s* Second Term ✦ *v* Visitor ✦ *vp* Visiting Professor ✦ *a* Research Assistant

Holger Horst Afflerbach
Modern History ✦ University of Leeds
Funding provided by the Fund for Historical Studies

Hassan Farhang Ansari
Intellectual and Legal Studies ✦ Institute for Advanced Study
Elizabeth and J. Richardson Dilworth Fellow

Marco Barducci
Intellectual History ✦ Institute for Advanced Study
Gerda Henkel Stiftung Member

Robert J. Bartlett
Medieval History ✦ University of St Andrews
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Adam G. Beaver
Spain and the Renaissance Mediterranean
Princeton University
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

David Anthony Bello
Late Imperial Chinese History, Environmental History ✦ Washington and Lee University
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Martin Bentz
Classical Archaeology ✦ Universität Bonn ✦ *v, f*

Sarah Betzer
Eighteenth- and Nineteenth-Century Art ✦ University of Virginia
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John P. Bodel
Ancient History ✦ Brown University ✦ *s*
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Ari Bryen
Ancient History ✦ West Virginia University
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Suzannah Clark
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Edward T. Cone Member in Music Studies

Michael Cole
Renaissance and Baroque Art ✦ Columbia University
The Gladys Krieble Delmas Foundation Member; additional funding provided by the Elizabeth and J. Richardson Dilworth Fellowship Fund

Joan Breton Connelly
Classical Archaeology ✦ New York University ✦ *v, s*

David Bruce Crouch
Medieval History (Aristocracy) ✦ University of Hull ✦ *s*
Elizabeth and J. Richardson Dilworth Fellow

Olindo De Napoli
Colonialism, International Law ✦ Università degli Studi di Napoli Federico II
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Vincent Debiais
History and Theory of Medieval Art ✦ Centre National de la Recherche Scientifique, Paris
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Poshek Fu
Modern Chinese Studies, Film History ✦ University of Illinois at Urbana-Champaign
AMIAS Member

Ottó Sándor Gecser
Medieval Religious History and History of Medicine
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Linda Jane Goddard
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Agnes Gund and Daniel Shapiro Member

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History of Chinese Religions, Literary Studies
University of Macau ✦ *s*

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Geoffrey Allan Khan
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Guolong Lai
East Asian Art and Archaeology ✦ University of
Florida
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Vayos Liapis
Classics ✦ Open University of Cyprus ✦ *f*
Elizabeth and J. Richardson Dilworth Fellow

Xin Luo
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John Mark Marincola
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College of Criminal Justice, The City
University of New York
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Foundation Fellowships for Assistant Professors*

Alexander Desmond Potts
*Nineteenth- and Twentieth-Century Art and
Theory* ✦ University of Michigan
*Funding provided by The Andrew W. Mellon
Foundation*

Jonathan Jay Price
Ancient History, Epigraphy ✦ Tel Aviv
University ✦ *f*
Elizabeth and J. Richardson Dilworth Fellow

Nicole Reinhardt
Early Modern Political and Religious Culture
Durham University
Elizabeth and J. Richardson Dilworth Fellow

Teemu Ruskola
Chinese Legal History ✦ Emory University
Friends of the Institute for Advanced Study Member

Patrick Sänger
Ancient History, Papyrology ✦ Universität Wien ✦ *f*
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William Michael Schmidli
International Cold War History ✦ Bucknell
University
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Edward Schoolman
Early Medieval Italy ✦ University of Nevada, Reno
George William Cottrell, Jr., Member

Richard VanNess Simmons
Chinese Dialects, Phonology, and History
Rutgers, The State University of New Jersey ✦ *s*
*The Starr Foundation East Asian Studies
Endowment Fund Member*

Amy Elizabeth Singer
Ottoman History ✦ Tel Aviv University
William D. Loughlin Member

Nader Sohrabi
Ottoman History, Iranian History ✦ Carleton
College
*Funding provided by the Herodotus Fund and the
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Vlada Stankovic
Byzantine and Balkan Studies ✦ University of
Belgrade
Willis F. Doney Member

Owen Stanwood
Atlantic World, Colonial America ✦ Boston College
Hans Kohn Member

Andrea Sterk
Late Antiquity ✦ University of Florida ✦ *f*
*Felix Gilbert Member; additional funding provided by
the Elizabeth and J. Richardson Dilworth Fellowship
Fund*

Wendy Swartz
Premodern Chinese Literature ✦ Rutgers, The
State University of New Jersey
Funding provided by the Fund for Historical Studies

Emily Ann Thompson
History of Technology, Sound, Music ✦ Princeton
University

Stephen V. Tracy
Greek History and Epigraphy ✦ Institute for
Advanced Study ✦ *v*

Michael van Walt van Praag
*Modern International Relations and International
Law* ✦ Institute for Advanced Study ✦ *vp*

Moulie Vidas
Rabbinic Literature, Late Antiquity ✦ Princeton
University
*The Andrew W. Mellon Foundation Fellowships for
Assistant Professors*

K. Steven Vincent
Modern European History ✦ North Carolina State
University at Raleigh ✦ *f*
Funding provided by the Fund for Historical Studies

Thomas Wallnig
History of Scholarship ✦ Universität Wien ✦ *s*
*Hans Kohn Member; additional funding provided by
the Herodotus Fund*

Xi Wang
Late Imperial Chinese History ✦ Renmin
University of China ✦ *a, f*

Mykhaylo Yakubovych
Islamic Studies ✦ The National University of
Ostroh Academy ✦ *f*
Willis F. Doney Member

Left: Jonathan Israel (left), Andrew W. Mellon Professor, is writing a book on the global impact of the ideas and principles of the American Revolution. *Center*: Scholars, librarians, geographers, and an engineer participate in a one-week workshop organized by Amy Singer, William D. Loughlin Member, and Professor Sabine Schmidtke to establish a transnational digital space in which to share source materials, datasets, and scholarly work related to the Ottoman world. *Right*: Professor Patrick Geary (center) continues to direct his long-term, collaborative, and interdisciplinary project that brings together geneticists, historians, and archaeologists from the United States, Germany, Italy, Austria, Hungary, Britain, and the Czech Republic to study early medieval population demographics through the analysis of ancient DNA.

AMY RAMSEY

Amy Singer on Designing the Digital Ottoman Project

What makes a digital Ottoman project different from other digital projects and why isn't it a straightforward endeavor but rather one that will probably take several years to develop successfully? And why isn't there one already? Why would twenty-four people need one week together even to figure out where to begin? The Digital Ottoman Platform (DOP) workshop convened at the Institute June 8–12, 2015, to establish a transnational digital space in which to create, collect, and manage source materials, datasets, and scholarly work related to the Ottoman world. The goal is that these resources will be transparently and reliably authored, referenced, and reviewed to ensure that scholarly standards of research and publication are maintained for materials created and made available. The site, its materials, and its datasets will be sustainably managed to serve the global community of scholars, many of whom will also have contributed to the platform from their own research. At the same time, the space will be accessible to students, researchers, and readers worldwide. Our vision is that the DOP will make it possible to locate and share resources and results in original, intermediate, and published formats and to create new collaborations for research and learning. It also aims to identify and document best practices among the dynamically developing digital technologies that now enrich the tools and methodologies of the humanities. Although these efforts focus specifically on Ottoman history, they may well create models for other fields of study or enterprises facing similar challenges. Read more at www.ias.edu/ias-letter/2015/singer-digital-ottoman.

Hassan Ansari on the Necessity of a Historical Approach to Islamic Theology

When Professor Sabine Schmidtke and Member Hassan Ansari, an Iranian national, met more than a decade ago in Tehran, Ansari was a student of the traditional religious system in Qum and Tehran (the "Hawza"). Ansari had read Schmidtke's doctoral thesis *The Theology of al-ʿAllāma al-Ḥillī (d. 726/1325)*, which was translated into Persian and published in Iran in 1999. Schmidtke's scholarship changed Ansari's approach to Islamic sources and was one of the reasons why he became interested in historical studies on Islamic theology. "The historical approach is not only useful, it is necessary," says Ansari. "I talk now as a Muslim scholar. We need to have this kind of historical studies to change our approach to our own intellectual and legal tradition and its holy texts."

What makes Ansari a particularly exceptional scholar is his combination of Western and traditionalist Islamic training. In the "Hawza" in Qum and Tehran, he successfully completed the very highest level of study for the rank of Ayatollah,

DAN KING

in the Shiʿi clerical system. He also has studied Islamic and Western philosophy and Islamic intellectual history at universities in Tehran, Beirut, and Paris. Read more at www.ias.edu/ias-letter/2014/ansari-islam.

## Danian Hu on Chinese Physicists in America

Addressing an international audience in 2004, Professor Dong Guangbi, an erudite historian of science, summarized Chinese physics development over the previous century, and he argued that the country from which Chinese physicists and physics benefited most was the United States of America. Dong's argument was supported by the background of the seven "most creative Chinese physicists."

Five out of these seven received doctorates in America and four of the five—Pei-Yuan Chou, Ta-You Wu, Chen-Ning Yang, and Tsung-Dao Lee—were former Members of the Institute for Advanced Study, indicating the dominating American influence and the significant role of IAS in Chinese development. This essay supports Dong's thesis with additional evidence revealed in my preliminary survey

of Chinese physicists schooled in America during the first half of the twentieth century. The first Chinese physicist to graduate from an American college was most likely Yuanli Hsia (夏元瑮, 1883–1944), one of a few in the first generation of Chinese physicists. Sponsored by the Guangdong Provincial Government, Hsia came to study at Yale University. Upon his graduation in 1907, Hsia went on to the University of Berlin where he studied with Max Planck and Heinrich Rubens before his return to China in 1912. Read more at www.ias.edu/ias-letter/2015/hu-studying-physics.

C. S. Wang Chang at IAS
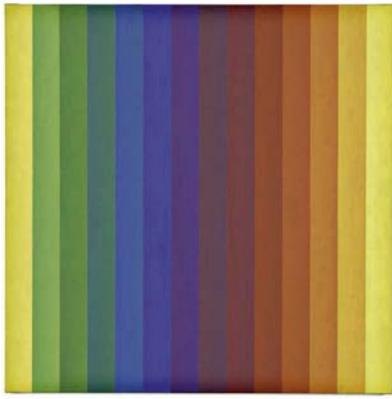
Spectrum I (1953)

YVE-ALAIN BOIS ON ELLSWORTH KELLY: VOLUME I

Ellsworth Kelly likes to recall the incident in which a child, pointing at the five panels of *Painting for a White Wall*, enumerated their colors from left to right and back. It was at this moment that the artist realized that what he had wanted to do in this painting was to "name" colors.

The idea that a juxtaposition of color rectangles was the visual equivalent of a suite of color names had two components, both related to an essential property of language, namely its infinite permutational capability. When the child enumerated the colors of *Painting for a White Wall* in both directions, he produced a permutation on what linguists call the syntagmatic level (in an enumeration, to take the example of the child's utterance, the sequencing of the terms is of no grammatical consequence).

The second aspect of the comparison concerns permutation on what linguists call the paradigmatic level: on this level, it is not a matter of changing the *position* of a given term within a set sequence but it involves the potential for replacing any term in the set sequence with another *absent* term that fits the same grammatical criteria. In "black, rose, orange, white, blue," to take the example of the child's utterance again, the word "black" could be replaced by the word "gray," the word "rose" by the word "purple," orange by red, white by yellow, blue by green—but any other set of color names would do just as well. Read more at www.ias.edu/ias-letter/2015/bois-ellsworth-kelly.
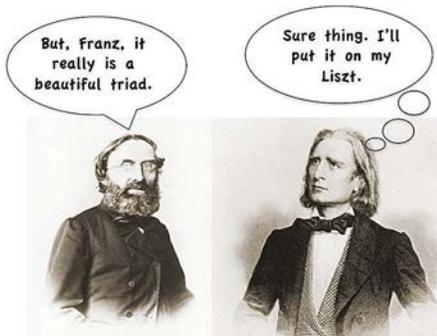
SUZANNAH CLARK ON MUSIC THEORY'S MONSTROUS CHORD

On the second Sunday after Trinity in 1724, the congregation at the Thomaskirche in Leipzig heard Johann Sebastian Bach's new cantata that began with the words *Ach Gott.* Bach set the word *Gott* to the most dissonant triad known at the time: the augmented triad. Bach's own son, Carl Philipp Emanuel Bach, wrote in the second volume of his treatise of 1762 that the offending augmented fifth of this harmony requires careful preparation. His father did not prepare it at all. Acclimatized as we are today to all kinds of dissonances, this harmony might pass the modern listener by. But it would have disconcerted the ears of the eighteenth-century congregation, giving them a God-fearing shudder, while setting the scene for the biblical message of the day. Bach, after all, was setting the tune and words, *Ach Gott, vom Himmel sieh darein*, that Martin Luther had penned exactly two hundred years earlier, in 1524. Based on Psalm 12, Luther tells of a perilous world filled with those who shun God.

The augmented triad has long been a headache for music theorists, only partially on the basis of its harsh sound. Read more at www.ias.edu/ias-letter/2015/clark-music.

ANGELOS CHANIOTIS ON STUDYING GRAFFITI IN AN ANCIENT CITY

From the late first century B.C.E. to the seventh century C.E., Aphrodisias was one of the most important urban centers in Asia Minor. The city owed its name and its fame to the sanctuary of an old Anatolian goddess of fertility and war who, in the second century B.C.E. at the latest, was identified with the Greek Aphrodite. As a loyal ally of Rome, but also because Aphrodite was regarded as an ancestor of the Roman imperial family, Aphrodisias received political and economic privileges. Thanks to imperial support and the exploitation of marble quarries, the city of Aphrodite grew into a prosperous urban center and a leader in ancient sculpture. The New York University excavations, under Kenan Erim (1961–90) and Bert Smith (from 1991 onwards), have made Aphrodisias one of the most important archaeological sites in Asia Minor.

Almost all graffiti that had been incised or painted on plastered walls have now been lost, but the textual and pictorial graffiti that have been engraved and chiseled on marble have been preserved. Thousands of them have been recorded in the last decades. I can find no explanation for the great number, variety, and sometimes good quality of the Aphrodisian graffiti other than the fact that a substantial part of the population was involved in the carving of stone, as sculptors and masons. I assume that graffiti were primarily made by artists and workers who visited the theater, the stadium, and the markets with their implements. Graffiti, therefore, primarily reflect the thoughts and emotions of men—possibly also of children, apprentices in these crafts. Read more at www.ias.edu/ias-letter/2015/chaniotis-graffiti.
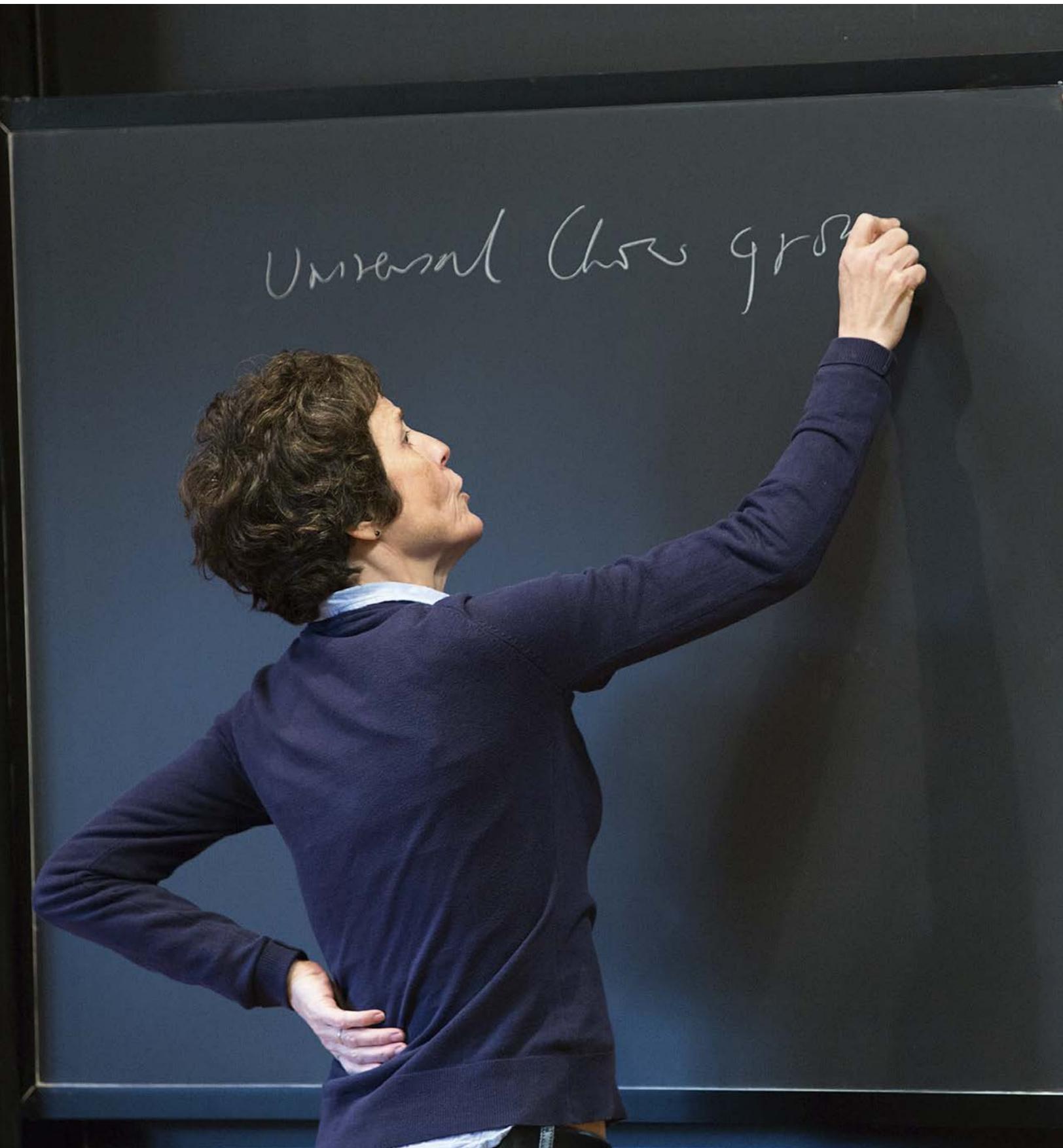
Claire Voisin, Distinguished Visiting Professor, led a special program, "The Topology of Algebraic Varieties," which attracted a mix of mathematicians interested in various aspects of the subject—including motives, K-theory, Chow groups, periods, and fundamental groups.

School of Mathematics

The School of Mathematics, established in 1933, was the first School at the Institute for Advanced Study. Several central themes in mathematics of the twentieth and twenty-first centuries owe their major impetus to discoveries that have taken place in the School, which today is an international center for research on mathematics and computer science.

DURING THE ACADEMIC YEAR 2014–15, the School of Mathematics conducted a special program, "The Topology of Algebraic Varieties." The program was led by Distinguished Visiting Professor Claire Voisin, from the Centre National de la Recherche Scientifique and Institut de Mathématiques de Jussieu, and Member Burt Totaro from the University of California, Los Angeles. The central themes of the program were Hodge theory and algebraic cycles. A large group of Members took part in the program. The senior Members who participated for the full year included Francis Brown, Institut de Mathématiques de Jussieu; Richard Hain, Duke University; Matthew Kerr, Washington University at St. Louis; Bruno Klingler, Institut de Mathématiques de Jussieu; János Kollár, Princeton University; Radu Laza, Stony Brook University; and Fabien Morel, University of Munich. There were approximately twenty-seven participants in the program, which included postdoctoral and mid-career Members.

Algebraic geometry is the study of spaces (called algebraic varieties) defined by polynomial equations. When the field of coefficients is the real or complex numbers, an algebraic variety has topological invariants such as singular cohomology and the fundamental group. One great success of algebraic geometry is Alexander Grothendieck's theory of étale cohomology and the étale fundamental group, which produces similar computable invariants, in a purely algebraic way, for varieties over any field.

On the other hand, one central goal of algebraic geometry, which remains mysterious, is to describe all the subvarieties of a given algebraic variety. More precisely, one considers algebraic cycles, which are linear combinations of subvarieties, and Chow groups, which are the algebraic cycles modulo a natural equivalence relation. We want to understand the Chow groups of an algebraic variety in terms of its Hodge theory, which is a more computable invariant related to singular cohomology and integrals of algebraic functions (known as periods). The Hodge conjecture is a model problem of this type.

Director and Leon Levy Professor Robbert Dijkgraaf, a mathematical physicist, leads a conversation on quantum spectral curves.

MATHEMATICAL CONVERSATIONS, which started in spring 2011, are designed to broaden the mathematical horizons of all who attend. The format consists of a twenty-minute talk and a ten-minute formal discussion period, with time for a longer informal discussion for the most interested participants.

The presentations, which are given by Members and Faculty, cover topics from all of mathematics and the interface to natural sciences. The conversations are very popular, and during the 2014–15 year, they were organized by Members Joel Fish and Ori Parzanchevski and Professor Helmut Hofer. For abstracts of the talks, see www.math.ias.edu/mathconversations.

The Chow group of codimension-one cycles has been related to the theory of Hodge structures of weight 1 since the nineteenth century (Abel's theorem), and there are now major open conjectures (Bloch, Bloch-Beilinson) relating the size of Chow groups in any codimension to the size of Hodge structures. These conjectures fit well with the generalized Hodge conjecture due to Grothendieck, which concerns the codimension of support of a Hodge structure.

Another distinctive feature of algebraic geometry is that the space of algebraic varieties of a given type can itself be viewed as an algebraic variety, known as a moduli space. There are deep interactions between moduli spaces and the theory of algebraic cycles. For example, Professor Emeritus **Pierre Deligne**'s notion of an absolute Hodge class depends on the possibility of changing the coefficients of the defining equations. Voisin made progress on the Bloch-Beilinson conjecture for complete intersection varieties by considering the moduli space of all such varieties. Over the complex numbers, the study of the deformations of a variety leads to the theory of periods and associated monodromy representations. Over number fields, the role of monodromy is played by representations of Galois groups. The interactions of mathematicians working on the topol-

ogy of algebraic varieties from these many different viewpoints made this one-year program very fruitful.

The program had four main themes:

1) Topological restrictions on complex projective manifolds. This includes restrictions on fundamental groups, and an essential tool is Hodge theory and the study of the moduli spaces of representations of the fundamental group (non-abelian Hodge theory). The analysis of the fundamental group and its profinite completion also has deep arithmetic aspects that have been studied by Members Richard Hain and Francis Brown.

2) Moduli spaces: construction and properties. This subject is very much related to the previous one via the period map and the theory of variations of Hodge structures, which is a fundamental tool developed by Professor Emeritus **Phillip Griffiths** to study both the topology or motive of a given variety and the properties of moduli spaces. Moduli spaces usually have a rich fundamental group represented on cohomology (the monodromy representation), and this conversely has strong consequences on their topology and curvature properties. The program included an informal working group on moduli spaces and the minimal model program.

3) Motives and Chow groups. Chow groups are not well understood, but they have properties that make them very

useful and easy to manipulate, like the "localization exact sequence." The general expectation (summarized under the name of the Bloch-Beilinson conjectures) is that over the complex numbers, Chow groups are governed in a rather precise way by the shape of the Hodge structures. The Chow groups also provide the most refined theory to speak about motives, the motive being the study of algebro-geometric properties of a variety that are reflected on cohomology via the cycle class map. The Chow ring is also a very rich object with very distinctive properties (partially conjectural) in the case of hyperkähler manifolds. The program included an informal working group on Chow groups and their relation to Hodge theory.

4) Singularity theory. This is classically a very important part of the study of the topology of algebraic varieties over the complex numbers, that is, in the analytic setting. A crucial tool in the study of singular varieties is mixed Hodge theory, as developed by Deligne. This has become still more important with the recent progress of birational geometry, which produces minimal models that are in general singular.

Here are some of the numerous advances achieved during the program:

1) Junyi Xie and Member Serge Cantat proved the first significant restrictions on the birational automorphism group of an arbitrary algebraic variety. For example, the group $SL(n, Z)$ cannot act faithfully by birational transformations on a variety of dimension less than $n-1$.

2) Members János Kollár and Chenyang Xu proved that the dual complex of a Calabi–Yau pair in low dimensions is homeomorphic to a finite quotient of a sphere. This statement was expected as part of mirror symmetry, the family of algebro-geometric conjectures inspired by string theory.

3) Voisin introduced a new approach to a central problem of algebraic geometry: which varieties are rational or stably rational? Her method, an unexpected application of the theory of algebraic cycles, has led to a series of rapid advances. In particular, Member Burt Totaro proved that most hypersurfaces of

degree at least about two-thirds their dimension are not stably rational.

4) Christopher Hacon, James McKernan, and Member Chenyang Xu made a fundamental contribution to the construction of a compact moduli space for stable varieties of general type, showing that the stable varieties of given degree form a bounded family.

In addition to numerous one-hour lectures, the program included several three-hour lecture series, for example, by Members Francis Brown on the projective line minus 3 points, Serge Cantat on birational actions of $SL(n, Z)$, Fabien Morel on the homology and the tree of $SL(2)$ over polynomial rings, Bruno Klingler on the André-Oort conjecture, and Chenyang Xu on boundedness of log general type pairs.

Two workshops were organized as part of the program, with outstanding speakers from the Institute and beyond. The first workshop was on fundamental groups and periods. Several speakers used analytic methods to give powerful restrictions on the possible fundamental groups of smooth projective varieties. Arithmetic aspects of fundamental groups were also presented: representations of étale fundamental groups and flat connections in nonzero characteristic, the fundamental group of the projective line minus 3 points, and mixed Tate motives and multizeta values.

The second workshop was on Chow groups, motives, and derived categories. The derived category of an algebraic variety has been studied intensely, as a precise and refined way of studying a variety by means of its vector bundles. The derived category determines the algebraic K-theory and the closely related Chow groups, but it contains more information. The workshop included advances on finiteness properties for Chow groups and motivic cohomology, as well as recent advances on derived categories such as new constructions of Bridgeland stability conditions.

As a complement to these workshops, a conference on rationality problems was organized at Stony Brook University by Voisin, Member Radu Laza, Christian Schnell, and Jason Starr, focusing on the applications of some of the tools sketched above to the so-called Luroth problem, or its stable version, searching for criteria characterizing rational or stably rational varieties. Two recently developed new tools or approaches for the Luroth problem were discussed and compared: methods of algebraic cycles (decomposition of the diagonal) and methods of derived categories.

Finally, two special days on algebraic geometry were organized, one joint with Columbia University and one with Princeton University.

The working group in algebraic number theory continued to meet two hours a week with Faculty and Members from the Institute and Princeton University. The group spent most of the year working through Matt Emerton's paper "Local Global Compatibility in the p-adic Langlands Program for $GL_{2/\mathbb{Q}}$" together with some of the required background. Toward the end of the year, some of the graduate students reported on their own work.

Meeting for an hour a week with speakers, usually visiting mathematicians from outside the Princeton area, the joint number theory seminar with Princeton continued. There were many excellent presentations with exciting new results announced. Following the talk of Benjamin Howard (Boston University) on a version of Colmez's formula that he and his collaborators established, Jacob Tsimerman of the University of Toronto announced a proof of the Andre-Oort conjecture. This is a culmination of a series of works by Tsimerman and Jonathan Pila and has its roots in the Bombieri-Pila theorem established at the Institute in the late 80s.

During the fall term, Robert and Luisa Fernholz Professor **Richard Taylor** taught a graduate class at Princeton, which introduced the theory of automorphic forms and Shimura varieties in the special case of $GL(2)$, but in a language that generalizes well to bigger groups. Two working groups were organized. Member and von Neumann Fellow Kartik Prasanna, Members Raphael Beuzart-Plessis, Hang Xue, and Bin Xu led a group on automorphic periods, refined versions of the Gan-Gross-Prasad conjecture and Arthur packets for classical groups.

During the second term, there was a working group on expanders and monodromy run by Members and von Neumann Fellows Christopher Hall and Kartik Prasanna and Members Alexei Entin, Ori Parzanchevski, Doron Puder, Michael Magee, Yaiza Canzani, and Princeton University graduate student

Seminars on spectral geometry were held in March and April and included a talk by Member Michael Magee (right), who helped run a working group on expanders and monodromy.

Will Sawin. A goal of the working group was to create a friendly atmosphere in which everyone felt comfortable learning new material and discussing research ideas with others. At the beginning of the term, the group chose a list of topics that everyone was interested in discussing and for which at least one group member could prepare a presentation. The group usually met once a week and during that time someone gave a ninety-minute lecture on their assigned topic. Each lecturer was also responsible for creating an electronic set of notes summarizing their talk. Near the end of the term, the group replaced the lecturers with a series of meetings focused on research projects. As a result of this working group, Entin and Hall have a couple of other projects lined up for the near future.

Activities of some of our Members:

- Hang Xue found a conjectural identity between the Fourier-Jacobi coefficients of automorphic forms on symplectic groups and central values of Ranking-Selberg L-functions. He can verify his conjecture in a few cases.
- Bin Xu completed and wrote up his work classifying automorphic forms on symplectic and orthogonal similitude groups.
- Together with short-term visitor Atsushi Ichino of Kyoto University, Member and von Neumann Fellow Kartik Prassana wrote a paper on periods of quaternionic Shimura varieties.

He continued a project with Visitor Chris Skinner of Princeton and began a project with Member Vasudevan Srinivas.

- Member Michael Reiterer and Eugene Trubowitz of Eidgenössische Technische Hochschule have formulated a new approach to problems in general relativity motivated by the study of the BKL (Belinsky–Khalatnikov–Lifshitz) singularity. They constructed a graded Lie algebra in which a solution to the vacuum Einstein equations is any element of degree 1 whose bracket with itself is zero.
- Veblen Research Instructor Florian Sprung wrote a paper on the p-adic Birch-Swinnerton-Dyer conjecture at supersingular primes.
- Visitor Chris Skinner proved if E/Q is an elliptic curve with at least one proof of non-split multiplicative reduction, and if E has rank one a finite Tate-Shafarevich group then E has analytic rank one—a sort of converse to the Gross-Zagier-Kolyvagin theorem. Together with Manjul Bhargava of Princeton and Wei Zhang of Columbia University, Skinner also proved that a majority of elliptic curves over Q satisfy the Birch-Swinnerton-Dyer conjecture.

The symplectic geometry group continued to meet every Friday. Member

Matthew Strom Borman gave a minicourse on his recent breakthrough results, jointly with Yasha Eliasberg (Stanford University) and Emmy Murphy (Massachusetts Institute of Technology), on the "Classification of Overtwisted Contact Structures," which unifies the previously known results in dimension three with a new viewpoint covering the higher dimensions as well.

Members Joanna Nelson and Ana Pires and Member and Veblen Research Instructor Nicholas Sheridan organized the weekly joint symplectic geometry seminar with Princeton University. In addition, Nelson and Sheridan organized, with Mohammed Abouzaid and Ailsa Keating from Columbia University, the joint Columbia/IAS seminar, which meets twice a term, alternating locations between Princeton and New York City.

The work of the group focused on a variety of different topics covering questions in homological mirror symmetry, symplectic field theory, symplectic embedding problems, symplectic group actions, polyfold theory, and symplectic dynamics. Member Joel Fish and Professor **Helmut Hofer** made substantial progress on a problem by Walter Helbig Gottschalk, formulated in 1958, which asked if there exists a flow on the three-sphere with all orbits dense. It is known that analytic diffeomorphisms exist for which all orbits are dense. The results obtained by Fish and Hofer, which provide an existence mechanism for proper invariant subsets for flows, strongly suggest that a smooth volume preserving flow on the three-sphere will always have small closed invariant subsets, and therefore not all orbits can be dense. Of importance is the new idea of "feral curves," which generalizes the pseudoholomorphic curve theory from symplectic field theory. This new tool opens up many interesting directions for future research in dynamics as well as symplectic geometry.

A "Workshop on Topology: Identifying Order in Complex Systems," was organized in April by Randall Kamien of the University of Pennsylvania, Konstantin Mischaikow of Rutgers, The State

Member and von Neumann Fellow Christopher Hall (left) and Member Yaiza Canzani (center)

University of New Jersey, and Herman Weyl Professor **Robert MacPherson**. Speakers were Danielle Basset and Toen Castle of the University of Pennsylvania, Leslie Greengard of New York University, Vladimir Itskov of Pennsylvania State University, and Don Sheehy of the University of Connecticut.

MacPherson gave the mini-symposium "What is Topology?" in May, moderated by Institute Director and Leon Levy Professor Robbert Dijkgraaf. Former Member Randall Kamien discussed topology and liquid crystals, and former Member Raúl Rabadán of Columbia University talked about how topology modifies our understanding of evolution and disease.

The following contains brief descriptions of some of the activities and discoveries in the School's Computer Science and Discrete Math group led by Herbert H. Maass Professor **Avi Wigderson**.

Information and communication complexity and coding

Information complexity attempts to generalize Claude Shannon's sixty-year-old theory from the classical one-way interaction to the adaptive exchange of information between two parties. This topic has been one of the hottest research topics in the theory of computation in the past few years. Information complexity interacts with the well studied *communication complexity*, and has generated applications and challenging open problems.

Shannon proved that one-way communication protocols can be compressed to their information contents, which in this case is the entropy of the message one player needs to send the other. For general communication protocols and tasks, information complexity emerged as the right notion of "information contents." Comparing it with the communication cost (bit complexity) in optimal communication protocols of general interactive tasks is a central challenge in attempts to generalize Shannon's theorem to the interactive setting.

Another basic question deals with error correction and the amount of redundancy needed to overcome noise across the communication channel. Again,

Shannon resolved this problem for one-way communication in the 1950s, and attempts to generalize it to the interactive setting are very challenging.

Several works of Visiting Professor Ran Raz and Member Gillat Kol (some joint with Weizmann Institute student Anat Ganor) represent major breakthroughs on these problems. In one paper, they are able to prove that in the interactive setting, the "capacity" of a noisy channel is smaller than in Shannon's one-way model, namely that redundancy for the same amount of error must be significantly larger. In two other papers, they show that there can be an exponential gap between the communication complexity and information complexity of a protocol. This later result has a surprising implication, which resolves a thirty-year-old question in communication complexity. They show that for some communication tasks, "economy of scale" is possible. Namely, solving k independent instances of a given communication problem can be done with far less than a factor k increase in communication over the cost of one instance. Despite being independent, the communication solving these k instances can magically be "merged" to obtain this savings.

Locally correctable and testable codes

Locality in the theory of error correction has arisen from a variety of motivations within the theory of computation (including program checking, probabilistically checkable proofs, hardness of approximation, pseudorandomness, and hardness amplification). The study of codes with these local testing and decoding properties had a significant effect on coding theory as well. The main parameter governing locality is the number of (randomly chosen) queries made to a corrupted code word. The trade-offs of this parameter with classical parameters of codes like rate and distance have been extremely important, and our understanding is far from complete.

Member Noga Ron-Zewi, last-year Member Or Meir, and Rutgers professors Swastik Kopparty and Shubhangi Saraf (both former Members) made significant improvements to the state-of-art. For both testing and decoding, new

....

codes were designed with rate approaching 1 (namely, negligible redundancy), for which the number of queries needed is sub-polynomial! All previous constructions with such query complexity have extremely poor rate, whereas constant rate codes could only work with polynomials many queries in the blocklength. The design of the new codes follows along the lines of zig-zag product iterations.

Sum-of-squares lower bounds

The *sum-of-squares* (also known as SoS/Lasserre/Parillo) hierarchy of convex relaxations is the strongest algorithmic technique known for a wide variety of optimization and statistical learning problems. Proving limits on its power, in the form of integrality gaps for high degree (or many rounds) of this framework, is an important challenge, especially for the average-case complexity of natural problems.

The planted clique problem is the task to discover a large clique hidden in an Erdős-Rényi random graph. It has attracted attention, both as a benchmark for a variety of approximation algorithm techniques, as well as an average-case hardness assumption with applications to cryptography, economics, sequencing, and community detection in large networks.

The best-known polynomial time algorithms can only find such a clique if its size is roughly the square root of the graph size n (whereas statistically but inefficiently a clique of logarithmic size can be found). A result of last-year Member Raghu Meka, Massachusetts Institute of Technology student Aaron Potechin, and Wigderson proves that d-round SoS algorithms cannot discover a clique of size roughly the dth root of n. Thus, restricting these algorithms to polynomial time, namely constant d, almost surely cannot find a hidden clique of size smaller than a polynomial in n. The

analytic and algebraic techniques used (respectively, the analysis of norm of random matrices with dependent entries, and the eigenstructure of matrices from the Johnson association scheme) may be useful for other lower bounds.

Lens of computation on the sciences
In addition to these activities, Wigderson organized a conference in November on "The Lens of Computation on the Sciences." As many natural processes may be viewed as information processes, computation must be an essential component in modeling them. This applies broadly to a wide variety of processes and structures in all fields, e.g., quantum interference, flocking of birds, Facebook communi–ties, and stock prices. Former Member Scott Aaronson of the Massachusetts Institute of Technology, Jon Kleinberg of Cornell University, Tim Roughgarden of Stanford University, and Leslie Valiant of Harvard University were speakers. Videos of the conference lectures may be viewed at https://video.ias.edu/computationconference/2014/1122.

2014–15 MEMBERS AND VISITORS

f First Term ✦ *s* Second Term ✦ *v* Visitor ✦ *vp* Visiting Professor ✦ *dvp* Distinguished Visiting Professor ✦ *vf* Veblen Fellow ✦ *vri* Veblen Research Instructorship
vnf von Neumann Fellowship ✦ *j* Joint Member School of Natural Sciences

Karim Alexander Adiprasito
Combinatorics in Algebra, Geometry, and Topology
Institute for Advanced Study ✦ *s*
Funding provided by the National Science Foundation

Noga Alon
Combinatorics ✦ Tel Aviv University ✦ *vp, f*
Funding provided by the Oswald Veblen Fund

Alexey Ananyevskiy
Algebra ✦ Institute for Advanced Study ✦ *s*
Funding provided by the National Science Foundation

Donu Arapura
Algebraic Geometry ✦ Purdue University ✦ *f*
Ralph E. and Doris M. Hansmann Member

Stefanos Aretakis
Partial Differential Equations, Mathematical Physics
Institute for Advanced Study and Princeton University ✦ *vri*

Christopher Beck
Mathematics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Raphaël Beuzart-Plessis
Mathematics ✦ Institute for Advanced Study
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Matthew Strom Borman
Symplectic Geometry ✦ Institute for Advanced Study
Neil Chriss and Natasha Herron Chriss Founders' Circle Member

Patrick Gerald Brosnan
Algebraic Geometry ✦ University of Maryland ✦ *f*

Francis Brown
Mathematics ✦ Institut de Mathématiques de Jussieu, Université Paris VII ✦ *vnf*
Funding provided by the National Science Foundation

Serge Marc Cantat
Geometry and Dynamical Systems ✦ CNRS, Université de Rennes 1 ✦ *f*
Ralph E. and Doris M. Hansmann Member; additional funding provided by The Bell Companies Fellowship Fund

Yaiza Canzani
Geometric Analysis ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Ana Caraiani
Number Theory ✦ Institute for Advanced Study and Princeton University ✦ *vri*

Pierre-Henri Chaudouard
Automorphic Forms ✦ Université Paris VII ✦ *vnf, f*
Funding provided by the National Science Foundation

Anindya De
Theoretical Computer Science ✦ Institute for Advanced Study ✦ *v*

Mark de Cataldo
Algebra ✦ Stony Brook University, The State University of New York ✦ *f*
Funding provided by the James D. Wolfensohn Fund

Agnès Desolneux
Applied Mathematics ✦ École Normale Supérieure de Cachan ✦ *f*

Hansheng Diao
Number Theory ✦ Institute for Advanced Study ✦ *s*
Funding provided by the National Science Foundation

Alexandru Dimca
Algebraic Geometry ✦ Université Nice Sophia Antipolis ✦ *f*

Alexei Entin
Number Theory ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Javier Fernandez de Bobadilla
Algebraic Geometry, Singularity Theory ✦ Instituto de Ciencias Matemáticas, Consejo Superior de Investigaciones Científicas
AMIAS Member

Yuval Filmus
Computer Science ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Joel Fish
Symplectic/Contact Topology, Hamiltonian Dynamics ✦ Institute for Advanced Study

Michael Forbes
Theoretical Computer Science, Pseudorandomness
Institute for Advanced Study ✦ *s*
Funding provided by the National Science Foundation

Daniel Freed
Geometry and Physics ✦ The University of Texas at Austin ✦ *j, s*
IBM Einstein Fellow; additional funding provided by the James D. Wolfensohn Fund

Lie Fu
Algebraic Geometry ✦ Institute for Advanced Study ✦ *f*
Funding provided by the National Science Foundation

Mark Goresky
Geometry, Automorphic Forms ✦ Institute for Advanced Study
Funding provided by The Ambrose Monell Foundation and the Oswald Veblen Fund

Richard M. Hain
Geometry, Topology ✦ University of Washington and Duke University
Friends of the Institute for Advanced Study Member

Christopher Hall
Number Theory ✦ University of Wyoming ✦ *vnf*
Funding provided by the National Science Foundation

Daniel Halpern-Leistner
Algebraic Geometry, Representation Theory, Homological Algebra ✦ Institute for Advanced Study

Tara Holm
Symplectic Geometry ✦ Cornell University ✦ *vnf, f*
Funding provided by the National Science Foundation

June Huh
Algebraic Geometry, Combinatorics ✦ Institute for Advanced Study and Princeton University ✦ *vf*
Funding provided by the Clay Mathematics Institute; additional funding provided by the National Science Foundation

Klaus Hulek
Algebraic Geometry ✦ Gottfried Wilhelm Leibniz Universität Hannover ✦ *s*

Christian Johansson
Number Theory ✦ Institute for Advanced Study ✦ *s*
Funding provided by the National Science Foundation

Junehyuk Jung
Analytic Number Theory, Spectral Geometry
Institute for Advanced Study

Matt Kerr
Algebraic Geometry ✦ Washington University in St. Louis

Moritz Kerz
Arithmetic Geometry ✦ Universität Regensburg ✦ *s*

Nayoung Kim
Number Theory ✦ Institute for Advanced Study

Bruno Klingler
Hodge Theory, Algebraic Geometry, Arithmetic Groups ✦ Institut de Mathématiques de Jussieu, Université Paris VII

Gillat Kol
Theory of Computation ✦ Institute for Advanced Study

János Kollár
Algebraic Geometry ✦ Princeton University

Sándor J. Kovács
Algebraic Geometry ✦ University of Washington ✦ *f*

Radu Laza
Algebraic Geometry ✦ Stony Brook University, The State University of New York ✦ *vnf*

John Daniel Lesieutre
Algebraic Geometry ✦ Institute for Advanced Study

Michael Robert Magee
Automorphic Forms ✦ Institute for Advanced Study

Jasmin Matz
Automorphic Forms ✦ Institute for Advanced Study ✦ *s*

Luca Migliorini
Algebraic Geometry ✦ Università di Bologna ✦ *s*

Irina Mitrea
Analysis ✦ Temple University ✦ *vnf*

Fabien Morel
Algebraic Topology, Algebraic Geometry ✦ Ludwig-Maximilians–Universität München

Joanna Nelson
Symplectic and Contact Topology ✦ Institute for Advanced Study

Madhav Nori
Algebraic Geometry ✦ The University of Chicago ✦ *f*

Kieran O'Grady
Algebraic Geometry ✦ Università degli Studi di Roma, La Sapienza ✦ *f*

Ania Agata Otwinowska
Algebraic Geometry ✦ Université Paris–Sud 11 ✦ *v*

Ivan Panin
Algebra ✦ Steklov Mathematical Institute, Russian Academy of Sciences ✦ *s*

Ori Parzanchevski
Algebra, Combinatorics ✦ Institute for Advanced Study

Amit Patel
Applied Topology ✦ Institute for Advanced Study

Sam Payne
Algebraic Geometry ✦ Yale University ✦ *vnf, s*

Ana Pires
Symplectic Geometry ✦ Institute for Advanced Study ✦ *f*

Kartik Prasanna
Number Theory ✦ University of Michigan ✦ *vnf*

Doron Puder
Combinatorics, Combinatorial and Geometric Group Theory ✦ Institute for Advanced Study

Ran Raz
Computational Complexity ✦ Weizmann Institute of Science ✦ *vp*

Michael Reiterer
Mathematical Physics ✦ Institute for Advanced Study

Timothy Riley
Geometric Group Theory ✦ Cornell University ✦ *f*

Noga Ron-Zewi
Computer Science ✦ Institute for Advanced Study

Giulia Saccà
Algebraic Geometry ✦ Institute for Advanced Study

Nicholas Sheridan
Symplectic Geometry ✦ Institute for Advanced Study and Princeton University ✦ *vri*

Carlos Tschudi Simpson
Moduli Spaces and Higher Categories ✦ CNRS, Université Nice Sophia Antipolis ✦ *s*

Christopher Skinner
Number Theory ✦ Princeton University ✦ *v*

Florian Sprung
Number Theory ✦ Institute for Advanced Study ✦ *vri*

Vasudevan Srinivas
Algebraic Geometry ✦ Tata Institute of Fundamental Research, Mumbai ✦ *s*

Lenny Taelman
Number Theory ✦ Universiteit Leiden ✦ *vnf, s*

Zhiyu Tian
Algebraic Geometry ✦ Institute for Advanced Study ✦ *s*

Burt Totaro
Algebraic Geometry ✦ University of California, Los Angeles

Karen Uhlenbeck
Gauge Theory ✦ The University of Texas at Austin ✦ *v*

Charles Vial
Algebraic Geometry ✦ University of Cambridge ✦ *s*

Claire Voisin
Complex Algebraic Geometry, Hodge Theory
CNRS, Institut de Mathématiques de Jussieu ✦ *dvp*

Yi Wang
Geometric Analysis, Harmonic Analysis ✦ Institute for Advanced Study

Robert F. Williams
Topology, Dynamical Systems ✦ The University of Texas at Austin ✦ *v*

Krzyztof Wysocki
Symplectic Geometry, Contact Geometry, Hamiltonian Dynamics ✦ The Pennsylvania State University ✦ *s*

Bin Xu
Automorphic Forms ✦ Institute for Advanced Study

Chenyang Xu
Algebraic Geometry ✦ Beijing University ✦ *f*

Hang Xue
Number Theory, Arithmetic Geometry ✦ Institute for Advanced Study

Matthew Patrick Young
Analytic Number Theory ✦ Texas A&M University ✦ *vnf, f*

Runhong Zong
Algebra ✦ Institute for Advanced Study

SERGE J-F. LEVY

John Forbes Nash, Jr., 1928–2015

On May 19, 2015, King Harald V of Norway presented the Abel Prize from the Norwegian Academy of Science and Letters to John Forbes Nash, Jr., Member (1956–57, 1961–62, 1963–64) in the School of Mathematics, and long-time member of the Princeton University Department of Mathematics, for his contributions to the theory of nonlinear partial differential equations, which are used to describe the basic laws of phenomena in physics, chemistry, biology, and other sciences. Returning to Princeton from the prize ceremony in Oslo, Nash and his wife Alicia died together in an automobile accident. "I hope one thing will become clear when we look back on Dr. John Nash's life," observed Robbert Dijkgraaf, Director of the Institute and Leon Levy Professor. "There are many brilliant minds, but he was a very special kind. . . . He was always going in directions that were either thought to be impossible, or actively discouraged."

One of a handful of mathematicians known outside academia, Nash's early brilliance and later acclaim were contrasted by decades of mental illness and relative obscurity. International recognition came in October 1994 when Nash, after attending an Institute seminar, had a conversation with mathematician Harold Kuhn. "As we sat on the bench, enjoying the mild fall weather and the splendor of the Institute woods, I told John that he should be up at 6:30 a.m. the following morning to receive a phone call from Carl-Olof Jacobsen, Secretary General of the Nobel Foundation, who would tell him that he was sharing the Prize in Economic Sciences in Memory of Alfred Nobel," recalled Kuhn in the preface to *The Essential John Nash* (Princeton University Press, 2002). Nash married Alicia during his first visit as a Member in 1956–57. Read more at www.ias.edu/ias-letter/2015/john-nash.

Is the Abstract Mathematics of Topology Applicable to the Real World?

Topology is the only major branch of modern mathematics that wasn't anticipated by the ancient mathematicians. Throughout most of its history, topology has been regarded as strictly abstract mathematics, without applications. However, illustrating Eugene Wigner's principle of "the unreasonable effectiveness of mathematics in the natural sciences," topology is now beginning to come up in our understanding of many different real-world phenomena. In a mini-symposium organized in May, Robert MacPherson, Hermann Weyl Professor in the School of Mathematics, described the history and pervasiveness of topology, Raúl Rabadán described how topology modifies our understanding of evolution and disease, and Randall Kamien discussed the relationship between topology and liquid crystals, like those in computer displays. Videos of the talks are available at https://video.ias.edu/mini-symposium-topology-2015.

DAN KOMODA

Daniel Freed on How Topology Detects Certain Phases of Matter

Topology is the branch of geometry that deals with large-scale features of shapes. One cliché is that a topologist cannot distinguish a doughnut from a coffee cup: if a coffee cup were made of rubber, one could continuously deform it to a doughnut without tearing. A geometer, equipped with precision tools, can measure local quantities (distances, curvature) to distinguish the coffee cup from the doughnut. A topologist, seemingly handicapped by defective eyes, can only discern that each has one hole, so at least can distinguish both from a two-holed pretzel. But, after all, a topologist is a geometer too, and the lack of close vision can reveal a forest otherwise obscured by trees. For many problems, that global vision provides crucial insights. This has long been true internally in mathematics: topological ideas play an important role in analysis, algebra, and many other areas. In recent years, topological ideas have found applications to many problems outside of mathematics: data analysis, biology, and robotics to name just a few. My concern in this article is a particular application of topology to quantum physics. Beyond that, the story I tell is one small illustration of the many wonders of mathematics. Read more at www.ias.edu/ias-letter/2015/freed-topology.
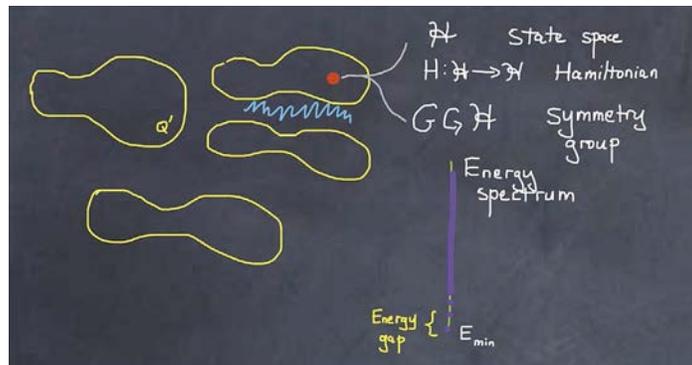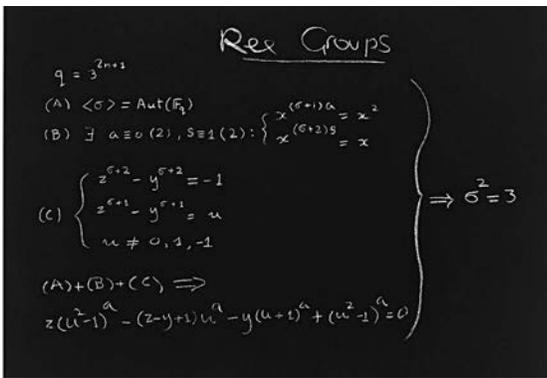
Enrico Bombieri on the Ree Group Formula

Does beauty exist in mathematics? The question concerns mathematical objects and their relations, the real subject of verifiable proofs. Mathematicians generally agree that beauty does exist in the structural beauty of theorems and proofs, even if most of the time it is largely visible only to mathematicians themselves.

The concept of group beautifully expresses symmetry in mathematics. What is a group? Consider any object, concrete or abstract. A symmetry of the object—mathematically, an automorphism—is a mapping of the object onto itself that preserves all of its properties. The product of two symmetries, one followed by the other, also is a symmetry, and every symmetry has an inverse that undoes it. Mathematicians consider continuous Lie groups, such as the rotations of a circle or of a sphere, to be a beautiful foundation for a great portion of mathematics, and for physics as well. Besides continuous Lie groups there are noncontinuous finite and discrete groups; some are obtainable from Lie groups by reduction to a finite or discrete setting. Read more at www.ias.edu/ias-letter/2015/bombieri-concinnitas.

Lens of Computation on the Sciences

What do quantum interference, flocking of birds, Facebook communities, and stock prices have in common? Many natural and social phenomena may be viewed as inherently computational; they evolve patterns of information that can be described algorithmically and studied through computational models and techniques. A workshop on the computational lens, organized by Avi Wigderson, Herbert H. Maass Professor in the School of Mathematics,

highlighted the state-of-art and future challenges of this interaction of computational theory with physics, social sciences, economics, and biology.

Speakers were Leslie Valiant, T. Jefferson Coolidge Professor of Computer Science and Applied Mathematics in the School of Engineering and Applied Sciences at Harvard University; Tim Roughgarden, Associate Professor of Computer Science and (by courtesy) Management Science and Engineering at Stanford University; Jon Kleinberg, Tisch University Professor in the Departments of Computer Science and Information Science at Cornell University; and former Member Scott Aaronson, Associate Professor of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology. Among the questions Aaronson explored: Can scalable quantum computers be built? Can they teach us anything new about physics? Which systems in nature can be universal computers, and which cannot? View the lectures at https://video.ias.edu/computationconference/2014/1122.

Cédric Villani on the Birth of a Theorem

Cédric Villani, Member in the School of Mathematics in the spring of 2009 and currently Professor at Université Lyon I and Director of the Institut Henri Poincaré, has called his stay at the Institute one of his most productive periods, during which more than 250 pages were written. In his Member report to then-Director Peter Goddard at the end of his stay, Villani wrote of his collaboration with Clément Mouhot from Paris, "Writing up the paper on Landau damping was one of the most intense experiences of my professional life: for three months in a row, we kept unlocking seemingly untractable obstacles on a weekly basis. Our 180-page-long paper solves a fifty-year-old open problem." A year after his IAS visit, Villani was awarded the 2010 Fields Medal, in part for the work that he did at the Institute on his proof of nonlinear Landau damping. In *Birth of a Theorem*, translated by Malcolm DeBevoise (Farrar, Straus and Giroux, 2015), originally published in 2012 as *Théorème Vivant* (Éditions Grasset & Fasquelle), Villani describes his fervent, halting, and very human experience in trying to obtain the proof. Read more at www.ias.edu/ias-letter/2015/villani-theorem. Villani returned to IAS in 2015 to deliver the lecture "Of Particles, Stars, and Eternity," which may be viewed at https://video.ias.edu/villani-publiclecture-2015.
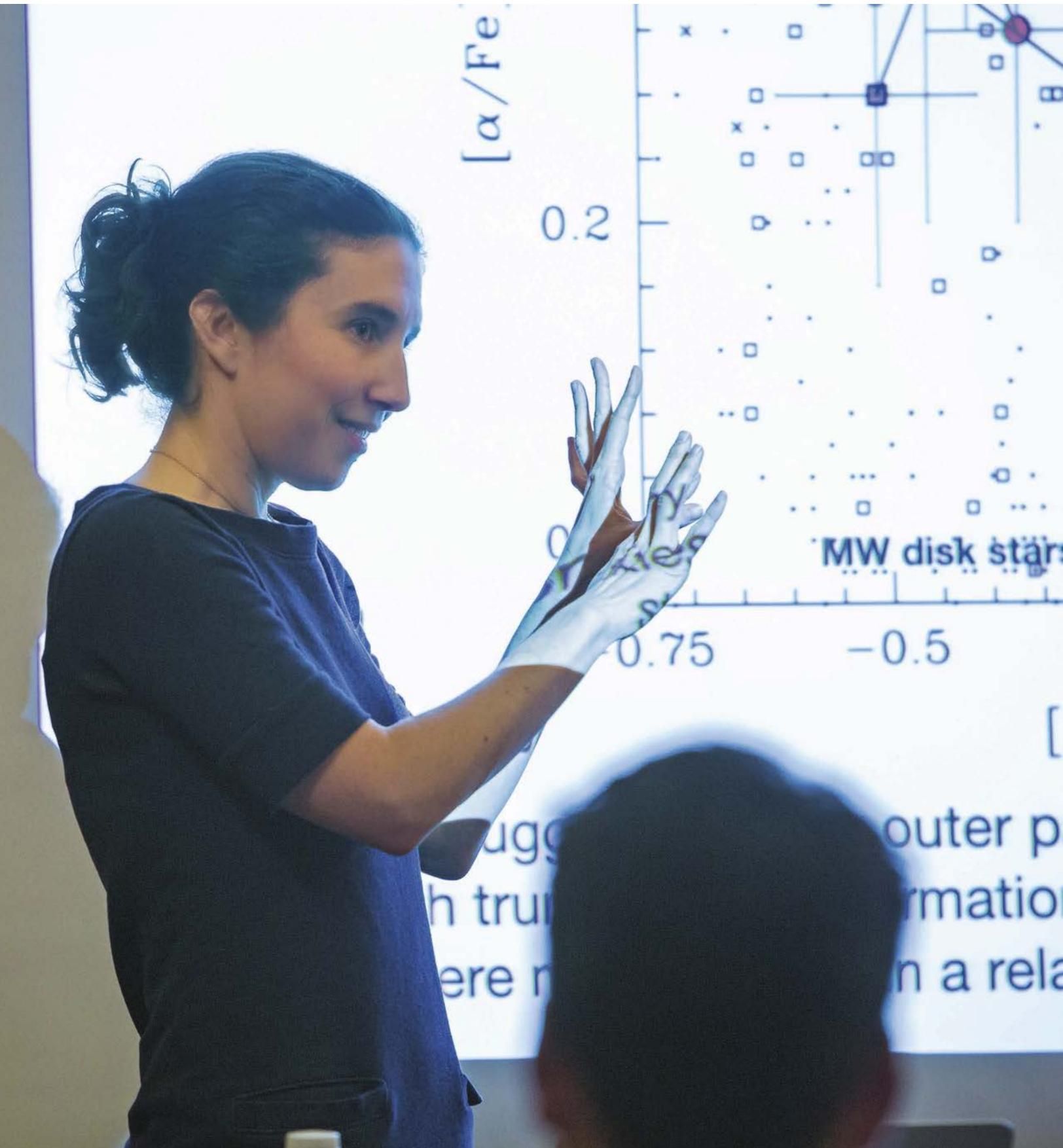
Jenny Greene of Princeton University gives a talk on massive galaxies and small, supermassive black holes in an informal astrophysics seminar at the Institute.

School of Natural Sciences

The School of Natural Sciences, established in 1966, supports research in broad areas of astrophysics, systems biology, and theoretical physics. Areas of current interest include investigating the origin and composition of the universe; conducting research at the interface of molecular biology and the physical sciences; and elementary particle physics, string theory, quantum theory, and quantum gravity.

EACH YEAR THE SCHOOL OF NATURAL SCIENCES appoints about fifty Members, the majority of them postdoctoral fellows, who are typically at the Institute for three years, some for up to five years. Collaboration is encouraged among Members who work in the School's many scientific areas—from molecular biology to mathematical physics.

From its earliest days, the Institute has been a leading center for fundamental physics, contributing substantially to many of its central themes, which now interrelate with astrophysics and biology. Areas of current interest in theoretical physics include elementary particle physics, string theory, quantum theory, and quantum gravity, and their relationship to geometry, theoretical and observational astrophysics, and cosmology.

Research in the School's astrophysics group encompasses astronomical systems from nearby planets to distant galaxies, from black holes to the dark matter and dark energy that dominate the evolution of the universe. There is a growing cross-fertilization between astrophysics and elementary particle physics, and the work of many Members and Faculty crosses the boundary between these two disciplines. Members in the astrophysics research group employ an array of tools from theoretical physics, large-scale computer simulations, and ground- and space-based observational studies to investigate the origin and composition of the universe, and to use the universe as a laboratory to study fundamental physics. At the Simons Center for Systems Biology, the tools of modern physics and mathematics are being applied to biological investigation, on varying scales, from molecular to organismic, and in some cases focusing on understanding disease processes.

The School's collaborative and pioneering approach to the sciences, which extends to the Institute's School of Mathematics, Princeton University, and the larger scientific community, continues to transform research in these fields and open opportunities for powerful and important discoveries.

FACULTY

Nima Arkani-Hamed

Peter Goddard

Stanislas Leibler

Juan Maldacena

Nathan Seiberg

Scott Tremaine
Richard Black Professor

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Stephen L. Adler

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Arnold J. Levine

DAN KOMODA

Astrophysics

One of the most important unsolved problems of extragalactic astrophysics emerges from two simple facts. First, galaxies are formed by a hierarchical process in which small galaxies fall together under their mutual gravitational attraction and then merge to form larger ones. Second, the centers of most galaxies contain black holes millions to billions of times more massive than the Sun. After galaxies merge, their black holes spiral toward the center of the new, larger galaxy as they lose orbital energy to the surrounding stars. Do these black holes continue spiraling together until they eventually coalesce? If so, a burst of gravitational radiation will be emitted during the merger, which should be measurable with exquisite precision by space-based observatories planned for launch within the next two decades. The properties of these signals would provide unique and powerful tests of Einstein's theory of relativity. If, on the other hand, the inspiral process stalls, the consequences are almost as interesting: the centers of many or most galaxies should contain binary black holes with orbital periods of a few decades to a few thousand years.

Scott Tremaine, Richard Black Professor, Member Bence Kocsis, and their collaborators are investigating the detectability of binary black holes and black-hole mergers. Will there be an electromagnetic signal from the black-hole merger, and, if so, what are its properties and how can we look for it? Can we detect the expected population of binary black holes? Here is one promising possibility: quasars shine from glowing gas orbiting close to a black hole. If the black hole has a binary companion, the quasar spectral lines should exhibit a steady acceleration due to the orbital motion of the black hole, which could be detected by a large-scale monitoring program within a few years. Does the inspiral process stall? The inspiral is due to gravitational interactions of the black hole with the surrounding stars and gas, during which the stars and gas are usually either ejected or swallowed by the black hole. The rate of inspiral will depend on how rapidly the supply of stars and gas can be replenished, which in turn depends on the complex structure of the central light-year of the galaxy. Do nearby galaxies such as our own Milky Way contain binary black holes? There is a four-million solar-mass black hole at the center of the Milky Way, but so far there is no evidence for a binary companion, and any such companion must be no larger than about 1 percent of the mass of the primary black hole.

The last decades saw important advances in cosmology driven in large part by advances in observations. Cosmology now has a very successful standard model that can account for these observations, which span a wide range of spatial scales and probe the state of the universe throughout cosmic history.

Although very successful, the standard model requires physics that goes beyond what has already been established in the laboratory. To explain the clustering of matter, the formation of objects such as galaxies, the model relies on the existence of large amounts of dark matter, matter whose existence we can only infer due to its gravitational force on visible matter. We currently do not know when in cosmic history the dark matter formed, what sets its abundance, and whether it interacts appreciably with regular matter. We do not know much about it other than its total abundance.

To explain the late-time acceleration of the cosmic expansion, the model relies on the so-called cosmological constant or some other similar substance that leads to a gravitational repulsive force. The late-time acceleration of the cosmic expansion took cosmologists by surprise. We are still trying to make more precise measurements in the hopes of uncovering some additional clues that might shed some light on this component.

Finally, we have learned that structures in the universe grew as a result of the attractive nature of gravity out of primordial seeds. Observations have established that these primordial seeds were created before the hot Big Bang phase of the cosmic history. Thus they are a relic of the very early universe and potentially probe physics at energy scales substantially above what can be probed in the laboratory.

The activities of Professor **Matias Zaldarriaga** and Members working on cosmology have all centered around one of these puzzles. In the next few decades, additional information that might help answer these questions will come from surveys of the distribution of matter in the late universe. The process of structure formation—the growth of the initial seeds into objects of various sizes—is sufficiently complicated that extracting cosmological information from some of these measurements can be challenging. Zaldarriaga and collaborators have been engaged in trying to develop new tools to compute the predictions of the cosmological model for these type of observations.

Systems Biology

The enormous diversity of phenomena in biology implies that a large diversity of topics is being tackled in biological research. In the tradition of theoretical approaches in physics, Professor **Stanislas Leibler** and Members working at the Simons Center for Systems Biology are striving to find some common mechanisms that could operate across different length and time scales and across different organizational levels of biological systems. For instance, at all scales, from molecular machines to the whole brain, living systems exhibit overwhelming complexity; but what part of this complexity is relevant to function? In other words, what is the dimension of the phenotype space in which biological functions evolve? It seems that in some cases, the effective phenotypic space is a low-dimensional one.

For example, Michael Mitchell, a visiting student, and Member Tsvi Tlusty, together with Leibler, have been analyzing some mechanical properties of proteins based on published structural databases. This analysis, focused on the evaluation of internal strains, has indicated that deformations induced by

Bloomberg Hall Commons: Brian Willet (left, standing), Roger Dashen Member and a string/M-theorist; Professor Nima Arkani-Hamed (center, seated), who continues to make the physics case for the next-generation circular collider; and Professor Emeritus Freeman Dyson (right, standing), whose *Dreams of Earth and Sky* was published by the New York Review of Books

ligand binding or thermal fluctuations localize around regulatory and active sites, and that a structured, low-dimensional path of strains is often visible between these sites. On larger scales, the behavior of swimming bacteria such as *E. coli* seems to be described quite well in a low-dimensional space, as demonstrated by Leibler and his collaborators at Rockefeller University. On longer time scales, populations of microbes seem to exhibit strongly constrained dynamics. By precisely controlling boundary conditions and performing experiments in multiple replicates of a closed microbial ecosystem, Leibler and his collaborators at Rockefeller have demonstrated the existence of strongly deterministic dynamics, despite many stochastic phenomena *a priori* present on different scales and organizational levels. The origins of this phenomenon are at present unidentified. The theoretical research of Member Luca Peliti on population dynamics on ecological time scales will hopefully shed some light on this open problem. Finally, Member BingKan Xue who, together with Leibler, works on the evolutionary dynamics of microbial populations, also investigates, from a theoretical perspective, how low-dimen-

sional manifolds may emerge as relevant entities in the space of possible microbial survival strategies.

All this work implies that mapping the high-dimensional genetic information to phenotypes involves enormous dimensional reduction. One of the challenges of future research will be to further understand the underlying mechanisms.

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Professor Emeritus **Arnold Levine** pursued projects in the fields of cancer and virology in the academic year 2014–15. A study undertaken together with former Member Raúl Rabadán focused on developing new computational tools, based on applied topology (more specifically, persistent homology), to detect and quantify ancestral recombination events from samples of genetic sequences. Some of these theoretical developments have been presented in a paper, "Inference of Ancestral Recombination Graphs Using Topological Data Analysis" (submitted), and some have been used to build whole-genome recombination maps of seven different human populations, using 1000 Genomes Project data. The maps elucidate novel genomic associations with recombina-

tion: with binding sites of some transcription factors, and with some of the repeat-derived loci matched by piwi-interacting RNAs. These results will be presented in a paper, "Fine-scale Resolution of Human Recombination Using Topological Data Analysis."

The same group has initiated a study of aging and cancer in the BXD population of recombinant inbred mice. This study analyzed, by TCR beta chain sequencing, the distributions of T-cell clones in samples taken from the spleens of twenty-two mice (eleven of which showed abnormal enlargements, potentially related to lymphomas) from nine different strains. A similar analysis is being planned for the B-cell repertoire. This information, as well as other phenotypes, is being used to assess the statistical significance of potential associations among spleen enlargement, clonality of the T-cell repertoire and lifespans, in different BXD genetic backgrounds. These are preliminary steps designed to set up a path for the study of lymphomas in different genetic backgrounds, as well as their effect on the average lifespans of BXD mice.

An extension of a collaboration with former Members Benjamin Greenbaum,

Remi Monasson, and Simona Cocco, which used a set of methods from theoretical statistical physics to infer the action of the innate immune system on the evolution of viruses, employed a version of this approach to predict that a subset of noncoding RNA, expressed in tumors but not normal cells, stimulates the immune system. This prediction was tested in the laboratory of Nina Bhardwaj at Mount Sinai, and the predicted set of tumor-specific noncoding RNA were indeed found to be immunogenic. This work has implications for our basic understanding of noncoding RNAs and how they contribute to the role of the immune system in cancer.

Theoretical Physics

In the past year, Professor **Nima Arkani-Hamed** has continued to study the "positive geometry" of a new mathematical object—the amplituhedron—that reformulates the physics of scattering amplitudes for gluons without making use of the usual pictures of quantum-mechanical evolution through spacetime. With a number of mathematicians and physicists, he has found a new, almost completely topological characterization of the amplituhedron. This is hoped to be relevant to uncovering a "dual" of the amplituhedron—generalizing the usual duality between points and planes in projective space, which should be important for determining not just the integrand of the scattering amplitudes, but the actual amplitudes themselves. More conceptually, the dual should illuminate the holographic connection between the "gluon" and "string" descriptions of the physics.

Arkani-Hamed has also turned to thinking about "cosmological correlators," which are the important observables we can measure giving us direct information about the physics during the (likely) early inflationary epoch in our universe. With Professor Juan Maldacena, he studied "cosmological collider physics," understanding how the mass and spin of heavy particles coupled to the inflation during inflation are imprinted on correlators, just as the mass and spin of resonances are inferred from measurements at accelerators. He has also found a rough analogue of the amplituhedron for cosmological correlators in a simple toy class of theories— "cosmological polytopes"—whose volume computes the correlators without any explicit invocation of cosmological time evolution.

Arkani-Hamed also continued his efforts to make the physics case for the next generation of circular colliders, especially in China, leading to the completion of the preliminary conceptual design report for a Chinese collider. Together with a number of collaborators, he also released a long review article on the physics opportunities of a 100 TeV proton-proton collider.

Finally, together with a number of collaborators, Arkani-Hamed recently returned to thinking about the hierarchy problem from a new perspective, where cosmological reheating dynamics plays a crucial role in solving the problem without any new physics at the TeV scale. The idea, dubbed "N-naturalness," makes concrete predictions for signals in the cosmic microwave background and large-scale structure that will be tested in the next ten years.

Professor **Peter Goddard**, in collaboration with former Member Louise Dolan, has continued studying the scattering equations, originally introduced by David Fairlie and David Roberts in 1972. More recently, former Members Freddy Cachazo and Song He along with Ellis Yuan showed that formulae for the tree amplitudes for gauge theories and gravity in arbitrary dimensions can be expressed as sums over the solutions of these equations. In previous work, Dolan and Goddard gave similar formulae for the simplest case of massless scattering, scalar $\varphi 3$ theory, and proofs of these formulae and those for pure gauge theory. They also found a polynomial form of the scattering equations for N particles as a system of $N-3$ homogeneous equations in $N-1$ variables, which, *inter alia,* gives a direct demonstration that the scattering equations typically have $(N-1)!$ solutions.

This work concerns the scattering equations appropriate to the Riemann sphere, as is appropriate for the description of tree amplitudes. These equations have a natural generalization to higher genus. Dolan and Goddard have studied the scattering equations on the torus, which are expected to be relevant to one-loop amplitudes for the massless theories described at tree level, and have

Bernard Chazelle (left), Addie and Harold Broitman Member in Biology, explores whether there is any benefit to be gained from looking at living organisms through an algorithmic lens, and physicist Dmitry Krotov (right), Charles L. Brown Member in Biology, studies the impact of microscopic noise on the collective properties of biological systems at the network level.

DAN KOMODA

obtained two equivalent forms of these equations, each of which is polynomial in N pairs of variables describing points on a (cubic) elliptic curve corresponding to the torus. As in the genus zero case, these formulations facilitate the algebraic solution of the torus scattering equations.

Work has also continued on using methods of algebraic geometry to study the projective variety defined by the polynomial scattering equations on the sphere, showing that it necessarily is zero-dimensional for nonzero values of the Mandelstam variables.

Goddard has also continued working with former Member Matthias Gaberdiel on writing an accessible but rigorous treatment of conformal field theory, in the form of a monograph or graduate textbook. He has continued serving on the boards of institutes in Jerusalem, São Paolo, Vancouver, Geneva, and Zürich. In addition, he has been working with Edward Corrigan on a memoir about the life and work of the physicist David Olive, who died in 2012.

It is clear that the universe is not homogeneous. However, it is very close to homogeneous at very large scales. According to mainstream cosmological theories, the universe was very close to homogeneous in the past. It had only small inhomogeneities. The study of these primordial inhomogeneities is a very interesting topic that has dominated theoretical and experimental cosmology in the last couple of decades.

According to the theory of cosmic inflation, these inhomogeneities were created by quantum mechanical fluctuations during a period of rapid expansion. These fluctuations are random. Their random distribution is very close to a Gaussian (a bell curve). Small deviations from this Gaussian distribution can contain interesting information about the physics of the inflationary epoch. Professor **Juan Maldacena** with Professor Nima Arkani-Hamed have shown how these deviations (or non-Gaussianities) carry information about the masses and spins of particles that could have existed during the inflationary period. These could potentially give
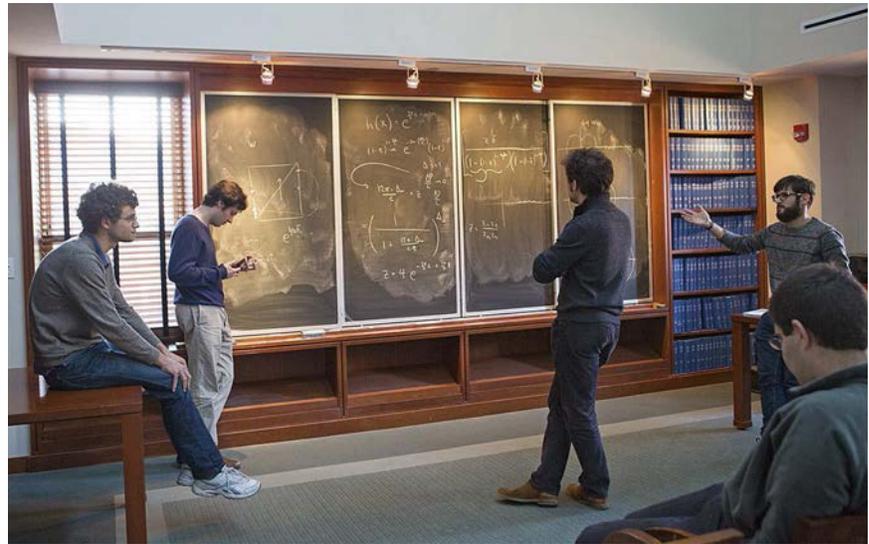
Member Douglas Stanford (far left) gives a physics group talk on computational chaotic commutators. Stanford studies quantum gravity, quantum field theory, and string theory and works on the AdS/CFT description of black-hole interiors and the relationship to chaotic dynamics in quantum field theory.

us indirect information about extra dimensions or the strings of string theory, if these objects had energies comparable to the one set by the expansion rate of the universe. Though these small effects are not observable by current technologies, they might be observable using future experiments proposed by Professor Matias Zaldarriaga and collaborators.

Maldacena has also been interested in the connection between chaos and black holes, which was pointed out by Member Douglas Stanford and collaborators. Chaotic systems are characterized by dynamic instabilities that grow with time. In most physical systems, these instabilities cannot grow arbitrarily fast—there is an upper bound on their rate of growth set by the temperature. It turns out that black holes actually saturate this bound. In the case of the black hole, this growth is due to the growth of gravitational interactions when we collide particles with increasing energies. This is an example where thinking about the dynamics of black holes led to a universal bound that is valid for more general systems.

Professor **Nathan Seiberg** continued his explorations of quantum field theory—a framework combining quantum theory with Einstein's special theory of relativity.

Quantum field theory is important in many branches of physics including particle physics, string theory, condensed-matter physics, and cosmology, and it leads to many insights in mathematics. There is no doubt that we are still very far from a clear and complete understanding of it.

Continuing his work with former Members Ofer Aharony and Shlomo Razamat and current Member Brian Willett, Seiberg studied the behavior of supersymmetric quantum field theories in one spatial dimension. As their higher-dimensional counterparts, these theories exhibit a rich structure of dualities. That is, several different classical theories turn out to be identical quantum mechanically. The new work derives some of these dualities in one spatial dimension as a consequence of similar dualities in higher-dimensional theories, leading to new insights about the dynamics of the lower-dimensional theories.

In another direction, Seiberg focused on the crucial role of symmetries in quantum field theory. In collaboration with former Members Davide Gaiotto and Anton Kapustin and current Member Brian Willett, Seiberg defined a new kind of symmetry. Unlike ordinary symmetries, this one is associated with higher-dimensional defects. This symmetry organizes the spectrum

of extended objects like strings or membranes and controls their behavior. The careful definition of these symmetries gave a new perspective on a number of known results and led to several new insights. Specifically, the new perspective extended the classic description of phases of matter due to Landau and incorporated known diagnostics of phases associated with the behavior of Wilson and 't Hooft loops into a unified description. The systematic analysis of these symmetries gave a simple way to analyze many phenomena like quark confinement and the Higgs mechanism. The study of anomalies in such symmetries has uncovered a detailed description of the boundaries between different phases of matter. This led to a surprising connection between phenomena discussed in condensed-matter physics (specifically, symmetry-protected topological phases), the physics of branes in string theory, and defects in quantum field theory.

The main new direction in Charles Simonyi Professor **Edward Witten**'s work in 2014–15 was to learn more about the applications of quantum field theory to condensed-matter physics. Quantum field theory is the framework for expressing the most fundamental laws of physics that we know. It is the framework for understanding the elementary particles, and it our most difficult theory mathematically. Most of Witten's career has been spent dealing with quantum field theory and its extension in string theory.

Quantum field theory also has applications to condensed-matter physics, which is the theory of ordinary matter, for instance a piece of lead. In fact, in recent years, many new applications have been found of quantum field theory to condensed-matter physics. Some of these applications involve new materials such as "topological insulators," materials that are insulators in bulk but that conduct electricity on their surface. In some cases, these are really newly appreciated materials rather than new materials; that is, the materials have been available for a long time but some of their unusual properties are only recently appreciated.

Witten has been working on the theory of "anomalies" applied to materials such as topological insulators. Anomalies—such as the Adler-Bell-Jackiw anomaly that plays an important role in the Standard Model of particle physics—are an important topic in quantum field theory. Anomalies applied to string theory were one of Witten's interests early in his career. In the fall of 2014, while trying to refine some of the traditional results concerning anomalies in string theory, Witten was surprised to realize that the same ideas were relevant to topological insulators and related materials. Developing this further has been one of his main interests since then.

Witten also worked with Professor Nathan Seiberg on applications to condensed-matter physics of Chern–Simons gauge theory, another concept of quantum field theory. Chern-Simons gauge theory, which Witten used a quarter century ago to describe topological properties of knots, has also been extensively used in the intervening years by condensed-matter physics to describe the properties of exotic "quasiparticles" that exist in certain materials. Seiberg and Witten have been reexamining this relationship and have reached a better understanding of several aspects. Among other things, they have a new understanding of what technically are called gapped surface states of a topological insulator. The idea here is that if the quantum interactions are strong enough, a topological insulator might remain insulating even on its surface, with no breakdown of symmetry.

One of the main mysteries in particle physics is the origin of the vast hierarchy in scales between the Standard Model scale of around 100 GeV, and the quantum gravity scale of order 10^{19} GeV. Another is the origin of three repeating families of quarks, with identical electroweak couplings but vastly different masses. Much current work centers on supersymmetry as an explanation for the hierarchy, but so far no experimental evidence for this symmetry has emerged, even though "naturalness" arguments suggest that it should have already been found in the last run of the Large Hadron Collider (LHC). The current LHC run may find supersymmetry, but it very well may not, and this motivates thinking about nonsupersymmetric alternatives for particle and force unification, and for explaining the occurrence of three families.

Professor Emeritus **Stephen Adler**'s project for the past year has been working on a new proposal for unification that he published this year both as a journal article and in an anthology, edited by Harald Fritzsch and Murray Gell-Mann, celebrating "50 Years of Quarks." Adler's idea is based on three novel ingredients: (1) boson-fermion balance, i.e., equal numbers of degrees of freedom, but without full supersymmetry, (2) cancellation of gauge anomalies between spin-3/2 and spin-1/2 particles, rather than just within the spin-1/2 sector, as usually assumed, and (3) symmetry breaking using a scalar field with a nonzero "charge" quantum number, requiring a discrete set of ground states with a modular or charge periodic structure, one of which seems to connect to the Standard Model particle content.

Following up on his initial paper, Adler has been investigating the various ingredients of his proposal in a series of papers. Two papers that have been published deal with details of ingredient (3), where he studies symmetry breaking by scalars in antisymmetric tensor representations, giving new results beyond those currently in the literature. Further published papers study spin-3/2 fields (so called Rarita-Schwinger fields) and show that some old results indicating that these theories are inconsistent in the massive case do not apply in the zero mass case used in his unification theory.

Adler's unification ideas have raised further issues that remain to be explored, and he expects this to be the main focus of his work over the next few years. He also had fruitful conversations with Angelo Bassi, who visited the IAS for two weeks in May, on the subject of gravitational decoherence, on which they have published a short paper.

2014–15 MEMBERS AND VISITORS

f First Term ✦ *s* Second Term ✦ *m* Long-term Member ✦ *v* Visitor ✦ *vp* Visiting Professor ✦ *jvp* Junior Visiting Professor ✦ *ra* Research Asociate
j Joint Member School of Mathematics

Victor Alexandrov
Biology ✦ Institute for Advanced Study

Dionysios Anninos
Quantum Gravity ✦ Stanford University
Martin A. and Helen Chooljian Founders' Circle Member; additional funding provided by the National Science Foundation

Tobias Baldauf
Cosmology ✦ Institute for Advanced Study
Corning Glass Works Foundation Fellowship

Till Bargheer
Quantum Field Theory, String Theory Institute for Advanced Study
European Commission Marie Curie Fellowship

Christopher John Beem
Theoretical Physics ✦ Institute for Advanced Study
Frank and Peggy Taplin Member; additional funding provided by the National Science Foundation

Eric Blackman
Astrophysics ✦ University of Rochester
IBM Einstein Fellow

Kfir Blum
Particle and Astroparticle Physics Institute for Advanced Study ✦ *m*
John N. Bahcall Fellow; additional funding provided by the United States–Israel Binational

Jo Bovy
Cosmology, Astrophysics ✦ Institute for Advanced Study ✦ *m*
John N. Bahcall Fellow; additional funding provided by the W. M. Keck Foundation Fund

Timothy David Brandt
Astrophysics ✦ Institute for Advanced Study
NASA Exoplanet Science Institute Carl Sagan Fellowship

Matthew Bullimore
Quantum Field Theory ✦ Perimeter Institute for Theoretical Physics
Martin A. and Helen Chooljian Member; additional funding provided by the National Science Foundation

Gustavo Burdman
Particle Physics ✦ University of São Paulo ✦ *s*
Funding provided by The Ambrose Monell Foundation

Bernard Chazelle
Biology ✦ Princeton University
Addie and Harold Broitman Member in Biology

Timothy Cohen
Particle Physics ✦ SLAC National Accelerator Laboratory ✦ *v*

Raffaele Tito D'Agnolo
Particle Physics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Neal Dalal
Astrophysics ✦ University of Illinois at Urbana-Champaign ✦ *jvp, s*
AMIAS Member

Tudor Dan Dimofte
Mathematical and Particle Physics Institute for Advanced Study ✦ *m*
Funding provided by the European Research Council and the U.S. Department of Energy

Michael Dine
Theoretical Particle Physics ✦ University of California, Santa Cruz ✦ *vp, s*
Funding provided by The Ambrose Monell Foundation

Daniel Freed
Geometry and Physics ✦ The University of Texas at Austin ✦ *j, s*
IBM Einstein Fellow; additional funding provided by the James D. Wolfensohn Fund

Abhijit Gadde
Theoretical Physics ✦ California Institute of Technology
Funding provided by the Raymond and Beverly Sackler Foundation Fund and the National Science Foundation

Vera Gluscevic
Cosmology, Astrophysics ✦ Institute for Advanced Study
Friends of the Institute for Advanced Study Member

Johannes Henn
Particle Physics ✦ Institute for Advanced Study ✦ *m*
Marvin L. Goldberger Member; additional funding provided by the U.S. Department of Energy

Anson Hook
Particle Physics ✦ Institute for Advanced Study
Funding provided by the U.S. Department of Energy

Yu-tin Huang
Particle Physics ✦ Institute for Advanced Study ✦ *s*

Johan Carl Gunnar Källén
Theoretical Physics ✦ Université de Genève
Funding provided by the Swedish Research Council

Hyung Do Kim
Particle Physics ✦ Seoul National University
IBM Einstein Fellow

Shinta Kobayashi
Biology ✦ Chugai Pharmaceutical Co., Ltd., Japan ✦ *v*

Bence Kocsis
Astrophysics ✦ Institute for Advanced Study
Funding provided by NASA

Dmitry Krotov
Biology ✦ Institute for Advanced Study
Charles L. Brown Member in Biology

Doron Kushnir
Astrophysics ✦ Institute for Advanced Study
Friends of the Institute for Advanced Study Member

Brian Lacki
Astrophysics ✦ Institute for Advanced Study

Paul Langacker
Particle Physics ✦ Institute for Advanced Study ✦ *v*

Marta Luksza
Biology ✦ Institute for Advanced Study ✦ *ra*
Janssen Fellow

Mehrdad Mirbabayi
Astrophysics ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Kohta Murase
Astroparticle Physics ✦ Institute for Advanced Study
Space Telescope Science Institute Hubble Fellow

James Owen
Astrophysics ✦ Canadian Institute for Theoretical Astrophysics
Space Telescope Science Institute Hubble Fellow

Sonia Paban
Particle Physics ✦ The University of Texas at Austin ✦ *s*

Luca Peliti
Biology ✦ Sezione di Napoli, Istituto Nazionale di Fisica Nucleare

Massimo Porrati
Theoretical High Energy Physics, String Theory, Quantum Gravity, Cosmology ✦ New York University ✦ *s*

Rami Pugatch
Biology ✦ Institute for Advanced Study ✦ *ra*
Janssen Fellow

Loganayagam Ramalingam
Particle Physics ✦ Institute for Advanced Study
Funding provided by the U.S. Department of Energy

Nir Shaviv
Astrophysics ✦ The Hebrew University of Jerusalem
IBM Einstein Fellow

David Simmons-Duffin
Particle Physics ✦ Institute for Advanced Study ✦ *m*
William D. Loughlin Member; additional funding provided by the U.S. Department of Energy

Marko Simonović
Cosmology ✦ Scuola Internazionale Superiore di Studi Avanzati, Trieste

David Spergel
Theoretical Astrophysics ✦ Princeton University ✦ *v, f*

Douglas Stanford
Theoretical Physics ✦ Stanford University
Funding provided by the National Science Foundation and the Paul Dirac Fund

Rashid Sunyaev
Astrophysics ✦ Max-Planck–Institut für Astrophysik ✦ *vp*
Maureen and John Hendricks Visiting Professor

Tsvi Tlusty
Biology ✦ Institute for Advanced Study
Martin A. and Helen Chooljian Member in Biology

David Vegh
Particle Physics ✦ CERN
CERN Fellowship

Aron Wall
Particle Physics, Gravity ✦ University of California, Santa Barbara
Funding provided by the National Science Foundation

Brian M. Willett
Particle Physics ✦ Institute for Advanced Study
Roger Dashen Member; additional funding provided by the U.S. Department of Energy

BingKan Xue
Biology ✦ Institute for Advanced Study
Eric and Wendy Schmidt Member in Biology

Masahito Yamazaki
Particle Physics ✦ Institute for Advanced Study ✦ *s*

Kazuya Yonekura
Particle Physics ✦ Institute for Advanced Study
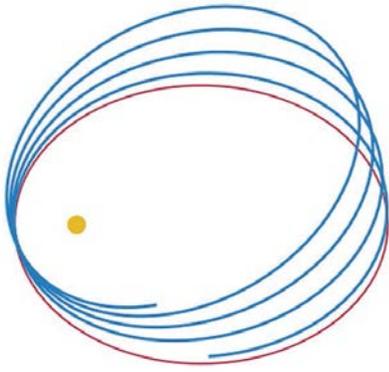*Funding provided by the U.S. Department of Energy*

Johannes Henn on the Motion of the Planets and Quantum Field Theory

What do the motion of the planets in our solar system, the energy levels of the hydrogen atom, and the interactions between subatomic particles have in common? Surprisingly, they are all governed by the same hidden symmetry principles.

Symmetry is a very important notion in physics, for mainly two reasons. On the one hand, systems with a lot of symmetry are usually easier to solve and study, so that key properties can be understood analytically. On the other hand, and more fundamentally, in the development of physics, symmetry principles have often been a successful guiding principle toward theories relevant for describing nature. An example is Einstein's equivalence principle that led to the development of general relativity.

What is the hidden symmetry underlying the motion of the planets, such as the Sun and the Earth? The answer to this question is important for the Kepler problem, i.e., the question of how to predict the position and velocity of two bodies, given some initial conditions. The motion is governed by Newton's laws, which tell us, in particular, that the gravitational force between two objects depends only on their relative distance. Read more at www.ias.edu/ias-letter/2015/henn-planets.

Scott Tremaine on the Odd Couple: Quasars and Black Holes

Black holes are among the strangest predictions of Einstein's general theory of relativity: regions of spacetime in which gravity is so strong that nothing—not even light—can escape. More precisely, a black hole is a singularity in spacetime surrounded by an event horizon, a surface that acts as a perfect one-way membrane: matter and radiation can enter the event horizon, but, once inside, can never escape. Remarkably, an isolated, uncharged black hole is completely characterized by only two parameters: its mass, and its spin or angular momentum.

Laboratory study of a macroscopic black hole is impossible with current or fore-seeable technology, so the only way to test these predictions of Einstein's theory is to find black holes in the heavens. Not surprisingly, isolated black holes are difficult to see. Not only are they black, they are also very small: a black hole with the mass of the Sun is only a few kilometers in diameter (this statement is deliberately vague: because black holes bend space, notions of "distance" close to a black hole are not unique). However, the prospects for detecting black holes in gas-rich environments are much better. Read more at www.ias.edu/ias-letter/2015/tremaine-quasars.
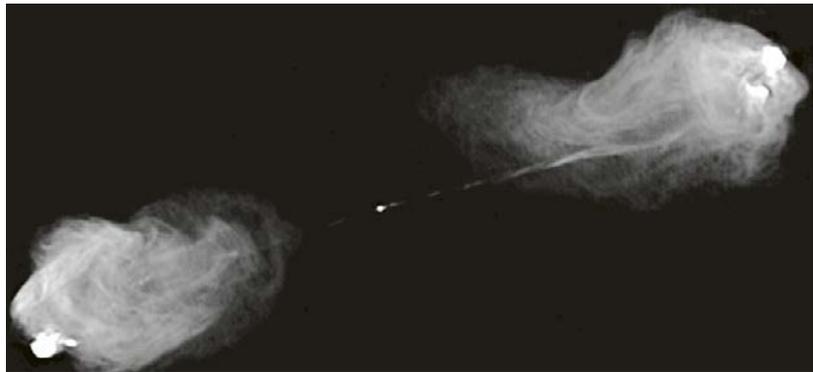
A radio image of jets from the quasar Cygnus A

Beyond the Higgs: From the LHC to China

Three years ago, just before it was scheduled to shut down in preparation for its second phase, the Large Hadron Collider (LHC) discovered the Higgs boson. Its discovery was expected, having been predicted nearly sixty years earlier by Peter Higgs, but the LHC-produced particle is bizarre and puzzling.

"There are all sorts of issues, theoretical issues surrounding the Higgs, which are very mysterious," says Nima Arkani-Hamed, Professor in the School of Natural Sciences. "The Higgs is the first truly new kind of elementary particle that we have discovered in four decades, and it is really a strange object." Point-like with no properties aside from a mass of 125 gigaelectronvolts (GeV), the Higgs particle does not have any charge or spin. It is also the only known particle with the ability to interact with itself.

Faced with such a compelling cliffhanger, Arkani-Hamed headed to China. "I thought the most effective thing I could do to push this part of physics forward is to try to make sure that the next machine happens," says Arkani-Hamed. Read more at www.ias.edu/ias-letter/2015/arkani-hamed-collider.

TIMOTHY BRANDT ON THE SUN, MOON, AND STARS

"How big" is almost always an easier question to answer than "how old." Though we can measure the sizes of animals and plants easily enough, we can often only guess at their ages. The same was long true of the cosmos. The ancient Greeks Eratosthenes and Aristarchus measured the size of the Earth and Moon, but could not begin to understand how old they were. With space telescopes, we can now even measure the distances to stars thousands of light-years away using parallax, the same geometric technique proposed by Aristarchus, but no new technology can overcome the fundamental mismatch between the human lifespan and the timescales of the Earth, stars, and universe itself. Despite this, we now know the ages of the Earth and the universe to much better than 1 percent, and are beginning to date individual stars. While we know the age of the Sun to about 0.1 percent, this is not true of any other star. Our ability to measure ages, to place ourselves in time as well as in space, stands as one of the greatest achievements of the last one hundred years. Read more at www.ias.edu/ias-letter/2015/brandt-dating-the-earth.

NIR SHAVIV ON SIGHTS FROM A FIELD TRIP IN THE MILKY WAY

How might climate be influenced by cosmic rays? In 1913, Victor Hess measured the background level of atmospheric ionization while ascending with a balloon. By doing so, he discovered that Earth is continuously bathed in ionizing radiation. These cosmic rays primarily consist of protons and heavier nuclei with energies between their rest mass and a trillion times larger. In 1934, Walter Baade and Fritz Zwicky suggested that cosmic rays originate from supernovae, the explosive death of massive stars. However, only in 2013 was it directly proved, using gamma-ray observations with the FERMI satellite, that cosmic rays are indeed accelerated by supernova remnants. Thus, the amount of ionization in the lower atmosphere is almost entirely governed by supernova explosions that took place in the solar system's galactic neighborhood in the past twenty million years or so.

Besides being messengers from ancient explosions, cosmic rays are extremely interesting because they link together so many different phenomena. They tell us about the galactic geography, about the history of meteorites or of solar activity, they can potentially tell us about the existence of dark matter, and apparently they can even affect climate here on Earth. Read more at www.ias.edu/ias-letter/2015/shaviv-milky-way.
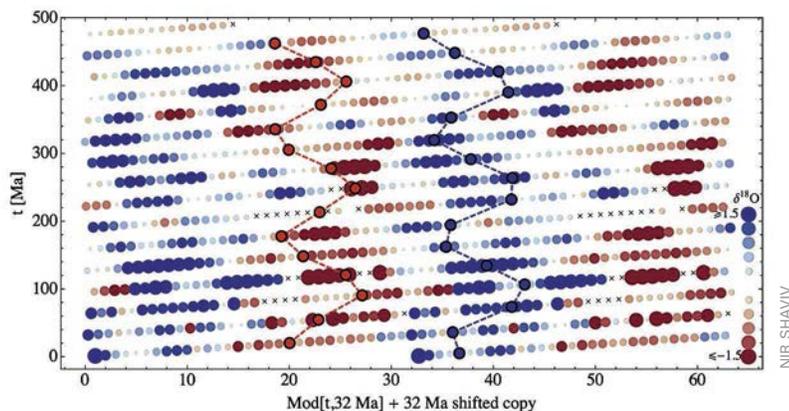
EDWARD WITTEN ON GEOMETRIC LANGLANDS, KHOVANOV HOMOLOGY, STRING THEORY

In 2006, Edward Witten, Charles Simonyi Professor in the School of Natural Sciences, cowrote with Anton Kapustin a 225-page paper, "Electric-Magnetic Duality and the Geometric Langlands Program," on the relation of part of the geometric Langlands program to ideas of the duality between electricity and magnetism. Witten spoke about his experience writing the paper with Kapustin and his thoughts about future directions in mathematics and physics in an interview that took place in November 2014 on the occasion of Witten's receipt of the 2014 Kyoto Prize in Basic Sciences for his outstanding contributions to mathematical science through his exploration of superstring theory. "It was very hard to write a paper about it. It took about a year. For that year, I felt like someone who had discovered the meaning of life and couldn't explain it to anybody else." Read more at www.ias.edu/ias-letter/2015/witten-interview.

The 2014–15 theme seminar, "Egalitarianisms," organized by UPS Foundation Professor Danielle Allen, examined central questions of democracy: What is political equality? How do political equality, social equality, and economic equality (and the corresponding inequalities) relate to each other? Are they separable or necessarily interdependent? What has been their historical relationship?

School of Social Science

The School of Social Science, founded in 1973, is devoted to a multidisciplinary, comparative, and international approach to the analysis of societies and social change and the examination of historical and contemporary problems. Every year, the School designates an annual theme, although some Members are selected to pursue research in other areas.

WHAT EXACTLY IS POLITICAL EQUALITY? This was a central question of the 2014–15 theme seminar, "Egalitarianisms," led by UPS Foundation Professor Danielle Allen. Insofar as the purpose of democracy is to empower individual citizens and give them sufficient control over their lives to protect themselves against domination, the core ideal of democracy is political equality. We have come to think of this ideal as consisting primarily of voting rights and the right to run for elected office. These political rights are, of course, fundamental. The carceral state draws our attention to that point, but voting rights are only one of the instruments available to be directed toward the egalitarian empowerment of a citizenry. How do political equality, social equality, and economic equality (and the corresponding inequalities) relate to each other? Are they separable or necessarily interdependent? What has been their historical relationship? How do questions of economics, law, institutions, social structure, culture, psychology, and human development intersect with the empowerment (and disempowerment) of individuals and collectivities? How have these intersections differed depending on time and place? In the current context, how do forms of global governance and democratic deficits relate to projects of empowerment at other levels? How have notions of empowerment differed in different historical and cultural contexts? Is it possible to articulate a clear definition of equality or should we think in terms of varying languages of egalitarianism? What have been the critiques of political equality? Must egalitarianism be understood in relation to democracy? How should we think about non-democratic egalitarianism? Members looked at the theoretical and philosophical dimensions of these questions, as well as concrete examples of different practices and definitions of equality.

Twenty-one scholars in residence, and one scholar who joined via videoconference, participated in a weekly seminar addressing questions

FACULTY

Danielle Allen
UPS Foundation Professor

Didier Fassin
James D. Wolfensohn Professor

Dani Rodrik
Albert O. Hirschman Professor

PROFESSORS EMERITI

Michael Walzer
Joan Wallach Scott

ANDREA KANE

such as these. Scholars came from all disciplines of the social sciences and launched their discussions through collective readings of political philosopher Elizabeth Anderson, public health scholar Nancy Krieger, economic historian Karl Polanyi, and intellectual historian Pierre Rosanvallon. Over the course of the year, progress was made at clarifying general and broad-brush invocations of "inequality" or "equality" as pertaining to one or another domain (moral, economic, social, or political) and as requiring clear explication of the relations among domains. Important themes in the conversation were the relationship between sociology and economics as rival efforts to solve social problems; questions of how culture and social practice establish egalitarian or hierarchical norms and, consequently, institutional structures; questions of whether political equality is a robust enough idea and ideal to generate egalitarianism in other realms (for instance, the economic or social); and questions of the sorts of institutional innovation that might revive political equality (expanded use of the lottery, revised

approaches to federalism, campaign finance legislation, etc.). A handful of outstanding outside speakers presented work in progress: Axel Honneth, Monica Prasad, Heather Gerken, and Tara Zahra, as well as two—Hoyt Bleakley and Glen Weyl—in collaboration with the "Workshop on Ideas, Institutions, and Political Economy." Finally, in a year where the United States was grappling with issues of policing and of race and injustice, those topics weaved regularly through the theme seminar. A few extra sessions to talk about those issues were scheduled, leading to the discovery that the more formal, theoretical seminars and the more informal efforts to come to grips with what was unfolding were highly, mutually productive.

In addition to leading the theme year seminar, **Danielle Allen**, UPS Foundation Professor, gave the Tanner Lectures on Education and Equality at Stanford University, which will be published by the University of Chicago Press (spring 2016), completed work on the co-edited *From Voice to Influence: Understanding Citizenship in a Digital Age* (University of Chicago Press, June 2015), and joined

the *Washington Post* as a contributing columnist, publishing regular op-eds. She also taught a graduate seminar at Princeton on the same subject. She continued her work with the MacArthur Foundation research network on youth and participatory politics, focusing particularly on the development of "design principles" intended to establish parameters for achieving effective, equitable, and self-protective civic agency in online environments. And she advanced her research agenda on assessment in the liberal arts and humanities, focusing in particular on the public humanities and providing research and evaluative reports for the Illinois Humanities Council, as well as launching a study of the People and Stories Program based in Trenton, New Jersey. Finally, she continued her efforts at professional service, chairing the Pulitzer Prize Board through its 2015 season and stepping into the chair of the Mellon Foundation Board.

Can states be moral? In the final year of the European Research Council program that **Didier Fassin**, James D. Wolfensohn Professor, has been coordi-

Left: Visitor Nannerl Keohane leads a talk on civil society, democratic knowledge, and democratic leadership as part of the "Workshop on Ideas, Institutions, and Political Economy," organized by Albert O. Hirschman Professor Dani Rodrik. *Right*: Conceptions of equality and inequality in sociology and those of wider publics are discussed in a seminar on "Egalitarianisms."

nating on what he proposes to name a political and moral anthropology, Fassin attempted to answer this question on the basis of the inquiry he conducted in France with a team of social scientists. Whereas states are usually regarded as neutral and distant bureaucratic entities, whose agents are moved by a combination of rules, interests, and power relations, the investigation established that they also mobilize values and emotions. This is true in particular of the institutions to which Fassin dedicated most of his personal research over the past decade: police, justice, and prison, which he studied through long-term participant observation in precinct, court, and prison. Not only do officers, magistrates, and guards constantly produce moral evaluations of the people and situations they have to deal with, but even policies, laws, and procedures express moral judgments on the part of society regarding whom to punish and in which manner, what to expect from prevention or repression, and how to justify or correct inequalities. Although each national context obviously produces specific norms and practices on these matters

in relation to its history and culture, the analysis presented in *At the Heart of the State: The Moral World of Institutions*, by Fassin et al., invites a broader and renewed approach to the political realm.

This theoretical discussion and these empirical findings are of obvious relevance in contemporary society. In light of recent events and growing concerns, in North America and Western Europe, with respect to law enforcement, the justice system, and the phenomenon of mass incarceration, the research has indeed received substantial public attention. This situation has provided an opportunity to pose the increasingly salient question of the complex relationships between the social sciences and society. How to translate fundamental research for wider audiences and at what cost in terms of simplification? How to establish connections with and respond to solicitations from publics as various as the media, policymakers, and nongovernmental organizations? These interrogations and the corresponding challenges, which interest all disciplines, have become the object of an extension of the program. As a result

of an international workshop held in the School of Social Science, an edited volume is in preparation, in which a dozen scholars working on five continents explore the multiple forms of interaction between research and society. A preliminary reflection was published in the *American Ethnologist* under the title "The Public Afterlife of Ethnography" and was the subject of a seminar at the École des Hautes Études en Sciences Sociales in Paris.

Dani Rodrik, Albert O. Hirschman Professor, completed the book *Economics Rules: The Rights and Wrongs of the Dismal Science*, to be published in fall 2015 by W. W. Norton. He argues in the book that the multiplicity of theoretical frameworks that exist side by side is economics' great strength. Economists are trained to hold diverse, possibly contradictory, models of the world in their minds. They have to be syncretic in how they think about social reality. This is what allows them, when they do their job right, to comprehend the world, make useful suggestions for improving it, and to advance their stock of knowledge over time.

Left: Economist Kalyan Chatterjee, Richard B. Fisher Member, who studies networks and complexity in games, gives the Social Science Lunch Seminar "Diffusion of Ideas and Innovations." *Right*: Didier Fassin (left), James D. Wolfensohn Professor, with Yve-Alain Bois, Professor of Art History in the School of Historical Studies

Member Jill Locke researches and writes about children's political activism, particularly the role of children in the U.S. civil rights movement.

But syncretism is not a comfortable state of mind, and economists often jettison it for misplaced confidence and arrogance, especially when they confront questions of public policy. Economists are prone to fads and fashions, and behave too often as if their discipline is about the search for *the* model that works always and everywhere, rather than a portfolio of models. Their training lets them down when it comes to navigating among diverse models and figuring out which one applies where.

So Rodrik offers in this book both a defense and critique of economics. Economists' way of thinking about social phenomena has great advantages. But the flexible, contextual nature of economics is also its Achilles' heel in the hands of clumsy practitioners.

Rodrik was engaged in two other major projects. One is an empirical project that examines patterns of deindustrialization in the world economy. In a research paper, he documented a dramatic trend of deindustrialization in developing countries. This is a trend that is appropriately called premature deindustrialization, since it means that many (if not most) developing nations are becoming service economies without having had a proper experience of industrialization. Rodrik found that Latin America was the worst-hit region. But worryingly, similar trends are very

much in evidence in sub-Saharan Africa too, where few countries had much industrialization to begin with. The only countries that seem to have escaped the curse of premature industrialization are a relatively small group of Asian countries and manufactures exporters. The advanced countries themselves have experienced significant employment deindustrialization. But manufactures output at constant prices has held its own comparatively well in the advanced world, something that is typically overlooked since so much of the discussion on deindustrialization focuses on nominal rather than real values.

The second project, joint with Member Sharun Mukand of the University of Warwick, is titled "The Political Economy of Liberalism." The starting point of this research is that the majority of today's democracies are electoral rather than liberal democracies. That is, they are political regimes that allow political competition and generally fair elections, but exhibit considerable violations of the civil rights of minority and other groups not in power. For example, Hungary, Ecuador, Mexico, Turkey, and Pakistan are all classified as electoral democracies (according to the Freedom House). But in these and many other countries, harassment of political opponents, censorship or self-censorship in the media, and discrimination against

minority ethnic/religious groups run rampant.

Rodrik and Mukand focused on the missing ingredient in illiberal electoral democracies: civil rights. They argue that the failure to protect civil rights is a readily understood consequence of the political logic behind the emergence of democracy. Democracy, when it arose, was typically the result of a quid pro quo between the elites and the mobilized masses. The elites acceded to the masses' demands that the franchise be extended (usually) to all males. In return, the newly enfranchised groups accepted limits on their ability to expropriate property holders. In short, electoral rights were exchanged for property rights. The defining characteristic of this political settlement is that it excludes the main beneficiary of civil rights— the dispossessed minorities—from the bargaining table. These minorities have neither resources (like the elite) nor numbers (like the majority) behind them.

So what requires explanation is not the relative paucity of liberal democracy, but its existence—rare as it may be. The surprise is not that few democracies are liberal, but that liberal democracies exist at all.

In addition to running the School's "Workshop on Ideas, Interests, and Political Economy," Rodrik was elected as Vice President of the International Economic Association in 2015. He continued his term as LSE Centennial Professor of Economics at the London School of Economics and as a monthly contributor to the Project Syndicate group of newspapers. He gave keynote speeches at the meetings of the Spanish Economic Society and the International Political Economy Society.

Professor Emerita **Joan Wallach Scott** did not get done as much writing as she would have liked since most of the spring term was taken up with the intense, difficult, and time-consuming deliberations about the future of the School of Social Science.

She hopes to be able to return to work on a book on secularism and gender equality during the summer. In this book, she argues that the simple

opposition between secularism and Islam, gender equality, and the subordination of women does not reflect the historical realities of the emergence of modern nation-states in the nineteenth and twentieth centuries. She lectured on secularism and gender at Oxford University and the University of Maryland. During the year, she met regularly with a small group of Members who each read one another's chapters. The group had in common a commitment to critical work in the field of history.

Scott gave a talk at the meetings of the American Historical Association on psychoanalysis and history, a topic on which she continues work begun in past years. And she gave lectures in Paris at the Institut Emilie du Châtelet and at Princeton University (the Meredith Miller Memorial Lecture) on the trajectory of her career as a historian.

She also participated in an investigation of the actions taken by the administration of the University of Illinois Urbana-Champaign in the case of Steven Salaita, an investigation that led to the American Association of University Professors censure of the university administration on the grounds that it had denied Salaita due process and academic freedom (www.aaup.org/report/UIUC). One of the issues raised in the Salaita case had to do with the question of whether tweets he had issued last summer during the Gaza War were "uncivil" and whether "incivility" was a ground for dismissal. Scott did some research and wrote a piece on the question of civility, which was published in the *Nation* on May 4, 2015 (www.thenation.com/article/204481/new-thought-police).

2014–15 MEMBERS AND VISITORS

f First Term ✦ *s* Second Term ✦ *v* Visitor

Tugba Basaran
Political Science ✦ University of Kent ✦ *v*

Gurminder K. Bhambra
Sociology ✦ University of Warwick ✦ *v*

Michael Bordo
Economic History ✦ Rutgers, The State University of New Jersey ✦ *v, s*

Brady Brower
History ✦ Weber State University

Manduhai Buyandelger
Anthropology ✦ Massachusetts Institute of Technology

Kalyan Chatterjee
Economics ✦ The Pennsylvania State University
Richard B. Fisher Member

Brian Connolly
History ✦ University of South Florida ✦ *v*

Pinar Doğan
Economics ✦ Harvard Kennedy School ✦ *v*

James Doyle
Philosophy ✦ Institute for Advanced Study ✦ *v*

Sara Edenheim
History, Gender Studies ✦ Umeå University ✦ *v, s*

Adam Elga
Philosophy ✦ Princeton University
Deutsche Bank Member

Anver M. Emon
Law ✦ University of Toronto

Gary Alan Fine
Sociology ✦ Northwestern University

Paul Gowder
Law and Political Theory ✦ The University of Iowa

Alexander A. Guerrero
Philosophy ✦ University of Pennsylvania

Hugh Gusterson
Anthropology ✦ The George Washington University

Michael G. Hanchard
Political Science ✦ Johns Hopkins University

John Holmwood
Sociology ✦ The University of Nottingham

Nannerl O. Keohane
Political Theory ✦ Princeton University ✦ *v*

Julilly Kohler-Hausmann
History ✦ Cornell University

Jill Locke
Political Science ✦ Gustavus Adolphus College

Jennifer A. London
Political Science ✦ Institute for Advanced Study ✦ *v*

Anandi Mani
Economics ✦ University of Warwick
Deutsche Bank Member

Nolan McCarty
Political Science ✦ Princeton University

Maurizio Meloni
Sociology ✦ Sheffield University

Peter Alexander Meyers
Intellectual History, Political Theory ✦ Université Paris III ✦ *v*

Jennifer L. Morgan
History ✦ New York University
AMIAS Member

Sharun W. Mukand
Political Economy of Development ✦ University of Warwick
Roger W. Ferguson, Jr., and Annette L. Nazareth Member

Serguei A. Oushakine
Anthropology ✦ Princeton University
Frederick Burkhardt Fellowship funded by the American Council of Learned Societies

Charles M. Payne
Social Change, Civil Rights ✦ The University of Chicago
Friends of the Institute for Advanced Study Member

Gideon A. Rosen
Philosophy ✦ Princeton University ✦ *v*

Sophia Rosenfeld
History ✦ University of Virginia
Ed Kaufmann Founders' Circle Member

Noah Salomon
Religion ✦ Carleton College ✦ *v, f*

Valentin Seidler
Development Economics ✦ Universität Wien ✦ *v*

Cécile Stehrenberger
History of Cold War Social Science Disaster Research ✦ Universität Zürich ✦ *v, f*
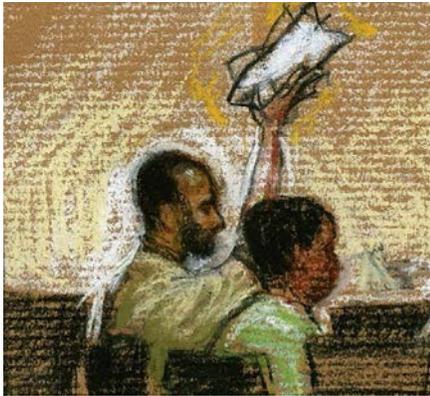
Joanna Tokarska-Bakir
Cultural and Historical Anthropology ✦ University of Warsaw ✦ *v*

Mara Viveros Vigoya
Anthropology ✦ Universidad Nacional de Colombia
Wolfensohn Family Member

Richard Ashby Wilson
Anthropology and Law ✦ University of Connecticut
Friends of the Institute for Advanced Study Member

Ali al-Bahlul waves a sign, "Boycott," printed in Arabic and English, during his arraignment for war crimes related to his work as al-Qaeda media secretary.

RICHARD ASHBY WILSON AND CHRISTINE LILLIE ON PROPAGANDA AND VIOLENCE

Over the last ten years, national and international courts have prosecuted a greater number of political leaders and their propagandists who incite others to commit acts of war, terrorism, and genocide. The United States government, a self-avowed promoter of freedom of speech, has pursued al-Qaeda propagandists such as Ali al-Bahlul and Sulaiman Abu Ghaith, and in 2014 a federal court sentenced Ghaith to life in prison for what his defense attorney called "just talk." The International Criminal Tribunal for Rwanda has convicted eight defendants, including radio broadcasters and a Rwandan pop star, of direct and public incitement to commit genocide. Combatting election propaganda is a priority of the International Criminal Court's chief prosecutor, Fatou Bensouda, who warned in advance of the recent Nigerian elections that "any person who incites or engages in acts of violence by ordering, requesting, encouraging, or contributing in any other manner to the commission of crimes … is liable to prosecution either by Nigerian courts or by ICC."

Intuitively, we may feel that leaders and media figures who incite genocide and crimes against humanity should bear criminal responsibility. Yet there does not exist any conclusive body of social science evidence demonstrating that extreme speech directly influences attitudes and behavior. Read more at www.ias.edu/ias-letter/2015/wilson-lillie-propaganda.

ANVER EMON ON ISLAMIC LAW AND PRIVATE INTERNATIONAL LAW

How can private international law reconcile differences between not only two parties, but two legal systems? In the 1991 film *Not Without My Daughter*, Sally Field plays an American woman who has a daughter with her Iranian-born husband. When the family visits Iran, Field's character learns that the husband plans to stay in Iran with their daughter. To escape Iran with her daughter, Field's character must dupe her increasingly abusive husband, and hire a smuggler to help her and her daughter escape to Turkey. In the backdrop of the dramatic escape is an Iranian legal system premised on national laws of citizenship and Islamic legal doctrines on child custody and guardianship. That legal background informs a broad research question I am exploring while in residence at the Institute for Advanced Study concerning the relationship between Islamic law and international law. The issue of international child abduction offers a useful case study to put the stakes of this question into stark relief.

International child abduction is a particular phenomenon that implicitly reflects the complex implications of a globalized economic environment. Generally, this form of abduction occurs in the context of marital breakdown, where one parent has dual nationality. Read more at www.ias.edu/ias-letter/2015/emon-law.

MICHAEL HANCHARD ON INSTITUTIONAL RACISM

I first met Emery Robinson at Albert Leonard Junior High School in New Rochelle, New York. He was two grades behind me, a seventh grader when I was in the ninth grade. He was known as a manchild, not only in terms of size, because he was much bigger than most ninth graders even then, but because he had the physicality and presence of a young man. He could have easily passed for seventeen or eighteen years old when, by my recollection, he could not have been much more than eleven or twelve.

His face, however, betrayed his youth; cherubic, at times shy, an easy laugh and mischievous smile, he was what one would refer to as "not a bad kid," to indicate someone who was a bit mischievous but not malicious. Because of his size he made the basketball team, though it did not seem as if he had a great interest in basketball. He gravitated to kids who were a little older, bolder, and who occasionally got into trouble, petty theft, but no violence to my knowledge. In my

hometown, junior high school was a pivotal point in the lives of many poor and not so poor, black, brown, and working class kids from many diverse backgrounds. Read more at www.ias.edu/ias-letter/2015/hanchard-racism.

Hugh Gusterson on Nuclear Weapons Testing

In 1987, in my third year as a graduate student in anthropology, I arrived in the small California town of Livermore, host to one of two nuclear weapons design laboratories in the United States. Thanks to an indulgent dissertation committee, which had allowed me to abandon my original goal of doing fieldwork in Africa for a much more unconventional project, I came to Livermore intent on understanding the culture of the scientists, mainly physicists, who worked on the most powerful weapons on Earth. The anthropology of science did not yet exist as a recognized subfield of anthropology but, in retrospect, that is what I was doing.

I came to Livermore at a moment when the nuclear weapons labs at Livermore and Los Alamos were on the defensive. The nuclear freeze campaign of the early 1980s had had some success in reframing the nuclear arms race as a danger to, not a guarantor of, security. "End the race or end the race," as their slogan went. In 1982, more than a thousand protestors were arrested for civil disobedience at the gates of the Livermore Laboratory. Read more at www.ias.edu/ias-letter/2015/gusterson-nuclear-weapons.

LAWRENCE LIVERMORE NATIONAL LABORATORY
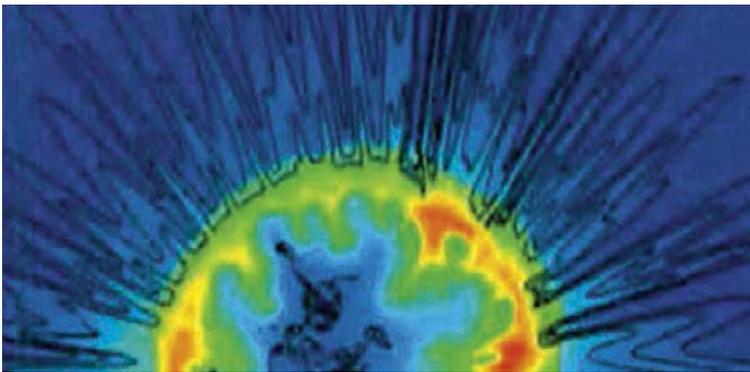
AMY RAMSEY

Michael Walzer on the Paradox of Liberation

National liberation is an ambitious and also, from the beginning, an ambiguous project. The nation has to be liberated not only from external oppressors—in a way, that's the easy part—but also from the internal effects of external oppression. Albert Memmi, the Tunisian Jew who wrote perceptively about the psychological effects of foreign rule, makes the critical point. The Jews will have to be delivered from "a double oppression: an objective external oppression made up of the … incessant aggressions inflicted on [them] and an auto-oppression … whose consequences were just as harmful." Watch a series of four lectures given at Yale University by Walzer, on which his most recent book *The Paradox of Liberation* (Yale University Press, 2015) is based: www.ias.edu/2015/walzer-liberation.

Joan Wallach Scott on the New Thought Police

In August 2014, Steven Salaita was scheduled to take up a position as a tenured associate professor in the American Indian and Indigenous Studies program at the University of Illinois at Urbana-Champaign. Salaita had resigned his job at Virginia Tech, where he had tenure, and ordered books and submitted syllabuses for his new courses at UIUC. He had every reason to believe his future was secure. Although his appointment was contingent on a final approval by the board of trustees, which would meet two weeks after the school year began, Salaita had been assured that this was merely a formality. It wasn't; the board refused to ratify his appointment.

The reason was the uproar over his comments on Twitter, where Salaita had condemned—often using fierce invective—Israel's violence during its 2014 military attack on Gaza. Well-organized supporters of Israel alerted the university to his tweets, accused him of anti-Semitism, and questioned his scholarship as well as his political judgment. Salaita's scholarship, on colonial settler occupations, has been critical of Israeli policy toward the Palestinians. Protesters deluged the chancellor's office with emails warning that if Salaita were hired, they would withdraw their support of the university. After meeting with the university president and the board of trustees in late July, the chancellor, Phyllis Wise, informed Salaita that she could not recommend him to the board.

In her letter, the chancellor drew attention to civility, emphasizing it as a requirement for the exercise of academic freedom: "What we cannot and will not tolerate at the University of Illinois are personal and disrespectful words or actions that demean and abuse either viewpoints themselves or those who express them." In Wise's thinking, "viewpoints" have protected status. If that's the case, will anyone who demeans Nazism, terrorism, racism, sexism, homophobia, or creationism be subject to punishment on her campus? Or are certain selective instances of "disrespect"—in this case, for the current Israeli government—the real issue here? Read more at www.thenation.com/article/new-thought-police.

Harpist Bridget Kibbey, violist Jack Stulz, and flutist Julietta Curenton perform Artist-in-Residence Sebastian Currier's *15 Minutes*—a piece composed of fifteen movements, each exactly one minute long.

Special Programs and Outreach

The Institute for Advanced Study is committed to the idea that science and learning transcend all geographic boundaries and scholastic disciplines, and that scholars and scientists are members of one commonwealth of the mind. It engages with the greater Princeton community through public lectures, concerts, and events, and extends its influence beyond academia through innovative programs designed to inspire and educate.

BEYOND THE WORK THAT TAKES PLACE in the four Schools, the Institute's scope is broadened and enhanced by its special programs, which contribute much to the vitality of the Institute.

The Program in Interdisciplinary Studies, directed by Professor Piet Hut, explores ways of viewing the world that span a range of disciplines from computational astrophysics, geology, and paleontology to artificial intelligence, cognitive psychology, and philosophy.

The Director's Visitor program enables the Director to invite scholars from a variety of fields, including areas not represented within the four Schools, to participate in the range of intellectual and social activities at the Institute. Beginning with Director J. Robert Oppenheimer (1947–66) and formalized by Director Harry Woolf (1976–87), the program has included nearly eighty scholars invited as Director's Visitors, including philosopher Paul Benacerraf, biochemist Paul Berg, political theorist Isaiah Berlin, former U.S. Ambassador William H. Luers, and writer Sylvia Nasar.

Throughout each academic year, the Institute offers lectures and special events that are open to the public, as well as the Edward T. Cone Concert Series and talks organized by the Institute's Artist-in-Residence. The Artist-in-Residence Program was established in 1994 to create a musical presence within the Institute community, and to have in residence a person whose work could be experienced and appreciated by scholars from all disciplines. Artists-in-Residence have included Robert Taub, Jon Magnussen, Paul Moravec, Derek Bermel, and, as of 2013, Sebastian Currier.

The Institute also engages in outreach beyond its local community. Since 1994, the IAS/Park City Mathematics Institute has integrated mathematics educators, researchers, and students through innovative programs. The Program for Women and Mathematics, sponsored jointly with Princeton University, provides substantive mathematics content as well as practical encouragement for women to pursue careers in the field of mathematics.

The School of Natural Sciences sponsors Prospects in Theoretical Physics, a two-week residential summer program held at the Institute for exceptionally promising graduate students and postdoctoral scholars. In 1999, the Institute created the Science Initiative Group, an international team of scientific leaders and supporters dedicated to fostering science in developing countries.

SPECIAL PROGRAMS

Program in Interdisciplinary Studies

Director's Visitors

Artist-in-Residence Program

OUTREACH

IAS/Park City Mathematics Institute

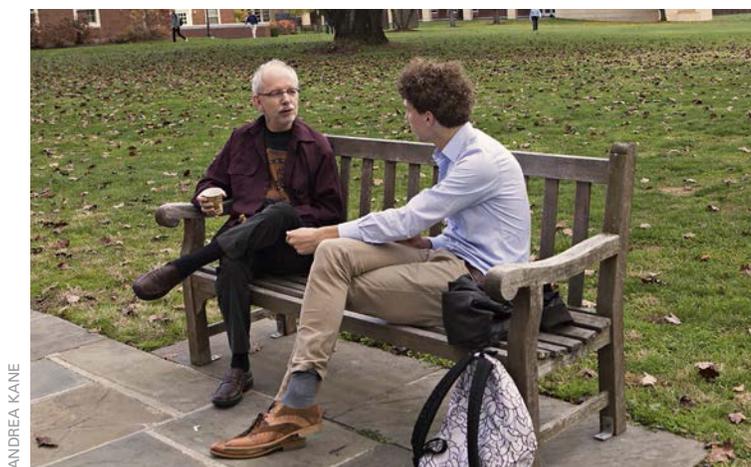Women and Mathematics Program
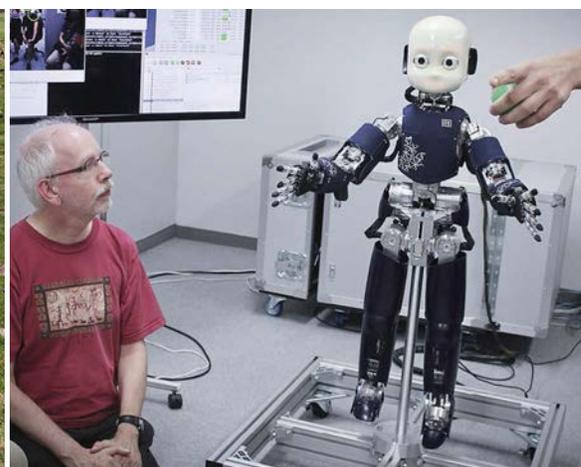
Prospects in Theoretical Physics

Science Initiative Group

DAN KOMODA

SPECIAL PROGRAMS

PROGRAM IN INTERDISCIPLINARY STUDIES

Left: Professor Piet Hut (left) with Jaco de Swart (right) from the University of Amsterdam. *Right*: The summer school co-organized by Hut in Kobe, Japan, visited a robotics lab led by Yuki Nagai of Osaka University—the robot could use his hands, head, and eyes to communicate.

Much of the work of **Piet Hut**, Professor and head of the Institute's Program in Interdisciplinary Studies, concerns the relationship between various "origins" questions such as: What is the relationship between a search for the origins of life, and the origins of more complex structures, such as multicellular plants, animals, and brains? Are they examples of something that can be described, at least to some abstract or "meta" extent, in more overarching ways, or should we be satisfied with attempts to answer each origins question separately?

In pursuit of these questions, Hut interacted with Visitors in his Program covering a range of areas—from astrophysics, geophysics, physics of complex systems, mathematics, statistics, chemistry, genomics, bioinformatics, computer science, and artificial life to sociology, political science, literature, art history, psychology, and philosophy.

Following a series of earlier workshops at IAS, in November 2014, Hut organized the "Modeling Origins of Life (MOL)" workshop in preparation for a larger conference in November 2015 at the Carnegie Institution for Science in Washington, D.C., on "Re-Conceptualizing the Origin of Life," as a way to let the MOL grassroots movement that he started gain more visibility.

At the Institute, Hut continued to lead the After Hours Conversations series, together with colleagues Didier Fassin from the School of Social Science, Patrick Geary from the School of Historical Studies, and Helmut Hofer from the School of Mathematics. These conversations were held in Harry's Bar, two times a week for a period of two months during each term, and they were widely seen as an effective way to encourage inter-School communication.

Hut continued his association with ELSI, the Earth-Life Science Institute at the Tokyo Institute of Technology, as a foreign Principle Investigator and Councilor. Launched at the end of 2012, ELSI is focused on the study of the origins and evolution of life on Earth, as well as possibly on other planets, within the context of geology and astrophysics.

In July 2015, Hut and collaborators at ELSI won a substantial grant, for which he was the Principle Investigator, from the John Templeton Foundation for the establishment of EON, the ELSI Origins Network. This network will strengthen the connections between broadly interdisciplinary collaborations in the field of origins of life in particular, and of origins of life-like processes in general, in natural as well as social sciences.

Hut also organized a three-week summer school in Kobe, Japan, titled "Towards an Integrative Approach to the Study of Awareness" in August 2015. The school's eighteen part-time teachers and twenty full-time students were drawn from a large range of disciplines, including neuroscience, cognitive science, artificial intelligence, artificial life, robotics, logic, high-performance computing, psychology, and philosophy, in particular phenomenology.

Hut continued his involvement with the B612 Foundation, dedicated to trying to protect the Earth from asteroid impacts. As a cofounder, he served for more than ten years as a Member of the Board, while he currently has the position of Strategic Advisor.

2014–15 VISITORS

Henderson James Cleaves II
Chemistry ✦ Carnegie Institution of Washington

Douglas Duckworth
Philosophy ✦ Temple University

Yuka Fujii
Planetary Science ✦ Earth-Life Science Institute, Tokyo Institute of Technology

Hyun Ok Park
East Asian Studies ✦ York University

Edwin L. Turner
Astrophysics ✦ Princeton University

ARTIST-IN-RESIDENCE PROGRAM

Composer **Sebastian Currier**, the Institute's Artist-in-Residence, curated the 2014–15 Edward T. Cone Concert Series, which featured performances by Ralph van Raat and The Crossing, a twenty-five person chorus, and works such as Currier's *15 Minutes* and David Lang's Pulitzer Prize–winning *The Little Match Girl Passion*.

Additionally, Currier organized the Artists Present series, which included talks by artists Shimon Attie and Michele Beck, writers A. M. Homes and Susan Steinberg, violinist Ruotao Mao, and pianist Michiko Otaki. Videos of talks from the Artists Present series and post-concert discussions are available at https://video.ias.edu/air.

During the 2014–15 academic year, three new works by Currier were premiered: *Ringtone Variations*, performed by violinist Anne-Sophie Mutter at Carnegie Hall; *Glow*, performed by pianist Inon Barnatan at Wigmore Hall in London; and a new work for orchestra, performed by the Seattle Symphony.

DAN KOMODA

Sebastian Currier (right), Artist-in-Residence, with (from left to right) Jack Stulz, Bridget Kibbey, and Julietta Curenton.

DIRECTOR'S VISITORS

DAN KOMODA

Writer **Catherine Chung** made progress writing a draft of "The Tenth Muse," a novel that explores math and physics as well as issues of race, gender, and war, and how seemingly distant, unrelated stories, lives, and ideas can turn out to be inextricably linked.


THE SCIENCE MUSEUM

Writer **Graham Farmelo** began writing his next book, which illustrates how modern mathematics is enriching the development of fundamental theoretical physics, and vice versa. A video of Farmelo's interview with Professor Nima Arkani-Hamed at the Science Museum of London is available at www.ias.edu/videos/2015/arkani-hamed-interview.

AMY RAMSEY

Rush Holt, CEO and Executive Publisher of the American Association for the Advancement of Science and a former U.S. Representative of New Jersey, reflected on science, policy, and their interaction during his time at the Institute. Focusing on the health of science in America and how the scientific enterprise can be fostered and sustained, Holt's engagement inspired new dialogues within and outside of the Institute community.
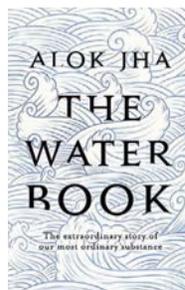
HEADLINE PUBLISHING GROUP

Journalist **Alok Jha** used his time at the Institute to complete *The Water Book*, which was published in 2015. It tells the extraordinary story of our most ordinary substance, exploring how water has shaped the Earth and the humans on it, and how we are now searching for this strange liquid on other planets, as a key marker of life.

AMERICAN COUNCIL OF LEARNED SOCIETIES

Pauline Yu, President of the American Council of Learned Societies, in connection with her work on Judith Gautier, wrote an essay on three major Western sinologists, which she presented at a University of Washington symposium in December 2014, as well as a related piece, "The Transit of Traditions in Chinese Studies," delivered as the Wan-Lin Kiang Lecture at the University of California–Irvine in May 2015.

OUTREACH

PARK CITY MATHEMATICS INSTITUTE

The Park City Mathematics Institute (PCMI) is an outreach program of the Institute for Advanced Study. It is an intensive three-week summer program, held each year near Park City, Utah, which contains several separate programs running in parallel and intended for different groups from across the entire mathematics community. It has been an Institute program since 1994, and summer 2015 was the twenty-fifth anniversary of its founding. PCMI is funded by major grants from the National Science Foundation, the National Security Agency, and Math for America, as well as grants from other private foundations and individuals.

The component programs of PCMI include a workshop for mathematics researchers; a set of nine mini-courses for graduate students and another set of lectures for undergraduate students; seminar-style courses for undergraduate faculty and mentors of underrepresented groups in university-level education; a content-based K-12 teacher development program; and a short course for talented high school students. Each program is self-contained, but the idea of bringing together these disparate groups in one place is to promote interactions between all participants and to help them understand the full reach of mathematical activity. Thus graduate students have extended opportunities to interact both mathematically and socially with top researchers; these researchers may converse with elementary, middle, or high school teachers; faculty from undergraduate institutions get a chance to integrate with the research community; and undergraduates get a good sense of what graduate student life is like.

Each year, a different research topic is chosen, and a set of organizers who are specialists in the area shape the research and graduate programs. These topics are chosen to reflect active research interests; the graduate mini-courses, aimed at the eighty graduate student participants (and attended by most of the sixty researchers) help train the next generation of researchers in this field. The lectures to the undergraduate students and faculty are related to this topic, the better to allow these participants to interact with the researchers and graduate students.

The research topic in 2015, "Geometry of Moduli Spaces and Representation Theory," was organized by Alexander Braverman (Brown University), Roman Bezrukovnikov (Massachusetts Institute of Technology), and Zhiwei Yun (Stanford University). This topic lies at the intersection of topology, algebraic geometry, and number theory, and the mini-courses by top experts from across this field ranged from lectures about fundamental topics to cutting-edge research. The Undergraduate Summer School hosted fifty undergraduate students who attended lectures on topics in algebraic geometry: "Flag Varieties and Representations" and "Moduli Theory and Invariants." The lectures for the undergraduate faculty also focused on topics about moduli spaces but included sessions on pedagogy at the undergraduate level.

The Teacher Leadership Program hosts sixty teachers from across the country who are eager to learn new mathematics, reflect on best pedagogical practices, and create new material for their own and other classrooms. A new feature in 2015 was the creation of a set of activities that stretch into the academic year and seek to extend the impact of this program. These new activities include an online course, a series of weekend workshops held at different locations around the country, and a webinar series intended to continue the bond between past PCMI participants.

The entire Park City Mathematics Institute has had an incredible impact over its history. A remarkable number of mathematics researchers at universities across the country and beyond have participated in one of these summer programs, and many cite the profound influence that the experience has had on their careers. PCMI is well positioned to continue this record of successful outreach. Its current Director is Rafe Mazzeo (Stanford University).

The Research Program in 2016 will be "The Mathematics of Data." This will include a much broader set of participants than usual, from mathematics, statistics, and computer science departments as well as industry. It will also include a special one-week subprogram, funded by the Sloan Foundation, on differential privacy.

To learn more about the IAS/Park City Mathematics Institute, please visit https://pcmi.ias.edu, and for further information about the teacher program, visit https://parkcitymath.org.

PROGRAM FOR WOMEN AND MATHEMATICS

Participants attend a lecture by Claire Voisin, Distinguished Visiting Professor in the School, on birational invariants.

The twenty-second annual Program for Women and Mathematics, "Aspects of Algebraic Geometry," was held at the Institute for Advanced Study from May 11 to May 22, 2015. Attendees—sixteen undergraduates, thirty-one graduates, and eleven postdoctoral mathematicians—lecturers, panelists, and teaching assistants came from thirty-seven educational institutions. Program activities were sponsored by the Institute and Princeton University and generously supported by the National Science Foundation.

Dusa McDuff of Barnard College, Antonella Grassi of the University of Pennsylvania, and Christine Taylor and Sun-Yung Alice Chang of Princeton University organized the 2015 program, which included lectures and research seminars, panels, and colloquia. A variety of topics in and related to algebraic geometry were explored, among them Grassmannians, flag varieties, birational invariants, tropical polynomials, special cubic fourfolds, enumerative geometry, quantum cohomology, and moduli space of curves, to name a few.

In addition to mathematical research, participants engaged in activities aimed at helping them explore mathematic and scientific career options, appear more confident, and balance career and family. These included an acting workshop, Women-in-Science seminars, career presentations, and panel discussions about the career and family choices made by fellow women mathematicians.

A special lecture by Claudia Perlich of Dstillery, "Tales from the Data Trenches of Display Advertising," explored the opportunities and pitfalls of using big data. *Particle Fever*, a documentary about the discovery of the Higgs boson at the Large Hadron Collider, was screened. A video of Perlich's talk may be viewed at https://video.ias.edu/claudiaperlich2015. Isabelle Nogues, a program participant and graduating mathematics major at Princeton University, gave a solo violin concert.

Informal mentoring partnerships were organized for participants interested in having a mentor who is further along in her mathematical career and can serve as a sounding board, friend, cheerleader, and promoter. In the program and through the alumnae database, participants found mentors who share similar experiences to themselves, including those from smaller universities and liberal arts colleges.

The twenty-second annual Program for Women and Mathematics on aspects of algebraic geometry drew women mathematicians from over thirty-seven educational institutions. Elizabeth Millićević of Haverford College (top center) gives a talk on Grassmannians and flag varieties. Claudia Perlich, Chief Scientist at Dstillery (below right), explores big data's promises and pitfalls in a public colloquium talk, "Tales from the Data Trenches."

PROSPECTS IN THEORETICAL PHYSICS

Prospects in Theoretical Physics (PiTP) is an intensive two-week summer program designed for graduate students and postdoctoral scholars considering careers in theoretical physics. First held by the School of Natural Sciences in the summer of 2002, the PiTP program is designed to provide lectures and informal sessions on the latest advances and open questions in areas of theoretical physics.

The Institute's fourteenth annual PiTP summer program, "New Insights into Quantum Matter," was held July 20–31, 2015, on the campuses of the Institute and Princeton University. PiTP 2015 was merged with the eleventh annual Princeton Summer School on Condensed-Matter Physics (PSSCMP), and the joint PiTP/PSSCMP program was cosponsored by the Institute, the Princeton Center for Complex Materials, and the Princeton Center for Theoretical Sciences.

The program focused on aspects of quantum field theory that are of interest to high-energy and condensed-matter physicists. Topics included theory and experimental probes of symmetry-protected topological phases and other topological states of condensed-matter systems. Theoretical tools presented included topological band theory, Chern-Simons theory, and applications of topological quantum field theory.

The full PiTP 2015 program and videos of talks—including an introduction to topological and conformal field theory by Robbert Dijkgraaf, Director and Leon Levy Professor, and advanced talks by Nathan Seiberg and Edward Witten, Professors in the School—may be viewed at https://pitp2015.ias.edu/schedule.html.

Professor Nathan Seiberg (top left) gives a lecture on generalized global symmetries. Edward Witten (top right), Charles Simonyi Professor, explains fermions and topological phases. Nicholas Read of Yale University (second from top, far right) discusses topological phases of matter. Professor Nima Arkani-Hamed (bottom right) with a program participant

SCIENCE INITIATIVE GROUP (SIG)

SIG, an IAS outreach program since 1999, fosters scientific research in developing countries. Since 2008, SIG has focused on the Regional Initiative in Science and Education (RISE). RISE supports scientists pursuing advanced degrees through university-based research and training networks in sub-Saharan Africa. Through affiliation with these networks, each student has access to instruction, research opportunities, and laboratory facilities in multiple universities. Students' research targets some of Africa's most pressing ecological challenges and technological deficits. Two examples are below. To learn more about the almost two hundred students who have benefited from RISE support since 2008, please visit https://sig.ias.edu/rise/scientists.

A Biochemistry Ph.D. with Applications for Sustainable Agriculture

After **Liberata Mwita** earned her M.Sc. from University of Dar es Salaam through RISE, her adviser Oleg Reva invited her to pursue a Ph.D. at the University of Pretoria, investigating how *Bacillus* bacteria interact with plants. Earlier research had shown that these bacteria can promote plant growth. Mwita was eager to understand how.

Growing plants secrete liquids called exudates from their roots into the soil. Mwita has been examining what happens at the molecular level when the exudates interact with *Bacillus*. She is trying to determine how the presence of exudates affects bacterial gene expression because this activity is believed to control the production of growth-promoting proteins.

If *Bacillus* bacteria do in fact speed plant growth, they could be a valuable new agricultural tool. "Most farmers now use chemical fertilizers, which have negative effects on both the farmers and the environment," says Mwita. "The use of biological fertilizers is not common in Africa, but I hope very much that this work can lead in that direction."

Bringing Skills Gained through RISE to a Young Tanzanian University

A major objective of RISE is to train a new cadre of professors to teach and inspire the next generation of scientists studying in Africa's universities. After earning his Ph.D. at the University of Cape Town, Tanzanian oceanographer **Majuto Manyilizu** returned to his home country to build up the seven-year-old University of Dodoma. An Assistant Lecturer, Manyilizu also serves as Coordinator of Research and Publications and Postgraduate Studies at the College of Informatics and Virtual Education, where he has emerged as a leader through his infectious energy and great ambition. Manyilizu has been taking full advantage of the connections he made through RISE, traveling to international scientific conferences and coordinating workshops.

Clockwise from top left: Liberata Mwita collects soil samples at the experimental farm at the University of Pretoria; Kennedy Ngwira works in the lab at the University of the Witwatersrand; Majuto Manyilizu and his team at the College of Informatics and Virtual Education at the University of Dodoma in Tanzania; Manyilizu teaches at a workshop; scientists prepare samples for laboratory testing at the Okavango Research Institute at the University of Botswana; Mwita explains her research to RISE staff member Jessika Naidoo at the University of Pretoria's experimental farm.

RECORD OF EVENTS

School of Historical Studies

September 25
Historical Studies Lunchtime Colloquium ✦ *First Term Introductions* ✦ **Yve-Alain Bois**, Professor, School of Historical Studies

September 30
Medieval Seminar ✦ *First Term Introductions* ✦ **Patrick J. Geary**, Professor, School of Historical Studies

October 2
Historical Studies Lunchtime Colloquium ✦ *The Politics of Entertainment: Cold War and Chinese Cinema* ✦ **Poshek Fu**, University of Illinois at Urbana–Champaign; Member, School of Historical Studies

October 4
Climate and Ecology of the Mongol Empire (CEME) Writing Workshop ✦ *Paleoclimate Dynamics of Drought and Pluvials in Mongolia* ✦ **Kevin Anchukaitis**, Woods Hole Oceanographic Institution ✦ *The Five Snouts, Vegetation, and Climate: Investigating the Terrestrial Ecosystem Dynamics of Central Mongolia Using Lake Sediment Records* ✦ **John Burkhart**, West Virginia University ✦ *Shallow Lakes and Regional Patterns: What We're Hoping to Learn from the Mud* ✦ **Avery Cook-Shinneman**, University of Washington ✦ *Climate Science Questions and Historical Questions: Looking for Matching Points* ✦ **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, School of Historical Studies ✦ *Droughts and Pluvials in Context: Tree-Rings and Climate History of the Last Two Thousand Years in Mongolia* ✦ **Amy Hessl**, West Virginia University ✦ *A Multiparameter Tree-Ring Approach for Understanding Climate Dynamics in Mongolia* ✦ **Caroline Leland**, Columbia University ✦ *Droughts in Central Asia over the Modern Era, 1901 through 2010: Frequency, Duration, and Impacts on Terrestrial Ecosystems* ✦ **Chaoqun Lu**, Auburn University ✦ *Climate Extremes, Grassland Productivity, and Animal Production during the Period 900–2010: Implications for Rise and Fall of the Mongol Empire* ✦ **Hanqin Tian**, Auburn University

October 5
Climate and Ecology of the Mongol Empire (CEME) Writing Workshop ✦ *Writing Workshops* ✦ **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, School of Historical Studies

October 6
Climate and Ecology of the Mongol Empire (CEME) Writing Workshop ✦ *Anatolian Environments: Climate, Land, and Politics, ca. 300–1000 (from Late Rome to Middle Byzantium)* ✦ **John Haldon**, Princeton University

October 7
Medieval Seminar ✦ *Vita Sancti Barbatiani* ✦ **Edward Schoolman**, University of Nevada, Reno; Member, School of Historical Studies

October 8
Art History Seminar ✦ *Artists' Writings, Primitivism, and Paul Gauguin* ✦ **Linda Jane Goddard**, University of St Andrews; Member, School of Historical Studies

October 9
Historical Studies Lunchtime Colloquium ✦ *Silence in Heaven: An Iconographic Approach to Rev. 1:8* ✦ **Vincent Debiais**, Centre National de la Recherche Scientifique, Paris; Member, School of Historical Studies

October 13
East Asian Studies Seminar ✦ *What Is the So-Called "Zhenmushou"?* ✦ **Guolong Lai**, University of Florida; Member, School of Historical Studies

October 14
Medieval Seminar ✦ *L'Écriture de l'Art: Entrejeux Texte/Image dans la Création Artistique Médiévale (800–1200)* ✦ **Vincent Debiais**, Centre National de la Recherche Scientifique, Paris; Member, School of Historical Studies

October 15
Art History Seminar ✦ *Picturing Antiquity and the Body after Archaeology* ✦ **Sarah Betzer**, University of Virginia; Member, School of Historical Studies

Islamicist Seminar ✦ *Early Origins of Islamic Philosophical Tradition in Crimea* ✦ **Mykhaylo Yakubovych**, The National University of Ostroh Academy; Member, School of Historical Studies

Early Modern Europe Workshop ✦ Élie Halévy on England and the English ✦ **K. Steven Vincent**, North Carolina State University at Raleigh; Member, School of Historical Studies

October 16
Historical Studies Lunchtime Colloquium ✦ *The Promise of New Worlds: Huguenot Refugees in the East and West Indies* ✦ **Owen Stanwood**, Boston College; Member, School of Historical Studies

October 21
Ancient Studies Seminar ✦ *Sport, Democracy, and War in Classical Athens* ✦ **David Prichard**, The University of Queensland and Brown University

Medieval Seminar ✦ *Creating the Rule of Kinsmen in Southeastern Europe in the Twelfth and Thirteenth Centuries* ✦ **Vlada Stankovic**, University of Belgrade; Member, School of Historical Studies

October 23
Historical Studies Lunchtime Colloquium ✦ *Weber's Tonal Space* ✦ **Suzannah Clark**, Harvard University; Member, School of Historical Studies

October 27
East Asian Studies Seminar ✦ *A Tale of Two Chinas: The Law and Politics of Economic Development* ✦ **Teemu Ruskola**, Emory University; Member, School of Historical Studies

October 28
Ancient Studies Seminar ✦ *Thales or Hippodamos? Agora and Town Planning before and after the Persian Wars* ✦ **Alexander Herda**, Freie Universität Berlin

Medieval Seminar ✦ *Eastern Christian Mission after Constantine* ✦ **Andrea Sterk**, University of Florida; Member, School of Historical Studies

October 29
Islamicist Seminar ✦ *Between Texts and Textual Practices: Initiating a Conversation between the Schools of Historical Studies and Social Science in the Study of Islam* ✦ **Noah Salomon**, Carleton College; Member, School of Social Science

October 30
Historical Studies Lunchtime Colloquium ✦ *The Assassination of Julius Caesar: Why Was It Such a Muddle?* ✦ **Jon E. Lendon**, University of Virginia; Member, School of Historical Studies

November 4
Medieval Seminar ✦ *Gerald of Wales's Preface to "Instruction for a Ruler"* ✦ **Robert J. Bartlett**, University of St Andrews; Member, School of Historical Studies

November 5
Seminar on International Relations ✦ *Liquid Dependencies: Water and Authority in Qing Borderlands (Eighteenth to Nineteenth Centuries)* ✦ **David Anthony Bello**, Washington and Lee University; Member, School of Historical Studies

November 6
Historical Studies Lunchtime Colloquium ✦ *China, for Example: China and the Making of Modern International Law* ✦ **Teemu Ruskola**, Emory University; Member, School of Historical Studies

November 11

Ancient Studies Seminar ◆ *Pennies for Thoughts: Monetization and Emerging Forms of Thought in Fifth-Century Greece* ◆ **Vayos Liapis**, Open University of Cyprus; Member, School of Historical Studies

Medieval Seminar ◆ *Where IS Edirne?* ◆ **Amy Elizabeth Singer**, Tel Aviv University; Member, School of Historical Studies

November 12

Art History Seminar ◆ *General Discussion* ◆ **Yve-Alain Bois**, Professor, School of Historical Studies

Islamicist Seminar ◆ *Film Screening and Discussion:* Footnote *(הערת שוליים) (2011)* ◆ **Sabine Schmidtke**, Professor, School of Historical Studies

Seminar on International Relations ◆ *Legitimizing Colonial Subjects: Native Chiefship and the First Italian Administration of Eritrea* ◆ **Olindo De Napoli**, Università degli Studi di Napoli Federico II; Member, School of Historical Studies

November 13

Historical Studies Lunchtime Colloquium ◆ *Editing Gerald of Wales's "Instruction for a Ruler"* ◆ **Robert J. Bartlett**, University of St Andrews; Member, School of Historical Studies

November 17

East Asian Studies Seminar ◆ *Reading and Writing Practices in Early Medieval China* ◆ **Wendy Swartz**, Rutgers, The State University of New Jersey; Member, School of Historical Studies

November 18

Medieval Seminar ◆ *The Transformation of the Carolingian World* ◆ **Herwig Wolfram**, Universität Wien

Early Modern Europe Workshop ◆ *Antiquarianism and Diplomacy in the Renaissance Mediterranean* ◆ **Adam G. Beaver**, Princeton University; Member, School of Historical Studies

November 19

Art History Seminar ◆ *Rosemarie Trockel's Idea of Relief* ◆ **Brigid Doherty**, Princeton University

November 20

Historical Studies Lunchtime Colloquium ◆ *Naturalism in the Nineteenth Century—Pictorial Truth and Social Reality* ◆ **Alexander Desmond Potts**, University of Michigan; Member, School of Historical Studies

November 25

Medieval Seminar ◆ *Comparing Genes Across Language Families* ◆ **Guido Barbujani**, Università degli Studi di Ferrara

December 1

East Asian Studies Seminar ◆ *The Death of Yelu Abaoji, the Founder of the Liao Dynasty* ◆ **Xin Luo**, Peking University; Member, School of Historical Studies

December 2

Ancient Studies Seminar ◆ *A Corpus of Ancient Synagogue Inscriptions: Methods and Problems* ◆ **Jonathan Jay Price**, Tel Aviv University; Member, School of Historical Studies

December 4

Historical Studies Lunchtime Colloquium ◆ *What Was a Bastard in Medieval Europe?* ◆ **Sara Ann McDougall**, John Jay College of Criminal Justice, The City University of New York; Member, School of Historical Studies

December 8

East Asian Studies Seminar ◆ *Cold War City: Rethinking the Politics of Mandarin Cinema* ◆ **Poshek Fu**, University of Illinois at Urbana–Champaign; Member, School of Historical Studies

December 9

Ancient Studies Seminar ◆ *The Jurisdiction of the Jewish Community of Herakleopolis: Normal or Special Case?* ◆ **Patrick Sänger**, Universität Wien; Member, School of Historical Studies

December 10

Islamicist Seminar ◆ *Greek, Syriac, and Arabic: The Road from Late Antiquity to the Middle Ages* ◆ **Jack Tannous**, Princeton University

Eighteenth Century Seminar ◆ *From the Desert to the Refuge: The Saga of New Bordeaux* ◆ **Owen Stanwood**, Boston College; Member, School of Historical Studies

December 11

Historical Studies Lunchtime Colloquium ◆ *"The Soul of the Italian Man Is So Shaken that He Is Completely Devoted to the Black Girl"—Notes on Law and Colonialism* ◆ **Olindo De Napoli**, Università degli Studi di Napoli Federico II; Member, School of Historical Studies

December 15

East Asian Studies Seminar ◆ *Liquid Dependencies: Water and Authority in Qing Borderlands (Eighteenth to Nineteenth Centuries)* ◆ **David Anthony Bello**, Washington and Lee University; Member, School of Historical Studies

December 17

Islamicist Seminar ◆ *Some Notes on the History and Theology of the Kārrāmīya—The Tafsīr-I Sūrābādī Responding to Anti-Karrāmī Polemicists* ◆ **Maryam Tiouri**, *Freie Universität Berlin*

Early Modern Europe Workshop ◆ *The Beginning of the End of the World* ◆ **Owen Stanwood**, Boston College; Member, School of Historical Stories

Seminar on International Relations ◆ *The Socialist Liberalism of Élie Halévy* ◆ **K. Steven Vincent**, North Carolina State University at Raleigh; Member, School of Historical Studies

December 18

Historical Studies Lunchtime Colloquium ◆ *On the Knife's Edge: How Germany Lost the First World War* ◆ **Holger Horst Afflerbach**, University of Leeds; Member, School of Historical Studies

January 6

Medieval Seminar ◆ *Second Term Introductions* ◆ **Patrick J. Geary**, Professor, School of Historical Studies

January 8

Historical Studies Lunchtime Colloquium ◆ *Second Term Introductions* ◆ **Yve-Alain Bois**, Professor, School of Historical Studies

January 13

Medieval Seminar ◆ *Doctors and Preachers Against the Plague: Attitudes toward Disease in Late Medieval Plague Tracts and Plague Sermons* ◆ **Ottó Sándor Gecser**, Eötvös Loránd University; Member, School of Historical Studies

January 14

Art History Seminar ◆ *The Enlivened Figures of Late Medieval and Early Modern Processional Stagings* ◆ **Laura Weigert**, Rutgers, The State University of New Jersey

Islamicist Seminar ◆ *The Birth of the Rabbinic Isnād: Citation and Attribution in Talmudic Literature* ◆ **Moulie Vidas**, Princeton University; Member, School of Historical Studies

Early Modern Europe Workshop ◆ *Hugo Grotius and the Ideological Origins of British Imperialism (Seventeenth to Early Eighteenth Centuries)* ◆ **Marco Barducci**, Member, School of Historical Studies

January 15

Historical Studies Lunchtime Colloquium ◆ *Enter, Riding on an Elephant* ◆ **Amy Elizabeth Singer**, Tel Aviv University; Member, School of Historical Studies

January 20

Ancient Studies Seminar ◆ *New Inscriptions from Aphrodisias* ◆ **Angelos Chaniotis**, Professor, School of Historical Studies

January 21

Islamicist Seminar ◆ *Americanization of Islamic Legal Scholarship* ◆ **Anver Emon**, University of Toronto; Member, School of Historical Studies

Seminar on International Relations ◆ *Human Rights and Democracy Promotion in U.S. Foreign Relations, 1977–1989* ◆ **William Michael Schmidli**, Bucknell Univerity; Member, School of Historical Studies

January 22

Historical Studies Lunchtime Colloquium ◆ *From the Ash to the Fire: Reanimating Antiquity in Pompeii* ◆ **Sarah Betzer**, University of Virginia; Member, School of Historical Studies

January 26

East Asian Studies Seminar ◆ *Drugs for the Masses: The Imperial Pharmacy during the Southern Song Dynasty (1127–1279)* ◆ **Asaf Goldschmidt**, Tel Aviv University; Member, School of Historical Studies

January 28

Islamicist Seminar ◆ *Why Study the Reception of Galen? Transmission of Knowledge from Late Antiquity to the Islamic World* ◆ **Leigh Chipman**, Johns Hopkins University

January 29

Historical Studies Lunchtime Colloquium ◆ *From Human-Spirit Resonance to Correlative Modes: The Shaping of Chinese Correlative Thinking* ◆ **Jinhua Jia**, University of Macau; Member, School of Historical Studies

February 3

Medieval Seminar ◆ *Looking Back from 1700: Medieval and Early Modern Prehistories for Benedictine Scholarly Practice* ◆ **Thomas Wallnig**, Universität Wien; Member, School of Historical Studies

February 4

Islamicist Seminar ◆ *Digital Ottoman: What? Why? How?* ◆ **Amy Elizabeth Singer**, Tel Aviv University; Member, School of Historical Studies

Seminar on International Relations ◆ *Imperial Germany and the First World War* ◆ **Holger Horst Afflerbach**, University of Leeds; Member, School of Historical Studies

February 5

Historical Studies Lunchtime Colloquium ◆ *Injury and Community in the Early Roman Empire* ◆ **Ari Bryen**, West Virginia University; Member, School of Historical Studies

February 9

East Asian Studies Seminar ◆ *Encountering Joseph Needham: William Band in Chongqing* ◆ **Danian Hu**, The City College of New York; Member, School of Historical Studies

February 10

Ancient Studies Seminar ◆ *Horace's Ode to Pollio (Ode 2.1)* ◆ **Stephen John Harrison**, University of Oxford; Member, School of Historical Studies

Medieval Seminar ◆ Cortesia *in the* Ensenhamen *of Garin lo Brun* ◆ **David Bruce Crouch**, University of Hull; Member, School of Historical Studies

February 11

Early Modern Europe Workshop ◆ *Counselling Monarchs in Seventeenth-Century France and Spain* ◆ **Nicole Reinhardt**, Durham University; Member, School of Historical Studies

February 12

Historical Studies Lunchtime Colloquium ◆ *Scholarship, Religion, and the Making of Judaism in Late Ancient Palestine* ◆ **Moulie Vidas**, Princeton University; Member, School of Historical Studies

February 17

Medieval Seminar ◆ *Text from the Annals of Cambrai* ◆ **Robert J. Bartlett**, University of St Andrews; Member, School of Historical Studies

February 18

Art History Seminar ◆ *Before Documentary: Ornament and Knowledge in Soviet Factography* ◆ **Devin Fore**, Princeton University

Seminar on International Relations ◆ *A Tale of Two Chinas: The Law and Politics of Economic Development* ◆ **Teemu Ruskola**, Emory University; Member, School of Historical Studies

February 19

Historical Studies Lunchtime Colloquium ◆ *Catharine Macaulay's French Connections* ◆ **Karen Anne Hamnet Green**, The University of Melbourne; Member, School of Historical Studies

February 23

East Asian Studies Seminar ◆ *The Politics of the Hunt in Late Koryŏ and Early Chosŏn Korea* ◆ **George Kallander**, Syracuse University; Member, School of Historical Studies

February 24

Medieval Seminar ◆ *Property and Memory in Ninth- and Tenth-Century Italy* ◆ **Edward Schoolman**, University of Nevada, Reno; Member, School of Historical Studies

February 25

One-Day Colloquium in Honor of Patricia Crone ◆ *Greetings and Introduction* ◆ **Sabine Schmidtke**, Professor, School of Historical Studies ◆ *Patricia Crone's Contribution to the Field of Islamic Studies* ◆ **Everett Rowson**, New York University ◆ *Muhammad's Deputies in Medina* ◆ **Michael Cook**, Princeton University ◆ *An Exercise in Methodological Skepticism: The Case of "The Cordovan Voluntary Martyrs"* ◆ **Sarah Stroumsa**, The Hebrew University of Jerusalem ◆ *Patricia Crone's Contribution to Premodern Iranian Studies: Politics, Society, and Religion* ◆ **Hassan Farhang Ansari**, Member, School of Historical Studies ◆ *Persian Origins in Arab Colonies of Marw and Transoxania* ◆ **Kevin van Bladel**, The Ohio State University ◆ *Nativism and Prophethood in Early Modern Iran: Āzar Kayvān and the Quest for*

Universal Religion ◆ **Daniel J. Sheffield**, Princeton University ◆ *Concluding Remarks* ◆ **Sabine Schmidtke**, Professor, School of Historical Studies

February 26

Historical Studies Lunchtime Colloquium ◆ *A Forgotten Sin:* Acceptio Personarum—*Early Modern Discussions on Personal Merit* ◆ **Nicole Reinhardt**, Durham University; Member, School of Historical Studies

March 3

Ancient Studies Seminar ◆ *Cleopatra's Cyprus: Excavations on Late Ptolemaic Yeronisos* ◆ **Joan Connelly**, New York University; Visitor, School of Historical Studies

Medieval Seminar ◆ *The Legitimacy of Children Born to Illegal Marriages in the Late Eleventh through the Early Thirteenth Centuries* ◆ **Sarah Ann McDougall**, John Jay College of Criminal Justice, The City University of New York; Member, School of Historical Studies

March 4

Islamicist Seminar ◆ *What Housework Signifies: Domestic Labor in Legal Manuals of the Eleventh to Twelfth Centuries C.E.* ◆ **Marion Holmes Katz**, New York University; Member, School of Historical Studies

Eighteenth Century Seminar ◆ *Locke, Enlightenment, and Liberty in the Works of Catharine Macaulay and Her Contemporaries* ◆ **Karen Anne Hamnet Green**, The University of Melbourne; Member, School of Historical Studies

March 5

Historical Studies Lunchtime Colloquium ◆ *Critical Monks, the German Benedictines, 1680–1740* ◆ **Thomas Wallnig**, Universität Wien; Member, School of Historical Studies

March 9

East Asian Studies Seminar ◆ *Religiosity and Literacy: The Journey of Daoist Priestesses in Tang China (618–907)* ◆ **Jinhua Jia**, University of Macau; Member, School of Historical Studies

March 10

Medieval Seminar ◆ *From Hadrian's Horse to the Sexuality of Christ: Toward a History of Medieval Political Semantics beyond Texts* ◆ **Bernhard Jussen**, Goethe-Universität Frankfurt

March 11

Early Modern Europe Workshop ◆ *Critical Monks, The German Benedictines, 1680–1740* ◆ **Thomas Wallnig**, Universität Wien; Member, School of Historical Studies

Seminar on International Relations ◆ *Turkish and Albanian Nationalism at the End of Empire* ◆ **Nader Sohrabi**, Carleton College; Member, School of Historical Studies

March 13

Ancient Studies Workshop: Epigraphic Friday ✦ *The Athenian Didascaliae (IG II² 2319–2323a): An Ensemble of Inscriptions* ✦ **Stephen V. Tracy**, Visitor, School of Historical Studies ✦ *Columnar Formatting in Fifth-Century Attic Inscriptions* ✦ **Elizabeth Meyer**, University of Virginia ✦ *The Lex de Imperio Vespasiani and the Digest* ✦ **Michael Peachin**, New York University ✦ *Problems in the Lex Libitinaria Cumana (AE, 1971, 89)* ✦ **John P. Bodel**, Brown University; Member, School of Historical Studies ✦ *The Late Trajanic Jewish Revolts and a New Inscription at Vaison-la-Romaine* ✦ **Glen W. Bowersock**, Professor Emeritus, School of Historical Studies ✦ *The Boxer Melancomas* ✦ **Christopher P. Jones**, Harvard University ✦ *New Inscriptions from Late Antique Aphrodisias* ✦ **Angelos Chaniotis**, Professor, School of Historical Studies

March 17

Medieval Seminar ✦ *Questions of Identity and Ideology in Serbia, Twelfth to Thirteenth Centuries* ✦ **Vlada Stankovic**, University of Belgrade; Member, School of Historical Studies

March 18

Islamicist Seminar ✦ *Arabic Documents from the Early Islamic Period* ✦ **Geoffrey Allan Khan**, University of Cambridge; Member, School of Historical Studies

March 19

Historical Studies Lunchtime Colloquium ✦ *Reasoning with Cases: The Transmission of Clinical Medical Knowledge in Twelfth-Century Song China* ✦ **Asaf Goldschmidt**, Tel Aviv University; Member, School of Historical Studies

S. T. Lee Public Lecture ✦ *Ancient Human Genomes Suggest Three Ancestral Populations for Present-Day Europeans* ✦ **Johannes Krause**, Eberhard Karls Universität Tübingen and Max-Planck-Institut für Menschheitsgeschichte

March 20

Workshop on Integrating Genomics and Human History: Challenges and Opportunities ✦ *Welcome and Opening Remarks* ✦ **Patrick J. Geary**, Professor, School of Historical Studies ✦ *Genetic History—A Challenge to Medieval Studies* ✦ **Jörg Feuchter**, Humboldt-Universität zu Berlin ✦ *Richard III Rediscovered* ✦ **Turi King**, University of Leicester ✦ *Tracing the Genetic Ancestry of Enslaved Africans Using Ancient DNA* ✦ **María Ávila-Arcos**, Center for Computational, Evolutionary and Human Genomics, Stanford University ✦ *Scientific Evidence, Historical Evidence, or Both?* ✦ **Michael Gordin**, Princeton University ✦ *Ancient DNA and the Settlement of Iceland: Assessing Authenticity and Continuity* ✦ **Agnar Helgason**, University of Iceland and deCODE Genetics ✦ *Inferring Relatedness between Individuals Using Genomic Data from Ancient Samples* ✦ **Krishna Veeramah**, Stony Brook University, The State University of New York ✦ *Detecting Natural Selection Using Ancient DNA* ✦ **Mark Thomas**, University College London ✦ *A Historian of Science's Perspective on Genetic History* ✦ **Soraya de Chadavarian**, University of California, Los Angeles ✦ *Closing Remarks* ✦ **Patrick J. Geary**, Professor, School of Historical Studies

March 24

Ancient Studies Seminar ✦ *Polybius on Emotional Engagement* ✦ **John Mark Marincola**, Florida State University; Member, School of Historical Studies

Medieval Seminar ✦ *Some Paleographic Issues in Medieval Inscriptions* ✦ **Vincent Debiais**, Centre National de la Recherche Scientifique, Paris; Member, School of Historical Studies

March 25

Islamicist Seminar ✦ *Neo-Ottomanism, Imperial Nation State, and Reluctant Nationalists* ✦ **Nader Sohrabi**, Carleton College; Member, School of Historical Studies

March 26

Historical Studies Lunchtime Colloquium ✦ *In Search of Chivalry: A Taxonomic Approach* ✦ **David Bruce Crouch**, University of Hull; Member, School of Historical Studies

March 30

East Asian Studies Seminar ✦ *Colloquial Mandarin in Outlying Regions in the Míng and Qīng* ✦ **Richard VanNess Simmons**, Rutgers, The State University of New Jersey; Member, School of Historical Studies

March 31

Ancient Studies Seminar ✦ *Rethinking the Roman Funeral* ✦ **John P. Bodel**, Brown University; Member, School of Historical Studies

Medieval Seminar ✦ *The Digital Ottoman Platform: The Only Way Forward or the Road to Hell?* ✦ **Amy Elizabeth Singer**, Tel Aviv University; Member, School of Historical Studies

April 1

Islamicist Seminar ✦ *Critical Approaches to the Philosophy of Avicenna: Sharaf al-Din al-Mas'udi and Afdal al-Din al-Ghaylani* ✦ **Hassan Farhang Ansari**, Member, School of Historical Studies

Early Modern Europe Workshop ✦ *Locke, Enlightenment, and Liberty in the Works of Catharine Macaulay and Her Contemporaries* ✦ **Karen Anne Hamnet Green**, The University of Melbourne; Member, School of Historical Studies

April 2

Historical Studies Lunchtime Colloquium ✦ *The Royal Hunt in Thirteenth-Century Korea: Koryo and the Mongol Empire* ✦ **George Kallander**, Syracuse University; Member, School of Historical Studies

April 15

Art History Seminar ✦ *The Prearchitectonic Condition: On Modern Architecture and Prehistory (Sigfried Giedion and André Leroi-Gourhan)* ✦ **Spyros Papapetros**, Princeton University

May 12

Medieval Seminar ✦ *The Meaning of a Law-Book: Lex Salica in the Frankish Kingdoms* ✦ **Karl Ubl**, Eberhard Karls Universität Tübingen; Summer Visitor, School of Historical Studies

May 13

Early Modern Europe Workshop ✦ *Early Modern Picturing of the Social and Nineteenth-Century Realism* ✦ **Alexander Desmond Potts**, University of Michigan; Member, School of Historical Studies

June 8

Digital Ottoman Platform Workshop ✦ *Welcome and Opening Remarks* ✦ **Sabine Schmidtke**, Professor, School of Historical Studies ✦ *Introduction to the Digital Ottoman Platform* ✦ **Amy Elizabeth Singer**, Tel Aviv University; Member, School of Historical Studies ✦ *China Historical GIS and China Biographical Database* ✦ **Lex Berman**, Harvard University ✦ *Developing Cross-Regional Syntheses from Regional Survey Data: Opportunities and Challenges* ✦ **Jim Newhard**, College of Charleston ✦ *Textual Topographies—Some Notes on Patterned Corpora of Arabic Literary Texts* ✦ **Elias Muhanna**, Brown University ✦ *Locating the Early Modern Islamic Archive in the Digital Turn* ✦ **Nir Shafir**, University of California, Los Angeles ✦ *General Discussion* ✦ **Mark Połczyński**, Marquette University

June 9

Digital Ottoman Platform Workshop ✦ *Data and Databases—Text, Place, and Numbers—Organizing, Relating, and Integrating* ✦ **Nir Shafir**, University of California, Los Angeles ✦ *Flexible Ontologies for Ottoman Person-Data* ✦ **Will Hanley**, Florida State University ✦ *Analyzing Arabic Biographical Collections at Scale* ✦ **Maxim Romanov**, Tufts University ✦ *E-Books in Seventeenth-Century Istanbul* ✦ **Meredith Quinn**, Harvard University ✦ *Relational Model of Data Collection: Geography of North African Piracy in the Seventeenth Century* ✦ **Eda Özel**, Harvard University ✦ *Linking Kemalpaşazade: Ottoman Studies and the Semantic Web* ✦ **Guy Burak**, New York University ✦ *Digitizing Dragomans: Exploring Connectivities, Confluences, and Textual Transformations in an Online Repository* ✦ **Natalie Rothman**, University of Toronto ✦ *General Discussion* ✦ **Lex Berman**, Harvard University

Column 1

June 10

Digital Ottoman Platform Workshop ✦ *Sourcing Crowds and Developing Publics: On Valuing Digital Work, Integrating Students, and the Public in the Work* ✦ **Michael Połczyński**, Georgetown University ✦ *Public History and the Middle East* ✦ **Chris Gratien**, Georgetown University ✦ *What to Expect from the Crowd and the Surrogate: An Experience with Collaborative Manuscript Description in the Digital Environment* ✦ **Evyn Kropf**, University of Michigan ✦ *Mapping Istanbul's Hamams and Routes of Visual Culture: Two Case-Studies of ArcGIS Use in Research and Teaching* ✦ **Nina Ergin**, Koç University ✦ *Reconstructing Ottoman Armenian Life, Culture, and Society in the Digital Age: Four Years with the Houshamadyan Project* ✦ **Vahe Tachjian**, Houshamadyan Project, Paris ✦ *General Discussion* ✦ **Jim Newhard**, College of Charleston

June 11

Digital Ottoman Platform Workshop ✦ *Visualization: Finding and Displaying Patterns in Data and the DOP Interface* ✦ **Chris Gratien**, Georgetown University ✦ *Ottoman Thrace in H-GIS SEE (Southeastern Europe)* ✦ **Grigor Boykov**, Sofia University ✦ *Mobility and Infrastructure in the Ottoman Balkans: Geospatial Analysis and Digital Imagery* ✦ **Jesse Howell**, Harvard University ✦ *Mapping Economic Space in the Ottoman World* ✦ **Elias Kolovos**, University of Crete and Institute for Mediterranean Studies, Foundation for Research and Technology–Hellas (FORTH) ✦ *Geographical Text Analysis: Approaches to Understand the Geographies in Texts* ✦ **Ian Gregory**, Lancaster University ✦ *Medieval Peasants in Space: Digital Implications of a Study of Landscape* ✦ **Nicolas Trépanier**, University of Mississippi ✦ *The Ottoman Inscription Archive: An On-Site, Crowdsourced, Online Digital Geodatabase of Ottoman Dedication Inscriptions* ✦ **Michael Połczyński**, Georgetown University ✦ *General Discussion* ✦ **Ian Gregory**, Lancaster University

June 12

Digital Ottoman Platform Workshop ✦ *The Digital Ottoman Platform—Shape, Size, Scope—Planning, Managing, Funding* ✦ **Amy Elizabeth Singer**, Tel Aviv University; Member, School of Historical Studies ✦ *The DOP: Opportunity for a Paradigm Shift? / Creating a Sustainable Competitive Advantage* ✦ **Mark Połczyński**, Marquette University ✦ *General Discussion and Closing Remarks* ✦ **Amy Elizabeth Singer**, Tel Aviv University; Member, School of Historical Studies

School of Mathematics

July 21

Joint IAS/Princeton University Geometry Seminar ✦ *Measures on Spaces of Riemannian Metrics* ✦ **Dmitry Jakobson**, McGill University

Column 2

September 16

Topology of Algebraic Varieties ✦ *Hodge Theory and Derived Categories of Cubic Fourfolds* ✦ **Richard Thomas**, Imperial College London ✦ *Generic K3 Categories and Hodge Theory* ✦ **Daniel Huybrechts**, Universität Bonn

September 18

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Iwasawa Main Conjecture for Supersingular Elliptic Curves* ✦ **Xin Wan**, Columbia University

September 22

Computer Science/Discrete Mathematics Seminar I ✦ *Coloring Graphs with No Odd Holes* ✦ **Paul Seymour**, Princeton University

September 23

Computer Science/Discrete Mathematics Seminar II ✦ *Uniform Words Are Primitive* ✦ **Doron Puder**, Member, School of Mathematics

Short Talks by Postdoctoral Members ✦ *Exponential Separation of Information and Communication* ✦ **Gillat Kol**, Member, School of Mathematics ✦ *Overtwisted Contact Structures* ✦ **Matthew Strom Borman**, Member, School of Mathematics ✦ *Arithmetic Statistics over Number Fields and Function Fields* ✦ **Alexei Entin**, Member, School of Mathematics ✦ *Analysis of Boolean Functions on Association Schemes* ✦ **Yuval Filmus**, Member, School of Mathematics ✦ *Instability and Stratifications of Moduli Problems in Algebraic Geometry* ✦ **Daniel Halpern-Leistner**, Member, School of Mathematics

September 25

Princeton/IAS Symplectic Geometry Seminar ✦ *Symplectic Fillings and Star Surgery* ✦ **Laura Starkston**, University of Texas at Austin

Short Talks by Postdoctoral Members ✦ *Algebraic Cycles on Holomorphic Symplectic Varieties* ✦ **Lie Fu**, Member, School of Mathematics ✦ *Local Relative Trace Formulas* ✦ **Raphaël Beuzart-Plessis**, Member, School of Mathematics ✦ *Rota's Conjecture and Positivity of Algebraic Cycles in Toric Varieties* ✦ **June Huh**, Princeton University; Veblen Fellow, School of Mathematics ✦ *Counting the Nodal Domains of the Laplacian Eigenfunctions on Surfaces* ✦ **Junehyuk Jung**, Member, School of Mathematics ✦ *The 3-Selmer Rank in Families of Cubic Twists of Elliptic Curves* ✦ **Nayoung Kim**, Member, School of Mathematics ✦ *High-Dimensional Expanders* ✦ **Ori Parzanchevski**, Member, School of Mathematics

September 26

Topology of Algebraic Varieties ✦ *Symmetric Differentials and the Fundamental Group* ✦ **Burt Totaro**, University of California, Los Angeles; Member, School of Mathematics

Column 3

Short Talks by Postdoctoral Members ✦ *The Polynomial Freiman-Ruzsa Conjecture in Additive Combinatorics and Its Applications in Computational Complexity* ✦ **Noga Ron-Zewi**, Member, School of Mathematics ✦ *From the Fukaya Category to Curve Counts via Hodge Theory* ✦ **Nicholas Sheridan**, Veblen Research Instructor, School of Mathematics ✦ *Fourier-Jacobi Periods and Central Value of L-Functions* ✦ **Hang Xue**, Member, School of Mathematics

September 29

Computer Science/Discrete Mathematics Seminar I ✦ *Breaking e^n Barrier for Deterministic Poly-Time Approximation of the Permanent and Settling Friedland's Conjecture on the Monomer-Dimer Entropy* ✦ **Leonid Gurvits**, City University of New York

Short Talks by Postdoctoral Members ✦ *On the Local Geometry of the Zero Set of High-Energy Laplace Eigenfunctions* ✦ **Yaiza Canzani**, Member, School of Mathematics ✦ *Persistent Sheaves for Stratified Maps* ✦ **Amit Patel**, Member, School of Mathematics ✦ *Topology of Toric Origami Manifolds* ✦ **Ana Pires**, Member, School of Mathematics ✦ *Time, Space, and Monotone Circuits* ✦ **Christopher Beck**, Member, School of Mathematics ✦ *Dominant Irreducible Representations in Spectra of Cayley Graphs of Finite Groups* ✦ **Doron Puder**, Member, School of Mathematics ✦ *Are There Self-Similar Solutions to the 3D Euler Equations for Incompressible Fluids?* ✦ **Michael Reiterer**, Member, School of Mathematics ✦ *Arthur Packet through the Trace Formula* ✦ **Bin Xu**, Member, School of Mathematics

September 30

Computer Science/Discrete Mathematics Seminar II ✦ *Uniform Words Are Primitive (continued)* ✦ **Doron Puder**, Member, School of Mathematics

Topology of Algebraic Varieties ✦ *The Fano Variety of Lines and Rationality Problem for a Cubic Hypersurface* ✦ **Lev Borisov**, Rutgers, The State University of New Jersey ✦ *Szemeredi-Trotter Theorems in Dimension 3* ✦ **János Kollár**, Princeton University; Member, School of Mathematics ✦ *Tropical Currents* ✦ **June Huh**, Princeton University; Veblen Fellow, School of Mathematics

October 1

Topology of Algebraic Varieties ✦ *The Topology of Proper Toric Maps* ✦ **Mark de Cataldo**, Stony Brook University, The State University of New York; Member, School of Mathematics

Short Talks by Postdoctoral Members ✦ *Sheaves on K3 Surfaces: Moduli Spaces, Lagrangian Fibrations, and Their Singularities* ✦ **Giulia Saccà**, Member, School of Mathematics ✦ *Spectral and Scattering Features of Hyperbolic Manifolds* ✦ **Michael Robert Magee**, Member, School of Mathematics ✦ *Higher-Order Curvatures and Isoperimetric Inequalities* ✦ **Yi Wang**, Member, School of Mathematics ✦ *Dynamics and*

Birational Geometry ✦ **John Daniel Lesieutre**, Member, School of Mathematics ✦ *Cylindrical Contact Homology in Dimension 3 via Intersection Theory and More* ✦ **Joanna Nelson**, Member, School of Mathematics ✦ *Finding Rational Curves by Forgetful Map* ✦ **Hong Run Zong**, Member, School of Mathematics

October 2

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *The Standard L-Function for G_2: A "New Way"* ✦ **Nadya Gurevich**, Ben-Gurion University of the Negev

October 6

Computer Science/Discrete Mathematics Seminar I ✦ *The Communication Complexity of Distributed Subgraph Detection* ✦ **Rotem Oshman**, Tel Aviv University

Members' Seminar ✦ *Hodge Theory, Coniveau, and Algebraic Cycles* ✦ **Claire Voisin**, CNRS, Institut de Mathématiques de Jussieu; Distinguished Visiting Professor, School of Mathematics

October 7

Computer Science/Discrete Mathematics Seminar II ✦ *Monotone Submodular Maximization over a Matroid* ✦ **Yuval Filmus**, Member, School of Mathematics

Topology of Algebraic Varieties ✦ *On Euler-Poincaré Characteristics* ✦ **Mark de Cataldo**, Stony Brook University, The State University of New York; Member, School of Mathematics ✦ *Chow Rings and Modified Diagonals* ✦ **Kieran O'Grady**, Università degli Studi di Roma, La Sapienza; Member, School of Mathematics ✦ *Two Counterexamples Arising from Infinite Sequences of Flops* ✦ **John Daniel Lesieutre**, Member, School of Mathematics

October 8

Topology of Algebraic Varieties ✦ *The Construction Problem for Hodge Numbers* ✦ **Stefan Schreieder**, Universität Bonn

Mathematical Conversations ✦ *Randomness in the Möbius Function and Dynamics* ✦ **Peter Sarnak**, Professor, School of Mathematics

October 9

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Euler Systems from Special Cycles on Unitary Shimura Varieties and Arithmetic Applications* ✦ **Dimitar Jetchev**, École Polytechnique Fédérale de Lausanne

October 10

Princeton/IAS Symplectic Geometry Seminar ✦ *Superconformal Simple Type and Witten's Conjecture on the Relation between Donaldson and Seiberg-Witten Invariants* ✦ **Paul Feehan**, Rutgers, The State University of New Jersey

October 13

Workshop on Fundamental Groups and Periods

Computer Science/Discrete Mathematics Seminar I ✦ *Cool with a Gaussian: An $O^{\star}(n^3)$ Volume Algorithm* ✦ **Santosh Vempala**, Georgia Institute of Technology

October 14

Workshop on Fundamental Groups and Periods

Computer Science/Discrete Mathematics Seminar II ✦ *Sampling-Based Proof of the Quasipolynomial Bogolyubov-Ruzsa Theorem and Algorithmic Applications* ✦ **Noga Ron-Zewi**, Member, School of Mathematics

October 15

Workshop on Fundamental Groups and Periods

October 16

Workshop on Fundamental Groups and Periods

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *On the Unipotent Contributions of the Arthur-Selberg Trace Formula for GL(n)* ✦ **Pierre-Henri Chaudouard**, Université Paris Diderot; von Neumann Fellow, School of Mathematics

October 17

Workshop on Fundamental Groups and Periods

Princeton/IAS Symplectic Geometry Seminar ✦ *Equivariant Structures in Mirror Symmetry* ✦ **James Pascaleff**, University of Illinois at Urbana–Champaign

October 18

Workshop on Topology: Identifying Order in Complex Systems ✦ *Topological Order: Umbilics in Chiral Liquid Crystals* ✦ **Gareth Alexander**, University of Warwick ✦ *Geometries of Sensor Outputs, Inference, Fusion, and Information Processing* ✦ **Ronald Coifman**, Yale University ✦ *Toward Predicting and Preventing Machine Chatter Using Persistent Homology* ✦ **Elizabeth Munch**, University at Albany, State University of New York ✦ *A Few Statistical Properties of Topological Information Inferred from Data* ✦ **Frederick Chazal**, Institut National de Recherche en Informatique et en Automatique, Saclay ✦ *Topological Data Analysis on Amorphous Structure* ✦ **Yasuaki Hiraoka**, Kyushu University

Members' Seminar ✦ *Act Globally, Compute Locally: Group Actions, Fixed Points, and Localization* ✦ **Tara Holm**, Cornell University; von Neumann Fellow, School of Mathematics

Overtwisted Contact Structures ✦ *Lectures on Overtwisted Contact Structures* ✦ **Matthew Strom Borman**, Member, School of Mathematics

Topology of Algebraic Varieties ✦ *Finite Dimensionality and Cycles on Powers of K3 Surfaces* ✦ **Claire Voisin**, CNRS, Institut de Mathématiques de Jussieu; Distinguished Visiting Professor, School of Mathematics ✦ *Positive Cones of Higher (Co)dimensional Numerical Cycle Classes* ✦ **Mihai Fulger**, Princeton University ✦ *The Structure of Instability in Moduli Theory* ✦ **Daniel Halpern-Leistner**, Member, School of Mathematics

October 22

Topology of Algebraic Varieties ✦ *Extending Differential Forms and the Lipman-Zariski Conjecture* ✦ **Sándor J. Kovács**, University of Washington; Member, School of Mathematics

Special Mathematical Physics Seminar ✦ *Quasiperiodic Operators with Monotone Potentials: Sharp Arithmetic Spectral Transitions and Small Coupling Localization* ✦ **Svetlana Jitomirskaya**, University of California, Irvine

Mathematical Conversations ✦ *Tropical Hypersurfaces* ✦ **Nicholas Sheridan**, Princeton University; Veblen Research Instructor, School of Mathematics

October 23

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *An Algebro-Geometric Theory of Vector-Valued Modular Forms of Half-Integral Weight* ✦ **Luca Candelori**, Louisiana State University

October 24

Joint Columbia/IAS/Princeton Symplectic Seminar ✦ *Symplectic Embeddings from Concave Toric Domains into Convex Ones* ✦ **Dan Cristofaro-Gardiner**, Harvard University

Joint Columbia/IAS/Princeton Symplectic Seminar ✦ *Beyond ECH Capacities* ✦ **Michael Hutchings**, University of California, Berkeley

October 27

Computer Science/Discrete Mathematics Seminar I ✦ *Discretization and Quantitative Differentiation* ✦ **Assaf Naor**, Princeton University

Members' Seminar ✦ *Apery, Irrationality Proofs, and Dinner Parties* ✦ **Francis Brown**, Institut de Mathématiques de Jussieu, Université Paris VII; von Neumann Fellow, School of Mathematics

Overtwisted Contact Structures ✦ *Lectures on Overtwisted Contact Structures* ✦ **Matthew Strom Borman**, Member, School of Mathematics

October 28

Computer Science/Discrete Mathematics Seminar II ✦ *Exponential Separation of Information and Communication* ✦ **Gillat Kol**, Member, School of Mathematics

Topology of Algebraic Varieties ✦ *Terminal Valuations and the Nash Problem* ✦ **Javier Fernández de Bobadilla**, Institute for Mathematical Sciences, Instituto de Ciencias Matemáticas, Consejo Superior de Investigaciones Científicas; Member, School of Mathematics ✦ *Singular Moduli Spaces and Nakajima Quiver Varieties* ✦ **Giulia Saccà**, Member, School of Mathematics

Special Symplectic Geometry Seminar ✦ *Designing Low Energy Capture Transfers for Spacecraft to the Moon and Mars* ✦ **Edward Belbruno**, Princeton University and Innovative Orbital Design, Inc.

October 29
Topology of Algebraic Varieties ✦ *Mirror Symmetry & Looijenga's Conjecture* ✦ **Philip Engel**, Columbia University

October 31
Princeton/IAS Symplectic Geometry Seminar ✦ *On the Gromov Width of Polygon Spaces* ✦ **Alessia Mandini**, Università degli Studi di Pavia

November 3
Computer Science/Discrete Mathematics Seminar I ✦ *Information Percolation for the Ising Model* ✦ **Eyal Lubetzky**, New York University

Hermann Weyl Lectures ✦ *Sparsification of Graphs and Matrices* ✦ **Daniel Spielman**, Yale University

November 4
Computer Science/Discrete Mathematics Seminar II ✦ *Sign Rank, Spectral Gap, and VC Dimension* ✦ **Noga Alon**, Tel Aviv University; Visiting Professor, School of Mathematics

Topology of Algebraic Varieties ✦ *Birational Actions of SL(n, Z) I* ✦ **Serge Marc Cantat**, CNRS, Université de Rennes 1; Member, School of Mathematics ✦ *Beauville's Splitting Principle for Chow Rings of Projective Hyperkähler Manifolds* ✦ **Lie Fu**, Member, School of Mathematics

November 5
Topology of Algebraic Varieties ✦ *Elliptic Genera of Pfaffian-Grassmannian Double Mirrors* ✦ **Lev Borisov**, Rutgers, The State University of New Jersey

Hermann Weyl Lectures ✦ *The Solution of the Kadison-Singer Problem* ✦ **Daniel Spielman**, Yale University

Mathematical Conversations ✦ *Differential Forms and Homotopy Groups* ✦ **Richard M. Hain**, Duke University; Member, School of Mathematics

November 6
Hermann Weyl Lectures ✦ *Ramanujan Graphs of Every Degree* ✦ **Daniel Spielman**, Yale University

Joint IAS/Princeton University Number Theory Seminar ✦ *Representations of Finite Groups and Applications* ✦ **Pham Tiep**, Harvard University and the University of Arizona

November 7
Princeton/IAS Symplectic Geometry Seminar ✦ *C^0-Characterization of Symplectic and Contact Embeddings* ✦ **Stefan Müller**, University of Illinois at Urbana-Champaign

November 10
Computer Science/Discrete Mathematics Seminar I ✦ *Talagrand's Convolution Conjecture and Geometry via Coupling* ✦ **James Lee**, University of Washington

Members' Seminar ✦ *Shot-Noise Random Fields: Some Geometric Properties and Some Applications for Images* ✦ **Agnès Desolneux**, École Normale Supérieure de Cachan; Member, School of Mathematics

Overtwisted Contact Structures ✦ *Lectures on Overtwisted Contact Structures* ✦ **Matthew Strom Borman**, Member, School of Mathematics

November 11
Computer Science/Discrete Mathematics Seminar II ✦ *Asymptotic Expansions of the Central Limit Theorem and Its Applications* ✦ **Anindya De**, Visitor, School of Mathematics

Topology of Algebraic Varieties ✦ *Birational Actions of SL(n, Z) II* ✦ **Serge Marc Cantat**, CNRS, Université de Rennes 1; Member, School of Mathematics ✦ *Mixed Hodge Theory: Some Intuitions* ✦ **Pierre Deligne**, Professor Emeritus, School of Mathematics ✦ *Zarhin's Trick and Geometric Boundedness Results for K3 Surfaces* ✦ **François Charles**, Université Paris–Sud 11

November 12
Topology of Algebraic Varieties ✦ *Universal Chow Group of Zero-Cycles on Cubic Hypersurfaces* ✦ **Claire Voisin**, CNRS, Institut de Mathématiques de Jussieu; Distinguished Visiting Professor, School of Mathematics ✦ *Network Topology and Strategic Behavior* ✦ **Michael Kearns**, University of Pennsylvania ✦ *Topological Mechanical Metamaterials* ✦ **Vincenzo Vitelli**, Universiteit Leiden ✦ *Topological Sampling and Disordered Solids* ✦ **Shmuel Weinberger**, The University of Chicago

November 13
Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Fourier-Jacobi Periods on Unitary Groups* ✦ **Hang Xue**, Member, School of Mathematics

November 14
Princeton/IAS Symplectic Geometry Seminar ✦ *Stability in Fukaya Categories of Surfaces* ✦ **Fabian Haiden**, Universität Wien

Princeton/IAS Symplectic Geometry Seminar ✦ *The Lefschetz Hyperplane Theorem Is Mostly Wrong (Symplectically Speaking)* ✦ **Mark McLean**, Stony Brook University, The State University of New York

Mathematical Conversations ✦ *The Surprise Examination Paradox and the Second Incompleteness Theorem* ✦ **Ran Raz**, Weizmann Institute of Science; Visiting Professor, School of Mathematics

November 17
Computer Science/Discrete Mathematics Seminar I ✦ *Mutation as a Computational Event* ✦ **Adi Livnat**, Virginia Polytechnic Institute and State University

Members' Seminar ✦ *Hyperbolic Groups, Cannon-Thurston Maps, and Hydra* ✦ **Timothy Riley**, Cornell University; Member, School of Mathematics

Overtwisted Contact Structures ✦ *Lectures on Overtwisted Contact Structures* ✦ **Matthew Strom Borman**, Member, School of Mathematics

November 18
Computer Science/Discrete Mathematics Seminar II ✦ *Toric Origami Manifolds and Origami Templates* ✦ **Tara Holm**, Cornell University; von Neumann Fellow, School of Mathematics

Topology of Algebraic Varieties ✦ *Boundedness of Log General Type Pairs I* ✦ **Chenyang Xu**, Peking University; Member, School of Mathematics ✦ *The Geometry and Topology of Rational Surfaces with an Anticanonical Cycle* ✦ **Robert Friedman**, Columbia University

November 19
Topology of Algebraic Varieties ✦ *Birational Geometry of Complex Hyperbolic Manifolds* ✦ **Gabriele di Cerbo**, Columbia University

Mathematical Conversations ✦ *Trivializing the Trivial Group* ✦ **Timothy Riley**, Cornell University; Member, School of Mathematics

November 20
Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Weyl-Type Hybrid Subconvexity Bounds for Twisted L-Functions and Heegner Points on Shrinking Sets* ✦ **Matthew Patrick Young**, Texas A&M University; von Neumann Fellow, School of Mathematics

November 21
Princeton/IAS Symplectic Geometry Seminar ✦ *Cyclic Homology and S^1-Equivariant Symplectic Cohomology* ✦ **Sheel Ganatra**, Stanford University

November 24

Computer Science/Discrete Mathematics
Seminar I ✦ *Computational Fair Division* ✦ **Ariel
Procaccia**, Carnegie Mellon University

Members' Seminar ✦ *P = W: A Strange Identity
for GL(2,C)* ✦ **Mark de Cataldo**, Stony Brook
University, The State University of New York;
Member, School of Mathematics

November 25

Computer Science/Discrete Mathematics
Seminar II ✦ *Sum-of-Squares Lower Bounds for
the Planted Clique Problem* ✦ **Avi Wigderson**,
Herbert H. Maass Professor, School of
Mathematics

Topology of Algebraic Varieties ✦ *Boundedness
of Log General Type Pairs II* ✦ **Chenyang Xu**,
Peking University; Member, School of
Mathematics

December 1

Computer Science/Discrete Mathematics
Seminar I ✦ *Parallel Repetition from Fortification* ✦
Dana Moshkovitz, Massachusetts Institute
of Technology

Members' Seminar ✦ *Graphs, Vectors, and
Integers* ✦ **Noga Alon**, Tel Aviv University;
Visiting Professor, School of Mathematics

December 2

Computer Science/Discrete Mathematics
Seminar II ✦ *Taming the Hydra: The Word Problem,
Dehn Functions, and Extreme Integer Compression* ✦
Timothy Riley, Cornell University; Member,
School of Mathematics

Topology of Algebraic Varieties ✦ *Degeneration
of Fano Kähler-Einstein Manifolds* ✦ **Xiaowei
Wang**, Rutgers University, Newark ✦
Codimension Two Cycles ✦ **Madhav Nori**,
The University of Chicago; Member, School
of Mathematics

December 3

Topology of Algebraic Varieties ✦ *Minimal Log
Discrepancy of Isolated Singularities and Reeb
Orbits* ✦ **Mark McLean**, Stony Brook
University, The State University of New York

December 4

Joint IAS/Princeton University Number
Theory Seminar ✦ *Level Raising Mod 2 and
Arbitrary 2-Selmer Ranks* ✦ **Chao Li**, Harvard
University

December 5

Princeton/IAS Symplectic Geometry Seminar ✦
*Gauged Linear s-Model and Gauged Witten
Equation* ✦ **Guangbo Xu**, University of
California, Irvine

Mathematical Conversations ✦ *Can One Decide
on Being Free or Thin?* ✦ **Christopher Hall**,
University of Wyoming; von Neumann Fellow,
School of Mathematics

December 8

Computer Science/Discrete Mathematics
Seminar I ✦ *Area Laws and the Complexity of
Quantum States* ✦ **Umesh Vazirani**, University
of California, Berkeley

Members' Seminar ✦ *Ball Quotients* ✦ **Bruno
Klingler**, Institut de Mathématiques de Jussieu,
Université Paris VII; Member, School of
Mathematics

December 9

Computer Science/Discrete Mathematics
Seminar II ✦ *More on Sum-of-Squares Proofs for
Planted Clique* ✦ **Avi Wigderson**, Herbert H.
Maass Professor, School of Mathematics

Topology of Algebraic Varieties ✦ *The Andre-
Oort Conjecture I* ✦ **Bruno Klingler**, Institut de
Mathématiques de Jussieu, Université Paris VII;
Member, School of Mathematics ✦ *A Support
Theorem for the Hitchin Fibration* ✦ **Pierre-Henri
Chaudouard**, Université Paris Diderot; von
Neumann Fellow, School of Mathematics

December 10

Topology of Algebraic Varieties ✦ *The Andre-
Oort Conjecture II* ✦ **Bruno Klingler**, Institut de
Mathématiques de Jussieu, Université Paris VII;
Member, School of Mathematics ✦ *Beyond
Linear Algebra* ✦ **Bernd Sturmfels**, University
of California, Berkeley ✦ *Topological Similarity
of Random Cell Complexes, and Applications* ✦
Benjamin Schweinhart, Princeton
University ✦ *The Law of Aboav-Weaire and
Extensions* ✦ **Richard Ehrenborg**, University
of Kentucky and Princeton University

December 11

Joint IAS/Princeton University Number
Theory Seminar ✦ *The Polynomial Method* ✦
Jordan Ellenberg, University of Wisconsin–
Madison

Joint IAS/Princeton University Number
Theory Seminar ✦ *Selmer Groups, Automorphic
Periods, and Bloch-Kato Conjecture* ✦ **Yifeng Liu**,
Massachusetts Institute of Technology

December 12

Princeton/IAS Symplectic Geometry Seminar ✦
On Normal Crossings Symplectic Divisors ✦
Aleksey Zinger, Stony Brook University,
The State University of New York

December 15

Analysis, Spectra, and Number Theory:
A Conference in Honor of Peter Sarnak's
61st Birthday

December 16

Analysis, Spectra, and Number Theory:
A Conference in Honor of Peter Sarnak's
61st Birthday

Topology of Algebraic Varieties ✦ *The
Archimedean Height and Singularities in Hodge
Theory* ✦ **Patrick Gerald Brosnan**, University
of Maryland; Member, School of Mathematics ✦

*Some Algebro-Geometric Aspects
of Limiting Mixed Hodge Structure* ✦ **Phillip A.
Griffiths**, Professor Emeritus, School of
Mathematics

December 17

Analysis, Spectra, and Number Theory:
A Conference in Honor of Peter Sarnak's
61st Birthday

Topology of Algebraic Varieties ✦ *Periods,
Calabi-Yau Fibrations, and Mirror Symmetry* ✦
Charles Doran, University of Alberta

December 18–19

Analysis, Spectra, and Number Theory:
A Conference in Honor of Peter Sarnak's
61st Birthday

January 13

Topology of Algebraic Varieties ✦ *Normal
Functions and the Geometry of Moduli Spaces of
Curves* ✦ **Richard M. Hain**, Duke University;
Member, School of Mathematics

January 14

Topology of Algebraic Varieties ✦ *Stable
Cohomology of Compactifications of A_g* ✦ **Klaus
Hulek**, Gottfried Wilhelm Leibniz Universität
Hannover

January 20

Computer Science/Discrete Mathematics
Seminar II ✦ *Small Value Parallel Repetition for
General Games* ✦ **Ankit Garg**, Princeton
University

Topology of Algebraic Varieties ✦ *On Descending
Cohomology Geometrically* ✦ **Sebastian
Casalaina-Martin**, University of Colorado

January 21

Topology of Algebraic Varieties ✦ *A Birational
Model of the Cartwright-Steger Surface* ✦ **Igor
Dolgachev**, University of Michigan

Mathematical Conversations ✦ *Galois Groups
and Hyperbolic 3-Manifolds* ✦ **Richard Taylor**,
Robert and Luisa Fernholz Professor, School
of Mathematics

January 26

Computer Science/Discrete Mathematics
Seminar I ✦ *Publicly Verifiable Non-Interactive
Arguments for Delegating Computation* ✦ **Guy
Rothblum**, Stanford University

January 28

Topology of Algebraic Varieties ✦ *Toric
Chordality and Applications* ✦ **Karim Alexander
Adiprasito**, Member, School of Mathematics

Mathematical Conversations ✦ *Periods* ✦
Francis Brown, Institut de Mathématiques
de Jussieu, Université Paris VII; von Neumann
Fellow, School of Mathematics

January 29

Joint IAS/Princeton University Number Theory Seminar ✦ *Endoscopy Theory for Symplectic and Orthogonal Similitude Groups* ✦ **Bin Xu**, Member, School of Mathematics

January 30

Princeton/IAS Symplectic Geometry Seminar ✦ *Symplectic Forms in Algebraic Geometry* ✦ **Giulia Saccà**, Member, School of Mathematics

February 2

Computer Science/Discrete Mathematics Seminar I ✦ *On Monotonicity Testing and Boolean Isoperimetric Type Theorems* ✦ **Subhash Khot**, New York University

Members' Seminar ✦ *Finite or Infinite? One Key to Algebraic Cycles* ✦ **Burt Totaro**, University of California, Los Angeles; Member, School of Mathematics

February 3

Computer Science/Discrete Mathematics Seminar II ✦ *Dimension Expanders via Rank Condensers* ✦ **Michael Forbes**, Member, School of Mathematics

Topology of Algebraic Varieties ✦ *On the Homology and the Tree of SL_2 over Polynomial Rings, and Reflexive Sheaves of Rank 2 on Projective Spaces I* ✦ **Fabien Morel**, Ludwig-Maximilians–Universität München; Member, School of Mathematics ✦ *Moduli of Degree 4 K3 Surfaces Revisited* ✦ **Radu Laza**, Stony Brook University, The State University of New York; von Neumann Fellow, School of Mathematics

Joint IAS/Princeton University Number Theory Seminar ✦ *On the Rationality of the Logarithmic Growth Filtration of Solutions of p-adic Differential Equations* ✦ **Shun Ohkubo**, The University of Tokyo

February 4

Topology of Algebraic Varieties ✦ *Exceptional Collections and the Néron-Severi Lattice for Surfaces* ✦ **Charles Vial**, University of Cambridge; Member, School of Mathematics

Mathematical Conversations ✦ *Structure vs. Randomness* ✦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

February 5

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *On the Formal Degrees of Square-Integrable Representations of Odd Special Orthogonal and Metaplectic Groups* ✦ **Atsushi Ichino**, Kyoto University

February 6

Princeton/IAS Symplectic Geometry Seminar ✦ *Path Products in Projective Space* ✦ **Nancy Hingston**, The College of New Jersey

February 9

Computer Science/Discrete Mathematics Seminar I ✦ *Quantum Computing with Non-Interacting Particles* ✦ **Alex Arkhipov**, Massachusetts Institute of Technology

Members' Seminar ✦ *Twisted Matrix Factorizations and Loop Groups* ✦ **Daniel Freed**, University of Texas at Austin; Member, Schools of Mathematics and Natural Sciences

February 10

Computer Science/Discrete Mathematics Seminar II ✦ *How to Round Subspaces: A New Spectral Clustering Algorithm* ✦ **Ali Kemal Sinop**, Simons Institute for the Theory of Computing, University of California, Berkeley

Topology of Algebraic Varieties ✦ *On the Homology and the Tree of SL_2 over Polynomial Rings, and Reflexive Sheaves of Rank 2 on Projective Spaces II* ✦ **Fabien Morel**, Ludwig-Maximilians–Universität München; Member, School of Mathematics ✦ *Extending the Prym Map* ✦ **Samuel Grushevsky**, Stony Brook University, The State University of New York

February 11

Topology of Algebraic Varieties ✦ *Algebraic Curves, Tropical Geometry, and Moduli* ✦ **Sam Payne**, Yale University; von Neumann Fellow, School of Mathematics

February 12

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Kottwitz-Rapoport Conjecture on Crystals with Additional Structure* ✦ **Xuhua He**, University of Maryland

February 13

Princeton/IAS Symplectic Geometry Seminar ✦ *Symplectic Homology via Gromov-Witten Theory* ✦ **Luis Diogo**, Columbia University

Mathematical Conversations ✦ *The Study of Free Groups via Stallings Core Graphs* ✦ **Doron Puder**, Member, School of Mathematics

February 16

Computer Science/Discrete Mathematics Seminar I ✦ *2-Server PIR with Sub-Polynomial Communication* ✦ **Sivakanth Gopi**, Princeton University

February 17

Computer Science/Discrete Mathematics Seminar II ✦ *The Log-Concavity Conjecture and the Tropical Laplacian* ✦ **June Huh**, Princeton University; Veblen Fellow, School of Mathematics

Topology of Algebraic Varieties ✦ *Proper Base Change for Zero Cycles* ✦ **Moritz Kerz**, Universität Regensburg; Member, School of Mathematics

February 18

Topology of Algebraic Varieties ✦ *The Cohomology Groups of Hilbert Schemes and Compactified Jacobians of Planar Curves* ✦ **Luca Migliorini**, Università Degli Studi Di Bologna; Member, School of Mathematics

Mathematical Conversations ✦ *Riemann-Hilbert Problems* ✦ **Irina Mitrea**, Temple University; von Neumann Fellow, School of Mathematics

February 19

Special Seminar ✦ *Bordism, QFT, and a Topological Invariant of Certain Lattice Systems* ✦ **Daniel Freed**, University of Texas at Austin; Member, School of Mathematics and Natural Sciences

Working Group on Algebraic Number Theory

Princeton/IAS Symplectic Geometry Seminar ✦ *Existence of Lefschetz Fibrations on Stein/Weinstein Domains* ✦ **John Pardon**, Stanford University

Joint IAS/Princeton University Number Theory Seminar ✦ *Eigencurve over the Boundary of the Weight Space* ✦ **Liang Xiao**, University of Connecticut

February 20

Princeton/IAS Symplectic Geometry Seminar ✦ *The Symplectic Displacement Energy* ✦ **Peter Spaeth**, GE Global Research

February 23

Computer Science/Discrete Mathematics Seminar I ✦ *Lower Bounds for Clique vs. Independent Set* ✦ **Mika Göös**, University of Toronto

Members' Seminar ✦ *Arthur's Trace Formula and Distribution of Hecke Eigenvalues for GL(n)* ✦ **Jasmin Matz**, Member, School of Mathematics

February 24

Computer Science/Discrete Mathematics Seminar II ✦ *Computing Inverses* ✦ **Louis Rowen**, Bar–Ilan University

Topology of Algebraic Varieties ✦ *Projectivity of the Moduli Space of KSBa Stable Pairs and Applications* ✦ **Zsolt Patakfalvi**, Princeton University

February 25

Topology of Algebraic Varieties ✦ *Automorphisms of Smooth Canonically Polarised Surfaces in Characteristic 2* ✦ **Nikolaos Tziolas**, University of Cyprus

February 26

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Around the Möbius Function* ✦ **Maksym Radziwill**, Rutgers, The State University of New Jersey

February 27

Princeton/IAS Symplectic Geometry Seminar ✦ *Disc Filling and Connected Sum* ✦ **Kai Zehmisch**, Universität Münster

Mathematical Conversations ✦ *The Algebraic Fundamental Group of a Topologically Simply-Connected Algebraic Variety* ✦ **Fabien Morel**, Ludwig-Maximilians-Universität München; Member, School of Mathematics

March 2

Computer Science/Discrete Mathematics Seminar I ✦ *Effective-Resistance-Reducing Flows, Spectrally Thin Trees, and Asymmetric TSP* ✦ **Shayan Oveis Gharan**, University of California, Berkeley

Marston Morse Lectures ✦ *Joint Equidistribution of Arithmetic Orbits, Joinings, and Rigidity of Higher Rank Diagonalizable Actions I* ✦ **Elon Lindenstrauss**, The Hebrew University of Jerusalem

Princeton/IAS Symplectic Geometry Seminar ✦ *From Knots to Clusters: The Path via Sheaves* ✦ **Eric Zaslow**, Northwestern University

March 3

Computer Science/Discrete Mathematics Seminar II ✦ *Whitney Numbers via Measure Concentration in Representation Varieties* ✦ **Karim Alexander Adiprasito**, Member, School of Mathematics

Topology of Algebraic Varieties ✦ *A Survey of Motivic Homotopy Theory* ✦ **Marc Levine**, Universität Duisburg-Essen ✦ *On Some Questions About Minimal Log Discrepancies* ✦ **Mircea Mustata**, University of Michigan

March 4

Topology of Algebraic Varieties ✦ *The Jumping Coefficients of Non-Q-Gorenstein Multiplier Ideals* ✦ **Patrick Graf**, Universität Bayreuth

Marston Morse Lectures ✦ *Joint Equidistribution of Arithmetic Orbits, Joinings, and Rigidity of Higher Rank Diagonalizable Actions II* ✦ **Elon Lindenstrauss**, The Hebrew University of Jerusalem

Mathematical Conversations ✦ *Symmetries and Deformation Invariants in Quantum Mechanics* ✦ **Daniel Freed**, University of Texas at Austin; Member, School of Mathematics and Natural Sciences

March 5

Joint IAS/Princeton University Number Theory Seminar ✦ *Faltings Heights of CM Abelian Varieties* ✦ **Benjamin Howard**, Boston College

March 6

Marston Morse Lectures ✦ *On Random Walks in the Group of Euclidean Isometries* ✦ **Elon Lindenstrauss**, The Hebrew University of Jerusalem

March 9

Workshop on Chow Groups, Motives, and Derived Categories

Computer Science/Discrete Mathematics Seminar I ✦ *Strong Contraction and Influences in Tail Spaces* ✦ **Elchanan Mossel**, University of Pennsylvania

Spectral Geometry Seminar ✦ *Arthur's Trace Formula and Distribution of Hecke Eigenvalues* ✦ **Jasmin Matz**, Member, School of Mathematics

March 10

Workshop on Chow Groups, Motives, and Derived Categories

Computer Science/Discrete Mathematics Seminar II ✦ *Chernoff Bounds for Expander Walks* ✦ **Christopher Beck**, Member, School of Mathematics

March 11

Workshop on Chow Groups, Motives, and Derived Categories

March 12

Workshop on Chow Groups, Motives, and Derived Categories

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *F-Crystalline Representations and Kisin Modules* ✦ **Tong Liu**, Purdue University

March 13

Workshop on Chow Groups, Motives, and Derived Categories

Princeton/IAS/Columbia Symplectic Geometry Seminar ✦ *Two New Constructions of Monotone Lagrangian Tori* ✦ **Denis Auroux**, University of California, Berkeley

Princeton/IAS/Columbia Symplectic Geometry Seminar ✦ *Koszul Duality Patterns in Floer Theory* ✦ **Yankı Lekili**, University of Illinois at Chicago

March 16

Computer Science/Discrete Mathematics Seminar I ✦ *Tight Hardness of the Non-Commutative Grothendieck Problem* ✦ **Oded Regev**, New York University

Members' Seminar ✦ *Structures at Infinity in the Character Variety* ✦ **Carlos Tschudi Simpson**, CNRS, Université de Nice Sophia Antipolis; Member, School of Mathematics

Spectral Geometry Seminar ✦ *Quantum Ergodicity and the Number of Nodal Domains of Eigenfunctions* ✦ **Junehyuk Jung**, Member, School of Mathematics

March 17

Computer Science/Discrete Mathematics Seminar II ✦ *Average-Case Lower Bounds for Formula Size* ✦ **Ran Raz**, Weizmann Institute of Science; Visiting Professor, School of Mathematics

Topology of Algebraic Varieties ✦ *A¹ Curves on Quasi-Projective Varieties* ✦ **Qile Chen**, Columbia University

March 20

IAS/Columbia University/Bendersky-Gitler Symplectic Geometry Seminar ✦ *Nearby Lagrangians Are Simply Homotopic* ✦ **Mohammed Abouzaid**, Columbia University ✦ *Non-Hamiltonian Actions with Isolated Fixed Points* ✦ **Sue Tolman**, University of Illinois at Urbana-Champaign

Mathematical Conversations ✦ *Quantum Spectral Curves* ✦ **Robbert Dijkgraaf**, Director and Leon Levy Professor, Institute for Advanced Study

March 23

Princeton/IAS Symplectic Geometry Seminar ✦ *Floer-like Complexes for Surfaces, Maximally Unlinked Braids, and Finite Energy Foliations* ✦ **Barney Bramham**, Ruhr-Universität Bochum

Computer Science/Discrete Mathematics Seminar I ✦ *Random Walks That Find Perfect Objects and the Lovász Local Lemma* ✦ **Dimitris Achlioptas**, University of California, Santa Cruz

Members' Seminar ✦ *Decoupling in Harmonic Analysis and Applications to Number Theory* ✦ **Jean Bourgain**, IBM von Neumann Professor, School of Mathematics

March 24

Computer Science/Discrete Mathematics Seminar II ✦ *Tractability as Compressibility* ✦ **Dimitris Achlioptas**, University of California, Santa Cruz

Topology of Algebraic Varieties ✦ *The Projective Line Minus 3 Points I* ✦ **Francis Brown**, Institut de Mathématiques de Jussieu, Université Paris VII; von Neumann Fellow, School of Mathematics ✦ *On the Incidence Complex of the Boundary of the Character Variety* ✦ **Carlos Tschudi Simpson**, CNRS, Université de Nice Sophia Antipolis; Member, School of Mathematics

March 25

Topology of Algebraic Varieties ✦ *Framed Motives of Algebraic Varieties (after V. Voevodsky)* ✦ **Ivan Panin**, Steklov Mathematical Institute, Russian Academy of Sciences; Member, School of Mathematics

Mathematical Conversations ◆ *The ABC Conjecture, Belyi's Theorem, and Applications* ◆ **Alexei Entin**, Member, School of Mathematics

March 26

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *Most Odd Degree Hyperelliptic Curves Have Only One Rational Point* ◆ **Bjorn Poonen**, Massachusetts Institute of Technology

March 30

Computer Science/Discrete Mathematics Seminar I ◆ *Intelligent Learning: Similarity Control and Knowledge Transfer* ◆ **Vladimir Vapnik**, Columbia University

Members' Seminar ◆ *Chern Classes of Schubert Cells and Varieties* ◆ **June Huh**, Princeton University; Veblen Fellow, School of Mathematics

Spectral Geometry Seminar ◆ *On the Geometry and Topology of Zero Sets of Schrödinger Eigenfunctions* ◆ **Yaiza Canzani**, Member, School of Mathematics

March 31

Computer Science/Discrete Mathematics Seminar II ◆ *Kolmogorov Width of Discrete Linear Spaces: An Approach to Matrix Rigidity* ◆ **Sergey Yekhanin**, Microsoft Research

Topology of Algebraic Varieties ◆ *The Projective Line Minus 3 Points II* ◆ **Francis Brown**, Institut de Mathématiques de Jussieu, Université Paris VII; von Neumann Fellow, School of Mathematics ◆ *Proof of the Grothendieck-Serre Conjecture on Principal Bundles over Regular Local Rings Containing a Field* ◆ **Ivan Panin**, Steklov Mathematical Institute, Russian Academy of Sciences; Member, School of Mathematics

April 1

Mathematical Conversations ◆ *Quasi-Crystals and Subdivision Tilings* ◆ **Robert F. Williams**, University of Texas at Austin; Visitor, School of Mathematics

April 2

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *Complex Multiplication and K3 Surfaces over Finite Fields* ◆ **Lenny Taelman**, Universiteit Leiden; von Neumann Fellow, School of Mathematics

April 3

Princeton/IAS Symplectic Geometry Seminar ◆ *On Symplectic Homology of the Complement of a Normal Crossing Divisor* ◆ **Khoa Nguyen**, Stanford University

April 6

Computer Science/Discrete Mathematics Seminar I ◆ *Natural Algorithms for Flow Problems* ◆ **Nisheeth Vishnoi**, École Polytechnique Fédérale de Lausanne

Members' Seminar ◆ *Fredholm Theory for Higher Order Elliptic Boundary Value Problems in Non-Smooth Domains* ◆ **Irina Mitrea**, Temple University; von Neumann Fellow, School of Mathematics

Spectral Geometry Seminar ◆ *Counting and Dynamics in SL_2* ◆ **Michael Robert Magee**, Member, School of Mathematics

April 7

Computer Science/Discrete Mathematics Seminar II ◆ *Interleaved Products in Special Linear Groups: Mixing and Communication Complexity* ◆ **Emanuele Viola**, Northeastern University

April 9

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *The André-Oort Conjecture Follows from the Colmez Conjecture* ◆ **Jacob Tsimerman**, University of Toronto

April 10

Princeton/IAS Symplectic Geometry Seminar ◆ *Equivalent Notions of High-Dimensional Overtwistedness* ◆ **Emmy Murphy**, Massachusetts Institute of Technology

April 13

Computer Science/Discrete Mathematics Seminar I ◆ *A New Approach to the Sensitivity Conjecture* ◆ **Michael Saks**, Rutgers, The State University of New Jersey

Members' Seminar ◆ *Quadratic Families of Elliptic Curves and Unirationality of Degree 1 Conic Bundles* ◆ **János Kollár**, Princeton University; Member, School of Mathematics

April 14

IAS/Princeton Algebraic Geometry Day ◆ *Embedding the Derived Category of a Curve into a Fano Variety* ◆ **Alexander Kuznetsov**, Steklov Mathematical Institute, Russian Academy of Sciences ◆ *Factorization of Birational Maps on Steroids* ◆ **Dan Abramovich**, Brown University ◆ *Syzygies, Gonality, and Symmetric Products of Curves* ◆ **Robert Lazarsfeld**, Stony Brook University, The State University of New York

Public Lecture ◆ *Of Particles, Stars, and Eternity* ◆ **Cédric Villani**, Université de Lyon and Institut Henri Poincaré

April 15

Princeton University Mathematics Department Colloquium ◆ *Universally Defined Cycles* ◆ **Claire Voisin**, CNRS, Institut de Mathématiques de Jussieu; Distinguished Visiting Professor, School of Mathematics

April 16

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *The p-adic Gross-Zagier Formula on Shimura Curves* ◆ **Daniel Disegni**, McGill University

April 17

Princeton/IAS Symplectic Geometry Seminar ◆ *Unlinked Fixed Points of Hamiltonian Diffeomorphisms and a Dynamical Construction of Spectral Invariants* ◆ **Sobhan Seyfaddini**, Massachusetts Institute of Technology

April 18

Workshop on Topology: Identifying Order in Complex Systems ◆ *Characterizing Force-Chain Network Architecture in Granular Materials* ◆ **Danielle Bassett**, University of Pennsylvania ◆ *Entanglement of Embedded Graphs* ◆ **Toen Castle**, University of Pennsylvania ◆ *A New Potential Theory for the Maxwell Equations* ◆ **Leslie Greengard**, New York University ◆ *A Topological Approach for Investigating the Intrinsic Structure of Neural Activity* ◆ **Vladimir Itskov**, The Pennsylvania State University ◆ *Sensors, Sampling, and Scale Selection: A Homological Approach* ◆ **Don Sheehy**, University of Connecticut

April 23

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *Extensions of the Gross-Zagier Formula* ◆ **Kartik Prasanna**, University of Michigan

April 29

Topology of Algebraic Varieties ◆ *Derived Categories of Cyclic Covers and Their Branch Divisors* ◆ **Alexander Perry**, Harvard University

April 30

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ◆ *Uniform Bounds for the Number of Rational Points on Curves of Small Mordell-Weil Rank* ◆ **Michael Stoll**, Universität Bayreuth

May 1

Princeton/IAS Symplectic Geometry Seminar ◆ *Periodic Symplectic Cohomologies* ◆ **Jingyu Zhao**, Columbia University

Mini-Symposium on Topology ◆ *Is the Abstract Mathematics of Topology Applicable to the Real World?* ◆ **Robert MacPherson**, Hermann Weyl Professor, School of Mathematics; **Randall D. Kamien**, University of Pennsylvania; **Raúl Rabadán**; Columbia University

May 7

Working Group on Algebraic Number Theory

Joint IAS/Princeton University Number Theory Seminar ✦ *Reductions of Galois Representations of Small Slopes* ✦ **Eknath Ghate**, Tata Institute of Fundamental Research, Mumbai

May 8
Special Analysis Seminar ✦ *Bernoulli Convolutions for Algebraic Parameters* ✦ **Péter Varjú**, University of Cambridge

May 11–15
2015 Women and Mathematics

May 19–22
2015 Women and Mathematics

School of Natural Sciences

ASTROPHYSICS ACTIVITIES

September 3
Special Cosmology Talk ✦ *Bayesian Chrono-Cosmography* ✦ **Florent Leclerq**, Institute d'Astrophysique de Paris

September 4
Special Cosmology Talk ✦ *Position-Dependent Power Spectrum of the Large-Scale Structure: A Novel Method to Measure the Squeezed-Limit Bispectrum* ✦ **Chi-Ting-Chiang**, Max–Planck–Institute für Astrophysik

September 9
Special Cosmology Talk ✦ *Renormalized Bias in the Excursion Set Peak Approach* ✦ **Vincent Desjacques**, Université de Genève

September 11
Astrophysics Informal Seminar ✦ *The Formation of the First Stars* ✦ **Thomas Greif**, Harvard–Smithsonian Center for Astrophysics

September 15
Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Introductions and General Discussion* ✦ **Matias Zaldarriaga**, Professor, School of Natural Sciences, and **David Spergel**, Princeton University; Visitor, School of Natural Sciences

September 16
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Various Aspects of the MW Disk's Vertical Structure* ✦ **Nir Shaviv**, The Hebrew University of Jerusalem; Member, School of Natural Sciences

September 18
Astrophysics Informal Seminar ✦ *Tidal Disruption of Stars by Supermassive Black Holes: Rates, Rotation, and Relativity* ✦ **Nicholas C. Stone**, Columbia University

September 23
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Gamma Ray Bursts from a Different Angle: The Sequel* ✦ **David Eichler**, Ben-Gurion University of the Negev

September 25
Astrophysics Informal Seminar ✦ *Generating and Constraining Primordial Magnetic Fields* ✦ **Takeshi Kobayashi**, Canadian Institute for Theoretical Astrophysics

September 29
Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Multiple Soft Limits of Cosmological Correlation Functions* ✦ **Marko Simonovi** , Member, School of Natural Sciences ✦ *Double Soft Limits of Cosmological Correlations* ✦ **Mehrdad Mirbabayi**, Member, School of Natural Sciences

September 30
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *See the Sound: Transients in the Local Universe* ✦ **Mansi M. Kasliwal**, Carnegie Institution of Washington and California Institute of Technology

October 2
Astrophysics Informal Seminar ✦ *Reconstructing the Mass Assembly of Galaxy Disks Over the Last 12 Billion Years with ALMA, HST, and Spitzer* ✦ **Kartik Sheth**, National Radio Astronomy Observatory

October 7
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Andromeda's Dust* ✦ **Bruce Draine**, Princeton University

October 9
Astrophysics Informal Seminar ✦ *Formation and Evolution of Star Clusters: A Simple, Unified Picture* ✦ **Michael Fall**, Space Telescope Science Institute, NASA, Baltimore

October 13
Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *The Illustris Simulation Observatory: Production and Analysis of a Catalog of Mock Images and Spectra* ✦ **Paul Torrey**, Harvard–Smithsonian Center for Astrophysics

October 14
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *How to Falsify a Dark Energy Paradigm* ✦ **Dragan Huterer**, University of Michigan

October 16
Astrophysics Informal Seminar ✦ *Disk Accretion onto Supermassive Black Hole Binaries* ✦ **Brian Farris**, New York University and Columbia University

October 21
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Explaining the Stellar Magnetic Activity-Rotation Relation: A Context for Some Broadly Applicable Principles* ✦ **Eric Blackman**, University of Rochester; Member, Institute for Advanced Study

October 23
Astrophysics Informal Seminar ✦ *The POLARBEAR Experiment: First Season Results on Sub-Degree Scales and Future Plans* ✦ **Zigmund Kermish**, Princeton University

October 27
Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Cosmological Simulations of Galaxy Cluster Outskirts* ✦ **Camille Avestruz**, Yale University

October 28
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Intrinsic Galaxy Alignments and the Cosmic Web* ✦ **Rachel Mandelbaum**, Carnegie Mellon University

October 30
Astrophysics Informal Seminar ✦ *Shedding Light on Planet-Disk Interactions* ✦ **Dave Tsang**, McGill University

November 4
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Think Globally, Act Locally: Physical Models of Galaxy Formation in a Cosmological Framework* ✦ **Rachel Somerville**, Rutgers, The State University of New Jersey

November 6
Astrophysics Informal Seminar ✦ *Sculpting Exoplanet Atmospheres: A Framework for Thermal Escape* ✦ **Ruth Murray-Clay**, Harvard–Smithsonian Center for Astrophysics

November 10
Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Measuring Dark Energy with CHIME* ✦ **Laura Newburgh**, Dunlap Institute, University of Toronto ✦ *A Radially-Resolved Equilibrium Model for a Baryonic Disk Evolution* ✦ **Ben Rathus**, Tel Aviv University

November 11
Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Two Milestones in the History of the Universe: Last Scattering Surface and Black Body Photosphere of the Universe; Unavoidable Spectral Distortions of CMB* ✦ **Rashid Sunyaev**, Max–Planck–Institute für Astrophysik; Visiting Professor, School of Natural Sciences

November 13

Astrophysics Informal Seminar ✦ *Powerful Radiatively Driven Jets in Supercritical Accretion Flows* ✦ **Olek Sadowski**, Massachusetts Institute of Technology

November 18

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *The Compositions of Small Planets* ✦ **Dave Charbonneau**, Harvard-Smithsonian Center for Astrophysics

November 20

Astrophysics Informal Seminar ✦ *Using Microhalos to Probe the Origins of Dark Matter* ✦ **Adrienne Erickcek**, The University of North Carolina at Chapel Hill

November 24

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *General Discussion* ✦ **Matias Zaldarriaga**, Professor, School of Natural Sciences, and **David Spergel**, Princeton University; Visitor, School of Natural Sciences

November 25

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Tracking Planet Footprints in Dusty Disks* ✦ **Catherine Espaillat**, Boston University

December 2

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Herschel Studies of Extrasolar Kuiper Belt–Like Systems* ✦ **Amaya-Moro Martin**, Space Telescope Science Institute, NASA, Baltimore

December 4

Astrophysics Informal Seminar ✦ *Gravity and the Search for New Particle Interactions with Cosmology* ✦ **Kris Sigurdson**, The University of British Columbia

December 8

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Galaxies on FIRE: Stellar Feedback and Galaxy Evolution* ✦ **Dusan Keres**, University of California, San Diego

December 9

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Dark Matter Dynamics* ✦ **Tom Abel**, Stanford University

December 11

Astrophysics Informal Seminar ✦ *On the Dynamics of Helium in the Dilute Intracluster Medium* ✦ **Martin Pessah**, Niels Bohr International Academy, Copenhagen

December 16

Institute for Advanced Study/Princeton University Joint Astrophysics Colloquium ✦ *Incorporating Post-Newtonian Effects in N-Body Dynamics* ✦ **Clifford Will**, University of Florida

January 8

Astrophysics Informal Seminar ✦ *How I Learned to Stop Worrying and Love Eclipsing Binaries* ✦ **Maxwell Moe**, Harvard-Smithsonian Center for Astrophysics

January 15

Astrophysics Informal Seminar ✦ *Disk-Planet Interaction: From 2D to 3D* ✦ **Jeffrey Fung**, University of Toronto

January 22

Astrophysics Informal Seminar ✦ *Inferring the Population of Exoplanets from Noisy, Incomplete Catalogs* ✦ **Daniel Foreman-Mackey**, New York University

January 29

Astrophysics Informal Seminar ✦ *Stellar Tides as a Probe of Hot Jupiters' Origin and Fate* ✦ **Francesca Valsecchi**, Center for Interdisciplinary Exploration and Research in Astrophysics, Northwestern University

February 5

Astrophysics Informal Seminar ✦ *Radiation Magnetohydrodynamic Simulations of Protostellar Collapse: Non-Ideal Magnetohydrodynamic Effects and Early Formation of Circumstellar Disks* ✦ **Kengo Tomida**, Princeton University

February 12

Astrophysics Informal Seminar ✦ *Astrophysical Models for Cosmochemical Questions* ✦ **James Owen**, Canadian Institute for Theoretical Astrophysics, Member, School of Natural Sciences

February 19

Astrophysics Informal Seminar ✦ *Chasing Our Cosmic Dawn: Opening the 21cm Cosmological Window on the Universe* ✦ **Daniel Jacobs**, Arizona State University

February 26

Astrophysics Informal Seminar ✦ *Structure Formation with Fast Particles* ✦ **Neal Dalal**, University of Illinois at Urbana–Champaign; Junior Visiting Professor, School of Natural Sciences

March 2

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Vesto Slipher and the Discovery of the Expanding Universe* ✦ **John Peacock**, The Royal Observatory, Edinburgh

March 5

Astrophysics Informal Seminar ✦ *Galaxy Intrinsic Alignments and Precision Cosmology* ✦ **Jonathan A. Blazek**, The Ohio State University

March 12

Astrophysics Informal Seminar ✦ *B-Mode Cosmology* ✦ **Marko Simonović**, Member, The School of Natural Sciences

March 16

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Probing Dark Matter Substructure with Dusty Galaxies* ✦ **Neal Dalal**, University of Illinois at Urbana–Champaign; Junior Visiting Professor, School of Natural Sciences

March 19

Astrophysics Informal Seminar ✦ *The Physics and Cosmology of TeV Blazars* ✦ **Philip Chang**, University of Wisconsin–Milwaukee

March 26

Astrophysics Informal Seminar ✦ *The Atacama Cosmology Telescope: Recent Results and Future Prospects* ✦ **Matthew Hasselfield**, Princeton University

March 30

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Measuring Lensing of the CMB by Galaxy Clusters with the South Pole Telescope* ✦ **Eric Baxter**, University of Pennsylvania

April 2

Astrophysics Informal Seminar ✦ *Early Stages of Planet Formation—Bridging Theory and Observations* ✦ **Til Birnstiel**, Harvard-Smithsonian Center for Astrophysics

April 8

Astrophysics Informal Seminar ✦ *Mechanism of Magnetar Activity* ✦ **Andrei Beloborodov**, Columbia University

April 13

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *CMB Hemispherical Asymmetry* ✦ **Mohammad Hossein Namjoo**, The University of Texas at Dallas

April 16

Astrophysics Informal Seminar ✦ *IceCube and the Future of HE Neutrino Astronomy* ✦ **Eli Waxman**, Weizmann Institute of Science; Visitor, School of Natural Sciences

April 27

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Exploring Eternal Stability with the Simple Harmonic Universe* ✦ **Bart Horn**, Columbia University

April 28

Astrophysics Informal Seminar ✦ *A Search for Dark Matter Annihilation in the Newly Discovered Dwarf Galaxy Reticulum 2* ✦ **Alex Geringer-Sameth**, Carnegie Mellon University

April 30

Astrophysics Informal Seminar ✦ *Feedback Regulated Turbulence, Magnetic Fields, and Star Formation Rates in Galactic Disks* ✦ **Chang-Goo Kim**, Princeton University

May 7

Astrophysics Informal Seminar ✦ *Circular Polarization of Redshifted 21-cm Radiation: Another Futuristic Idea for Detecting Primordial Gravitational Waves* ✦ **Christopher Hirata**, The Ohio State University

May 8

Special Astrophysics Seminar ✦ *21cm Cosmology* ✦ **Max Tegmark**, Massachusetts Institute of Technology

May 12

Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *Boosted Dark Matter Enhanced with Self-Interactions* ✦ **Gopolang Mohlabeng**, The University of Kansas ✦ *The Splashback Radius as a Physical Boundary for Dark Matter Halos* ✦ **Surhud More**, Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo

May 14

Astrophysics Informal Seminar ✦ *MASSIVE Galaxies and Small Supermassive Black Holes* ✦ **Jenny Greene**, Princeton University

May 20

Astrophysics Informal Seminar ✦ *What We Can Learn from Planets in Binary Systems* ✦ **Kaitlin Kratter**, The University of Arizona and Steward Observatory

HIGH ENERGY THEORY ACTIVITIES

September 15

High Energy Theory Seminar ✦ *Toward Numerical Experiments of Quantum Gravity via Gauge/Gravity Duality* ✦ **Masanori Hanada**, Kyoto University

September 17

Physics Group Meeting ✦ *Coleman-Weinberg Higgs* ✦ **Hyung Do Kim**, Seoul National University; Member, School of Natural Sciences

September 26

High Energy Theory Seminar ✦ *Quantum Extremal Surfaces* ✦ **Aron Wall**, University of California, Santa Barbara; Member, School of Natural Sciences

September 29

High Energy Theory Seminar ✦ *Short-Range Entangled Phases and Topology* ✦ **Anton Kapustin**, Simons Center for Geometry and Physics, Stony Brook University, The State University of New York

October 1

Physics Group Meeting ✦ *From Spins to Matrices* ✦ **Dionysios Anninos**, Stanford University; Member, School of Natural Sciences

October 3

High Energy Theory Seminar ✦ *An Explanation of the WW Excess at the LHC by Jet-Veto (and π^2) Resummation* ✦ **Takemichi Okui**, Florida State University

October 13

High Energy Theory Seminar ✦ *Infinity-Algebras, SUSY Interfaces, and Categorified Wall-Crossing in the IR Limit of Massive d=2 N=(2,2) QFT* ✦ **Greg Moore**, Rutgers, The State University of New Jersey

October 15

Physics Group Meeting ✦ *Soft Collinear Effective Theory for Heavy WIMP Annihilation* ✦ **Timothy Cohen**, SLAC National Accelerator Laboratory; Visitor, School of Natural Sciences

October 17

High Energy Theory Seminar ✦ *Generalized Global Symmetries* ✦ **Nathan Seiberg**, Professor, School of Natural Sciences

October 22

Physics Group Meeting ✦ *The Anderson Transition and Supergroup Sigma Models* ✦ **Thomas Spencer**, Professor, School of Mathematics

October 27

High Energy Theory Seminar ✦ *Semiclassical Virasoro Symmetry of the Quantum Gravity S-Matrix* ✦ **Andrew Strominger**, Harvard University

October 29

Physics Group Meeting ✦ *Exact Solutions of 2d Supersymmetric Gauge Theories* ✦ **Abhijit Gadde**, California Institute of Technology; Member, School of Natural Sciences

October 31

High Energy Theory Seminar ✦ *SU(8) Family Unification with Boson-Fermion Balance* ✦ **Stephen L. Adler**, Professor Emeritus, School of Natural Sciences

November 4

Informal High Energy Theory Seminar ✦ *TBA for Minimal Surfaces in AdS from the Continuum Limit of Null Polygons* ✦ **Jonathan Toledo**, Perimeter Institute for Theoretical Physics

November 12

Physics Group Meeting ✦ *Four Computations of Chaotic Commutators* ✦ **Douglas Stanford**, Stanford University; Member, School of Natural Sciences

November 14

High Energy Theory Seminar ✦ *Fun with Black Holes: Asymmetric Hawking Radiation and Black Hole Catalyzed Vacuum Decay* ✦ **Anson Hook**, Member, School of Natural Sciences

November 20

Informal High Energy Theory Seminar ✦ *Hidden Hyperbolic Kac-Moody Structures in Supergravity and a Possible Quantum Avoidance of Cosmological Singularities* ✦ **Thibault Damour**, Institut des Hautes Études Scientifiques, Bures-sur-Yvette, France

November 24

High Energy Theory Seminar ✦ *Quantum Supergravity and Exact Holography* ✦ **Joao Gomes**, University of Cambridge

November 26

Physics Group Meeting ✦ *Boundary Conditions and Symplectic Duality in 3d N=4 Theories* ✦ **Tudor Dan Dimofte**, Long-Term Member, School of Natural Sciences

December 3

Informal High Energy Theory Seminar ✦ *Future Circular Colliders* ✦ **Yifang Wang**, Institute of High Energy Physics, Chinese Academy of Sciences, Beijing

December 5

High Energy Theory Seminar ✦ *The Coulomb Branch of 3d N=4 Theories and Finite W-Algebras* ✦ **Mathew Bullimore**, Perimeter Institute of Theoretical Physics; Member, School of Natural Sciences

December 8

High Energy Theory Seminar ✦ *Completing Higher Spin de Sitter Holography* ✦ **Frederik Denef**, Columbia University

January 15

Informal High Energy Theory Seminar ✦ *Scattering Equations and Matrices: Exploring the World of Massless Theories* ✦ **Song He**, Perimeter Institute for Theoretical Physics

January 26

High Energy Theory Seminar ✦ *The Time Reversal Invariant Fractional Josephson Effect* ✦ **Charles Kane**, University of Pennsylvania

February 3

High Energy Theory Seminar ✦ *Holographically Inspired Thoughts on High Temperature Superconductors and Other Bad Metals* ✦ **Sean Hartnoll**, Stanford University

February 4

Physics Group Meeting ✦ *Spectral Problems from Topological Strings* ✦ **Johan Carl Gunnar Källén**, Université de Genève; Member, School of Natural Sciences

February 6

High Energy Theory Seminar ✦ *The Three-Loop Cust Anomalous Dimension in QCD* ✦ **Johannes Henn**, Member, School of Natural Sciences

February 19

Special Physics Seminar ✦ *Bordism, QFT, and a Topological Invariant of Certain Lattice Systems* ✦ **Daniel Freed**, The University of Texas at Austin; Member, Schools of Mathematics and Natural Sciences

February 20

High Energy Theory Seminar ✦ *Spontaneous CP Violation and θ_{qcd}* ✦ **Michael Dine**, University of California, Santa Cruz; Visiting Professor, School of Natural Sciences

February 23

High Energy Theory Seminar ✦ *Exact Holographic Mapping, Tensor Networks, and Space-Time Geometry* ✦ **Xiaoliang Qi**, Stanford University

February 25

Physics Group Meeting ✦ *BIG J* ✦ **Simeon Hellerman**, Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo

March 2

High Energy Theory Seminar ✦ *The N=2 Superconformal Bootstrap and Chiral Algebras* ✦ **Leonardo Rastelli**, Stony Brook University, The State University of New York

March 6

High Energy Theory Seminar ✦ *Cosmological Polytopes* ✦ **Nima Arkani-Hamed**, Professor, School of Natural Sciences

March 11

Physics Group Meeting ✦ *Confronting the Strong CP Problem at the LHC* ✦ **Anson Hook**, Member, School of Natural Sciences

March 24

Informal High Energy Theory Seminar ✦ *Some Comments on the Necessity and Implications of State Dependence for the Black Hole Interior* ✦ **Suvrat Raju**, International Centre for Theoretical Sciences, Bangalore

March 25

Physics Group Meeting ✦ *Something Cloudy, Something Clear: Yet Another Look at Canonical Quantization of Pure Gravity on AdS3* ✦ **Massimo Porrati**, New York University; Member, School of Natural Sciences

March 30

High Energy Theory Seminar ✦ *Non-Thermal Dark Matter—A Generic Prediction of String/M Theory* ✦ **Bobby Acharya**, The Abdus Salam International Centre for Theoretical Physics, Trieste; King's College London

April 1

Physics Group Meeting ✦ *Higgs Production at N3LO* ✦ **Bernhard Mistlberger**, Eidgenössische Technische Hochschule Zürich

April 3

High Energy Theory Seminar ✦ *The Einstein-Rosen Bridge on the String* ✦ **David Vegh**, Stanford University; Member, School of Natural Sciences

April 8

Physics Group Meeting ✦ *New Views of Positive Geometry for Amplitudes and Correlators* ✦ **Nima Arkani-Hamed**, Professor, School of Natural Sciences

April 13

High Energy Theory Seminar ✦ *Mirror Symmetry and Loop Operators* ✦ **Jaume Gomis**, Perimeter Institute for Theoretical Physics

April 15

Physics Group Meeting ✦ *Bulk Locality and Quantum Error Correction in AdS/CFT* ✦ **Daniel Harlow**, Princeton University

April 16

Special High Energy Theory Seminar ✦ *Precursor Puzzles* ✦ **Joseph Polchinski**, Kavli Institute for Theoretical Physics, University of California, Santa Barbara

April 17

High Energy Theory Seminar ✦ *Network Operators and Quantum Moduli Space of Flat Connections* ✦ **Maxime Gabella**, Member, School of Natural Sciences

April 22

Physics Group Meeting ✦ *Holographic Rho Meson Condensation* ✦ **Nele Callebout**, Princeton University

April 27

High Energy Theory Seminar ✦ *Goldstone Gauginos* ✦ **Neal Weiner**, New York University

April 29

Physics Group Meeting ✦ *New Approaches to Scattering Amplitudes: From On-Shell Diagrams to the Amplituhedron* ✦ **Sebastian Franco**, The City College of New York

May 1

High Energy Theory Seminar ✦ *Recursion Relation for Conformal Blocks* ✦ **Masahito Yamazaki**, Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo; Member, School of Natural Sciences

May 7

Informal High Energy Theory Seminar ✦ *Ab Initio Calculation of the Neutron-Proton Mass Difference* ✦ **Zoltan Fodor**, Eötvös Loránd University

May 11

High Energy Theory Seminar ✦ *Aspects of 6D SCFTs and their Toroidal Compactifications* ✦ **Michele Del Zotto**, Harvard University

May 13

Physics Group Meeting ✦ *Cosmological Collider Physics* ✦ **Juan Maldacena**, Professor, School of Natural Sciences

May 18

Joint Astrophysics/High Energy Theory Seminar ✦ *Double Disk Dark Matter* ✦ **Lisa Randall**, Harvard University

May 20

Physics Group Meeting ✦ *Reciprocity Laws* ✦ **Richard Taylor**, Robert and Luisa Fernholz Professor, School of Mathematics

May 27

Physics Group Meeting ✦ *Tunneling in Theories with Many Fields* ✦ **Sonia Paban**, The University of Texas at Austin; Member, School of Natural Sciences

June 1

High Energy Theory Seminar ✦ *Geometric Phase, String Braiding Statistics, and Spacetime Surgery* ✦ **Juven Wang**, Massachusetts Institute of Technology

July 20–31

Prospects in Theoretical Physics: New Insights Into Quantum Matter
Organizers and Lecturers: **Waseem Bakr**, Princeton University; **Bogdan Bernevig**, Princeton University; **Robbert Dijkgraaf**, Director and Leon Levy Professor, Institute for Advanced Study; **Duncan Haldane**, Princeton University; **Zahid Hasan**, Princeton University; **Charles Kane**, University of Pennsylvania; **Vidya Madhavan**, University of Illinois at Urbana–Champaign; **Greg Moore**, Rutgers, The State University of New Jersey; **Chiara Nappi**, Princeton University; **Nai Phuan Ong**, Princeton University; **Nicholas Read**, Yale University; **Nathan Seiberg**, Professor, School of Natural Sciences; **Shivaji Sondhi**, Princeton University; **Xiao-Gang Wen**, Massachusetts Institute of Technology; and **Edward Witten**, Charles Simonyi Professor, School of Natural Sciences

SIMONS CENTER FOR SYSTEMS BIOLOGY ACTIVITIES

September 25

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Problems in Checking Systems* ✦ **Bernard Chazelle**, Princeton University; Member, School of Natural Sciences

October 2

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Effective Theories for Systems with the Gap* ✦ **Dmitry Krotov**, Member, School of Natural Sciences

October 6

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Emergence of Self-Replication in Evolving Computer Programs* ✦ **Andrew Pargellis**

October 14

The Simons Center for Systems Biology Seminar ✦ *Stem Cells and the Development of the Cells of the Blood System* ✦ **Arnold J. Levine**, Professor Emeritus, School of Natural Sciences

October 23

The Simons Center for Systems Biology Seminar ✦ *The Innate and Adaptive Immune System* ✦ **Arnold J. Levine**, Professor Emeritus, School of Natural Sciences

October 30

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Small RNAs and Transgenerational Epigenetic Inheritance* ✦ **Eric A. Miska**, Gurdon Institute, University of Cambridge

October 31

The Simons Center for Systems Biology Seminar ✦ *Outer Membrane Biogenesis in Gram-Negative Bacteria* ✦ **Thomas J. Silhavy**, Princeton University

November 6

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Mechanical Signaling in Heart Muscle* ✦ **Andrea Liu**, University of Pennsylvania

November 7

The Simons Center for Systems Biology Seminar ✦ *Inferring Fitness in Influenza* ✦ **Marta Luksza**, Research Associate, School of Natural Sciences

November 25

The Simons Center for Systems Biology Seminar ✦ *Elasticity in Physics and Biology* ✦ **Carl Goodrich**, University of Pennsylvania

December 1

Topological Data Analysis/Persistent Homology Meeting ✦ *Mapping Human Recombination with Persistent Homology* ✦ **Pablo G. Camara**, Columbia University ✦ *Coalescent Inference Using the Persistence Diagram* ✦ **Kevin Emmett**, Columbia University ✦ *Measuring Intra-Host HIV Evolution Using Computational Topology* ✦ **Daniel Rosenbloom**, Columbia University ✦ *Understanding Pluripotent Stem Cell Differentiation: Extracting Biologically Relevant Developmental Progression from High-Dimensional Single Cell Data* ✦ **Ryan L. McCarthy**, The University of Texas MD Anderson Cancer Center

December 1

Bacteria Meeting ✦ *Bacterial Sporulation and Germination* ✦ **Jonathan Dworkin**, Columbia University ✦ *Global Evolution Pressures on DNA* ✦ **Edo Kussell**, Columbia University

December 2

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Bacteria Community Assembly* ✦ **Otto Cordero**, Eidgenössische Technische Hochschule Zürich

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Cell Identities from Stem Cells* ✦ **Alex H. Lang**, Boston University

December 3

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Cell Growth Rate Laws* ✦ **Terence Hwa**, University of California, San Diego

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Microbial Ecology* ✦ **Forest Rohwer**, San Diego State University

December 4

Mutant p53 Reactivator Meeting ✦ *Review of the Biology* ✦ **Darren Carpizo**, Rutgers Cancer Institute of New Jersey ✦ *Physical Chemical Studies* ✦ **Stewart Loh** and **Adam Blanden**, Upstate Medical University, The State University of New York ✦ *Chemical Synthesis* ✦ **David Kimball**, **David Augeri**, and **John Gilleran**, Rutgers University

December 10

Joint Lab Meeting ✦ *Functional MRI Talk* ✦ **Jon Cohen**, **Ken Norman**, and **Nick Turk-Brown**, Princeton University ✦ *An Overview of Topological Data Analysis* ✦ **Pablo G. Camara**, Columbia University

December 12

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Units of Co-Regulation in Bacterial Genomes* ✦ **Olivier Rivoire**, CNRS and Université Joseph Fourier

February 10

The Simons Center for Systems Biology Seminar ✦ *Viral Integration and Cellular Gene Expression in Human Cancer* ✦ **James M. Pipas**, University of Pittsburgh

February 13–18

Convergence Ideas Lab ✦ *Cancer Immunotherapy: The End of the Beginning* ✦ **Jedd D. Wolchok**, Memorial Sloan Kettering Cancer Center ✦ *Stroma, Spatial Patterns, and Immune Signaling in Cancer* ✦ **Peter P. Lee**, City of Hope Comprehensive Cancer Center ✦ *Precision*

Medicine from Mitochondria ✦ **Anthony G. Letai**, Dana-Farber Cancer Institute/Harvard Medical School ✦ *Satellite ncRNAs in Cancer* ✦ **David T. Ting**, Massachusetts General Hospital/Harvard Medical School ✦ *Learning to Read Immunological Memory* ✦ **Harlan Robins**, Fred Hutchinson Cancer Research Center ✦ *Role of RNA Viruses & ncRNA in Inflammatory Responses* ✦ **Benjamin D. Greenbaum**, Icahn School of Medicine at Mount Sinai ✦ *Cancer Precision Medicine Initiative* ✦ **José T. Baselga**, Memorial Sloan Kettering Cancer Center ✦ *How Does Resistance Emerge?* ✦ **Jeffrey A. Engelman**, Massachusetts General Hospital ✦ *Questions from the "Leukemia Wars"* ✦ **Ross L. Levine**, Memorial Sloan Kettering Cancer Center ✦ *Pancreas Cancer Clinical Trials: Metabolism, Genomics, and Tumor-Stroma Interactions* ✦ **Jeffrey A. Drebin**, Perelman School of Medicine at the University of Pennsylvania ✦ *Principles of Resistance to Cancer Therapy* ✦ **Levi A. Garraway**, Dana-Farber Cancer Institute ✦ *Heterogeneity and Anticipation in LFS* ✦ **Chang S. Chan**, Rutgers Cancer Institute of New Jersey ✦ *On the Complexity of Cellular Heterogeneity* ✦ **Steven J. Altschuler**, University of California, San Francisco ✦ *Chemically Directing the Immune System* ✦ **Darrell J. Irvine**, Massachusetts Institute of Technology ✦ *Computational Modeling of Cancer-Related Signaling Pathways* ✦ **Reka Z. Albert**, The Pennsylvania State University ✦ *Epithelial Plasticity—A Hallmark of Metastasis* ✦ **Herbert Levine**, Rice University ✦ *Forestial Problems and Tumor Evolution* ✦ **Raul Rabadan**, Columbia University ✦ *Synthetic Biology: Engineering Viruses, Cells, and Networks* ✦ **Timothy K. Lu**, Massachusetts Institute of Technology ✦ *Why Do Tumors Occur Where They Do?* ✦ **Clare C. Yu**, University of California, Irvine ✦ *Using Sequence Data to Infer the Mechanisms of T-Cell Diversity Generation* ✦ **Curtis G. Callan**, Princeton University ✦ *Evolution of Cancer and Drug Resistance: Possible Lessons from Microbial Evolution and Evolutionary Dynamics of Large Populations* ✦ **Daniel S. Fisher**, Stanford University ✦ *Computational Analyses of the Multiscale Evolution of Cancer* ✦ **Gurinder S. Atwal**, Cold Spring Harbor Laboratory

February 19

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Thermodynamics with Information* ✦ **Jordan Horowitz**, University of Massachusetts, Boston

February 27

The Simons Center for Systems Biology Seminar ✦ *Transgenerational Immune Memory via Virus-to-Host Lateral Gene Transfer: A Eukaryotic CRISPR/Cas?* ✦ **Nicholas Parrish**, Institute for Virus Research, Kyoto University and University of Pennsylvania

March 18

The Simons Center for Systems Biology Informal Talks on Abstract/Conceptual/ Quantitative Aspects of Biology ✦ *Genetic and*

Phenotypic Variations in C. elegans ✦ **Marie-Anne Felix**, Institut de Biologie de l'École Normale Supérieure

April 8
The Simons Center for Systems Biology Seminar ✦ *Light to Life* ✦ **Paul Falkowski**, Rutgers University

April 10
The Simons Center for Systems Biology Seminar ✦ *Discovery of Precision Medicines for Glioblastoma* ✦ **Brent Stockwell**, Columbia University

April 23
Governor's Conference on Effective Partnering in Cancer Research ✦ *Immune Checkpoint Blockade in Cancer Therapy: New Insights and Opportunities* ✦ **James P. Allison**, The University of Texas MD Anderson Cancer Center ✦ *Combination Checkpoint Blockade and the Role of "Passenger" Mutations in Clinical Response to Ipilimumab* ✦ **Jedd D. Wolchok**, Memorial Sloan Kettering Cancer Center ✦ *Predicting Response to Immunotherapy with Immunosequencing* ✦ **Harlan Robins**, Fred Hutchinson Cancer Research Center ✦ *CAR Therapy and the Promise of T-Cell Engineering* ✦ **Michel Sadelain**, Memorial Sloan Kettering Cancer Center ✦ *Modulation of Immunity by Dendritic Cells* ✦ **Nina Bhardwaj**, Icahn School of Medicine at Mount Sinai ✦ *A Platform for the Discovery and Validation of Immune Gene-Related Tumor Signatures for Potential Applications in Immunotherapy* ✦ **James J. Mulé**, Moffitt Cancer Center

May 18
Joint Lab Meeting ✦ *Informatics Analysis of p53 Missense Mutations and Their Transcriptional Profiles in Cancer Cells Talks* ✦ **Kausik Regunath** and **Vitalay Fomin**, Columbia University

June 1
The Simons Center for Systems Biology Seminar ✦ *The Use of Recombinant Inbred Mouse Lines to Identify Interesting Gene Functions* ✦ **Evan G. Williams**, École Polytechnique Fédérale de Lausanne

School of Social Science

September 15
School Welcome Party

September 19
Writing, Inquiry, and Theory Reading Group ✦ Organizational Meeting

September 29
Social Science Lunch Seminar ✦ *The Discreet Charm of Ethnography* ✦ **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

October 1
Egalitarianisms Seminar ✦ Organizational Meeting

Workshop on Ideas, Institutions, and Political Economy ✦ *The Evolution of Culture and Institutions: Evidence from the Kuba Kingdom* ✦ **Nathan Nunn**, Harvard University

October 6
Social Science Lunch Seminar ✦ *The Case for Lottocracy* ✦ **Alexander A. Guerrero**, University of Pennsylvania; Member, School of Social Science

October 8
Workshop on Ideas, Institutions, and Political Economy ✦ *Political Language in Economics* ✦ **Suresh Naidu**, Columbia University

October 10
Writing, Inquiry, and Theory Reading Group ✦ Discussion of readings by **Hugh Gusterson**, The George Washington University; Member, School of Social Science, and **Brian Connolly**, University of South Florida; Visitor, School of Social Science

October 13
Social Science Lunch Seminar ✦ *Rethinking Urban Schools* ✦ **Charles M. Payne**, The University of Chicago; Member, School of Social Science

October 15
Egalitarianisms Seminar ✦ Discussion of Pierre Rosanvallon's *Society of Equals*

Workshop on Ideas, Institutions, and Political Economy ✦ *Geography, Uncertainty, and Polarization* ✦ **Nolan McCarty**, Princeton University; Member, School of Social Science

October 20
Social Science Lunch Seminar ✦ *The Specter of Race in Comparative Politics* ✦ **Michael G. Hanchard**, Johns Hopkins University; Member, School of Social Science

October 22
Workshop on Ideas, Institutions, and Political Economy ✦ *Democratic Knowledge vs. Social Capital: A Manifesto* ✦ **Danielle Allen**, UPS Foundation Professor, School of Social Science

October 27
Social Science Lunch Seminar ✦ *Gender Crime and Political Voice* ✦ **Anandi Mani**, University of Warwick; Member, School of Social Science

October 29
Egalitarianisms Seminar ✦ Discussion of readings by **Elizabeth S. Anderson**, **Karl Polanyi**, **Nancy Krieger**, and **John Holmwood**, The University of Nottingham; Member, School of Social Science

Workshop on Ideas, Institutions, and Political Economy ✦ *Bowling for Fascism: Social Capital and the Rise of the Nazi Party* ✦ **Shanker Satyanath**, New York University

November 3
Social Science Lunch Seminar ✦ *The Polarization of American Politics* ✦ **Nolan McCarty**, Princeton University; Member, School of Social Science

November 5
Workshop on Ideas, Institutions, and Political Economy ✦ *A Culture of Growth: Origins of the Modern Economy* ✦ **Joel Mokyr**, Northwestern University

November 7
Writing, Inquiry, and Theory Reading Group ✦ Discussion of readings by **Maurizio Meloni**, Sheffield University, and **Richard Ashby Wilson**, University of Connecticut; Members, School of Social Science

November 10
Social Science Lunch Seminar ✦ *Methodologies and Middle Passages* ✦ **Jennifer L. Morgan**, New York University; Member, School of Social Science

November 12
Egalitarianisms Seminar ✦ *Sociology's Promise* ✦ **John Holmwood**, The University of Nottingham; Member, School of Social Science

Workshop on Ideas, Institutions, and Political Economy ✦ *Civil Society, Democratic Knowledge, and Democratic Leadership* ✦ **Nannerl O. Keohane**, Princeton University; Visitor, School of Social Science

November 14
Law and History Reading Group ✦ Organizational Meeting

November 17
Social Science Lunch Seminar ✦ *Searching for the Truth About Lies* ✦ **Hugh Gusterson**, The George Washington University; Member, School of Social Science

Egalitarianisms Seminar ✦ *The Land of Too Much* ✦ **Monica Prasad**, Northwestern University

November 19
Workshop on Ideas, Institutions, and Political Economy ✦ *Bridging the Divide: Kagame and Nation Building in Rwanda* ✦ **Sharun W. Mukand**, University of Warwick; Member, School of Social Science

November 24
Social Science Lunch Seminar ✦ *Reading Piketty "Locally": The United States and the Dis-United Kingdom* ✦ **John Holmwood**, The University of Nottingham; Member, School of Social Science

November 26

Egalitarianisms Seminar ✦ *Arendt's Lament: The Death of Shame and the Rise of Political Children* ✦ **Jill Locke**, Gustavus Adolphus College; Member, School of Social Science

December 1

Social Science Lunch Seminar ✦ *Revenge and Moral Disgust: The Law and Psychology of International Speech Crimes* ✦ **Richard Ashby Wilson**, University of Connecticut; Member, School of Social Science

December 3

Egalitarianisms Seminar ✦ *Freedom's Right: The Social Foundations of Democratic Life* ✦ **Axel Honneth**, Goethe–Universität Frankfurt and Columbia University

Workshop on Ideas, Institutions, and Political Economy ✦ *Taxing the Rich: Fairness and Fiscal Sacrifice over Two Centuries* ✦ **Kenneth Scheve**, Stanford University

December 5

Law and History Reading Group ✦ Discussion of paper by **Teemu Ruskola**, Emory University; Member, School of Historical Studies

December 8

Social Science Lunch Seminar ✦ *Religious Pluralism and Islamic Law: After Tolerance* ✦ **Anver M. Emon**, University of Toronto; Member, School of Social Science

December 10

Egalitarianisms Seminar ✦ *Political Biology: Where the Natural and the Social Order Overlap* ✦ **Maurizio Meloni**, Sheffield University; Member, School of Social Science

Workshop on Ideas, Institutions, and Political Economy ✦ *A New Approach to Law and Economics* ✦ **Kaushik Basu**, The World Bank and Cornell University

December 12

Writing, Inquiry, and Theory Reading Group ✦ Discussion of readings by **Manduhai Buyandelger**, Massachusetts Institute of Technology, and **Serguei A. Oushakine**, Princeton University; Members, School of Social Science

December 15

Social Science Lunch Seminar ✦ *Genetics, Inequality, and Democracy: From Eugenics to Epigenetics* ✦ **Maurizio Meloni**, Sheffield University; Member, School of Social Science

Film screening and discussion of *Camp de Thiaroye* (Senegal, 1998), moderated by **Michael G. Hanchard**, Johns Hopkins University; Member, School of Social Science

December 16

Egalitarianisms Seminar ✦ *Discussion on Ferguson, MO* ✦ **Jill Locke**, Gustavus Adolphus College; Member, School of Social Science

January 14

Egalitarianisms Seminar ✦ *The Arts of Together: Social Coordination as Dyadic Achievement* ✦ **Gary Alan Fine**, Northwestern University; Member, School of Social Science

January 16

Law and History Reading Group ✦ Discussion of paper by **Brady Brower**, Weber State University; Member, School of Social Science

January 23

Law and History Reading Group ✦ Discussion of paper by **Anver M. Emon**, University of Toronto; Member, School of Social Science

January 28

Workshop on Ideas, Institutions, and Political Economy ✦ *Creating Democratic Knowledge Online?* ✦ **John Holmwood**, The University of Nottingham; Member, School of Social Science

January 29

Egalitarianisms Seminar ✦ Windsor*'s Mad Genius: The Interlocking Gears of Rights and Structure* ✦ **Heather Gerken**, Yale University

February 2

Social Science Lunch Seminar ✦ *From Corporate Order to Organic Solidarity: Biology and Social Thought in France* ✦ **Brady Brower**, Weber State University; Member, School of Social Science

February 3

Roundtable Discussion ✦ *France, Post–"Charlie Hebdo" Incident* ✦ **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

February 4

Egalitarianisms Seminar ✦ *"The Psychological Marshall Plan": Displacement, Gender, and Human Rights after World War II* ✦ **Tara Zahra**, The University of Chicago

Workshop on Ideas, Institutions, and Political Economy ✦ *The Political Psychology of Constitution-Making* ✦ **Jon Elster**, Columbia University

February 9

Social Science Lunch Seminar ✦ *Cascading Failures and Gambling Tasks* ✦ **Adam Elga**, Princeton University; Member, School of Social Science

February 11

Egalitarianisms Seminar ✦ *Democracy, Equality, and the Problem of Political Minorities* ✦ **Alexander A. Guerrero**, University of Pennsylvania; Member, School of Social Science

Workshop on Ideas, Institutions, and Political Economy ✦ *How Business Community Institutions Can Help Fight Corruption* ✦ **Avinash Dixit**, Princeton University

February 13

Law and History Reading Group ✦ Discussion of paper by **Joan Wallach Scott**, Professor Emerita, School of Social Science

February 18

SSRC Albert O. Hirschman Prize Ceremony and Lectures

February 23

Social Science Lunch Seminar ✦ *Political Equality and a Post-Metaphysical General Will* ✦ **Paul Gowder**, University of Iowa; Member, School of Social Science

February 24

Roundtable Discussion ✦ *Ferguson and Staten Island Incidents* ✦ **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

February 25

Workshop on Ideas, Institutions, and Political Economy ✦ *Up from Poverty? The 1832 Cherokee Land Lottery and the Long-Run Distribution of Wealth* ✦ **Hoyt Bleakley**, University of Michigan

February 27

Writing, Inquiry, and Theory Reading Group ✦ Discussion of readings by **Brady Brower**, Weber State University, and **Julilly Kohler-Hausmann**, Cornell University; Members, School of Social Science

March 2

Social Science Lunch Seminar ✦ *Welfare Crises and the Origins of Mass Incarceration in 1970s America* ✦ **Julilly Kohler-Hausmann**, Cornell University; Member, School of Social Science

March 4

Workshop on Ideas, Institutions, and Political Economy ✦ *Political Order and Inequality* ✦ **Carles Boix**, Princeton University

March 6

Egalitarianisms Seminar ✦ *Social Movements, Experiments in Living, and Moral Progress: Case Studies from Britain's Abolition of Slavery* ✦ **Elizabeth Anderson**, University of Michigan

March 9

Social Science Lunch Seminar ✦ *The Urban Memory Machine: Municipal Politics and the Creation of "Historic" Philadelphia* ✦ **Gary Alan Fine**, Northwestern University; Member, School of Social Science

March 11

Egalitarianisms Seminar ✦ *The Position of the Citizen* ✦ **Peter Alexander Meyers**, Université Paris III; Visitor, School of Social Science

Workshop on Ideas, Institutions, and Political Economy ◆ *Rent-Seeking Elites, Integration, and the Coevolution of Political Institutions* ◆ **Arthur Silve**, Sciences Po and École d'Économie de Paris

March 16

Social Science Lunch Seminar ◆ *Making Choices: Reflections on a Historical Problem* ◆ **Sophia Rosenfeld**, University of Virginia; Member, School of Social Science

March 18

Egalitarianisms Seminar ◆ *The Specter of Race in American Politics* ◆ **Michael G. Hanchard**, Johns Hopkins University; Member, School of Social Science

March 23

Social Science Lunch Seminar ◆ *Technologies of Elections and Appearance of Democracy* ◆ **Manduhai Buyandelger**, Massachusetts Institute of Technology; Member, School of Social Science

Workshop on Ideas, Institutions, and Political Economy ◆ *The Power of Ranking? The Ease of Doing Business as Soft Power* ◆ **Beth Simmons**, Harvard University

April 2

Writing, Inquiry, and Theory Reading Group ◆ Discussion of readings by **Jennifer L. Morgan**, New York University; Member, School of Social Science, and **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

April 6

Social Science Lunch Seminar ◆ *The Decline of Democracy in Turkey: Popular Support, Institutional Decay* ◆ **Yeşim Arat**, Boğaziçi University

April 8

Egalitarianisms Seminar ◆ *The Lost Tradition of Economic Equality in America, 1600–1880* ◆ **Daniel R. Mandell**, Truman State University

Workshop on Ideas, Institutions, and Political Economy ◆ *Mixing Methods: A Bayesian Approach* ◆ **Macartan Humphreys**, Columbia University

April 13

Social Science Lunch Seminar ◆ *Great Expectations: The Ambiguity of Social Whitening in Colombia* ◆ **Mara Viveros Vigoya**, Universidad Nacional de Colombia; Member, School of Social Science

April 14

Egalitarianisms Seminar ◆ *Global Sociology via the Haitian Revolution* ◆ **Gurminder K. Bhambra**, University of Warwick; Visitor, School of Social Science

April 15

Workshop on Ideas, Institutions, and Political Economy ◆ *How Political Economies Change: The Evolution of Growth Regimes in the Developed Democracies* ◆ **Peter Hall**, Harvard University

April 20

Social Science Lunch Seminar ◆ *What's Wrong with "Revolting Children"?* ◆ **Jill Locke**, Gustavus Adolphus College; Member, School of Social Science

Book Talk ◆ *The Paradox of Liberation: Secular Revolution and Religious Counterrevolution* ◆ **Michael Walzer**, Professor Emeritus, School of Social Science

April 21

Egalitarianisms Seminar ◆ *Global Redistribution* ◆ **E. Glen Weyl**, Microsoft Research New England

April 22

Workshop on Ideas, Institutions, and Political Economy ◆ *Quadratic Voting* ◆ **E. Glen Weyl**, Microsoft Research New England

April 27

Social Science Lunch Seminar ◆ *Diffusion of Ideas and Innovations* ◆ **Kalyan Chatterjee**, The Pennsylvania State University; Member, School of Social Science

April 29

Egalitarianisms Seminar ◆ *Intersectionality through the Prism of Latin-American Feminism* ◆ **Mara Viveros Vigoya**, Universidad Nacional de Colombia; Member, School of Social Science

April 30

Writing, Inquiry, and Theory Reading Group ◆ Discussion of readings by **Gary Alan Fine**, Northwestern University, and **Mara Viveros Vigoya**, Universidad Nacional de Colombia; Members, School of Social Science

May 4

Social Science Lunch Seminar ◆ *A Bridge Too Far?: Nation Building in Post-Genocide Rwanda* ◆ **Sharun W. Mukand**, University of Warwick; Member, School of Social Science

May 6

Egalitarianisms Seminar ◆ *The Logics of Coordination and Commitment* ◆ **Paul Gowder**, The University of Iowa; Member, School of Social Science

May 12

Egalitarianisms Seminar ◆ *Voting and the Invention of Political Choice* ◆ **Sophia Rosenfeld**, University of Virginia; Member, School of Social Science

May 19

Egalitarianisms Seminar ◆ *Security as Estrangement* ◆ **Tugba Basaran**, University of Kent; Visitor, School of Social Science

May 29

Egalitarianisms Seminar ◆ *The Subject of Tolerance* ◆ **Sara Edenheim**, Umeå University; Visitor, School of Social Science

June 3

Egalitarianisms Seminar ◆ *Fearless Sociology* ◆ **Charles M. Payne**, The University of Chicago; Member, School of Social Science

Director's Office Events

September 22

Institute Welcome Reception

September 26

AMIAS Family Barbecue

October 2

Artists Present ◆ *Spectacle* ◆ **Susan Steinberg**, Writer

October 10–11

Edward T. Cone Concert Series ◆ *The Little Match Girl Passion* ◆ **The Crossing**

Edward T. Cone Concert Series Talk ◆ **Donald Nally**, **Kile Smith**, and **Sebastian Currier**, Artist-in-Residence

October 17

Friends Culture and Cuisine ◆ *Mastery in Japanese Food Work: The Case of Coffee* ◆ **Merry White**, Professor of Anthropology, Boston University

October 18

Science Talk for Families ◆ *The Big Bang* ◆ **Robbert Dijkgraaf**, Director and Leon Levy Professor, Institute for Advanced Study

October 24

Public Lecture ◆ *Muslim Perceptions and Receptions of the Bible* ◆ **Sabine Schmidtke**, Professor, School of Historical Studies

October 30

Exhibit and Special Event ◆ *All This Has Come Upon Us* ◆ **Mark Podwal**, Artist

November 7

AMIAS Lecture ◆ *The Parthenon Sculptures: Decoding Images of Ancient Myths* ◆ **Joan Breton Connelly**, Professor of Classics, New York University

AMIAS Lecture ◆ *Finding Signs of Life on Earth-Like Exoplanets* ◆ **Hanno Rein**, Assistant Professor, University of Toronto

November 9

Princeton Symphony Orchestra Concert ◆ **Brad Balliet**, bassoon

November 14–15

Edward T. Cone Concert Series ✦ *Amsterdam/ New Amsterdam* ✦ **Ralph van Raat**, piano

Edward T. Cone Concert Series Talk ✦ **Ralph van Raat** and **Sebastian Currier**, Artist-in-Residence

November 19

Public Policy Lecture ✦ *The State of Democracy and Voting in a Post-Shelby Era* ✦ **Barbara Arnwine**, President and Executive Director, Lawyers' Committee for Civil Rights Under Law

November 21

Friends Fireside Chat ✦ *Serfdom and Splendor: The World of the Russian Country Estate* ✦ **Priscilla Roosevelt**, Fellow of the Institute for Russian, European, and Eurasian Studies, George Washington University

November 22

Lens of Computation on the Sciences Conference

December 19

Institute Community Holiday Party

January 11

Princeton Symphony Orchestra Concert ✦ *Spanish Winds* ✦ **Ventart–OSPA; Myra Pearse**, flute; **Juan Ferriol**, oboe; **Andreas Weisgerber**, clarinet; **Vincente Mascarell**, bassoon; and **José Luis Morato**, tuba

January 30

Friends Talk ✦ *A Conversation with Pia de Jong* ✦ **Pia de Jong**, Columnist and Novelist

February 4

Artists Present ✦ *Facts on the Ground* ✦ **Shimon Attie**, Artist

February 11

Friends Forum ✦ *Modern Cosmology and the Origin of the Universe* ✦ **Matias Zaldarriaga**, Professor, School of Natural Sciences

February 18

Albert O. Hirschman Prize Ceremony and Lectures ✦ **Abhijit Banerjee** and **Esther Duflo**, Co-Directors of the Abdul Latif Jameel Poverty Action Lab at the Massachusetts Institute of Technology; **Margaret Levi**, Institute Trustee and Director, Center for Advanced Study in Behavioral Sciences, Stanford University; and **Christopher Udry**, Henry J. Heinz II Professor of Economics, Yale University

February 20–21

Edward T. Cone Concert Series ✦ *A Harp, a Viola, and a Flute* ✦ **Bridget Kibbey**, harp; **Jack Stulz**, viola; **Julietta Curenton**, flute

Edward T. Cone Concert Series Talk ✦ **Bridget Kibbey**, **Jack Stulz**, **Julietta Curenton**, and **Sebastian Currier**, Artist-in-Residence

March 4

Artists Present ✦ *May We Be Forgiven* ✦ **A. M. Homes**, Writer

March 6

Friends Culture and Cuisine, ✦ *The American Plate: A Culinary History in 100 Bites* ✦ **Libby O'Connell,** Chief Historian, SVP Corporate Social Responsibility, HISTORY/A+E Networks

March 7

Science Talk for Families ✦ *Taking Galaxies Apart and Putting Them Back Together* ✦ **Jo Bovy**, John N. Bahcall Fellow in the School of Natural Sciences

March 8

Princeton Symphony Orchestra ✦ *The Romantic Violin* ✦ **Ruotao Mao**, violin, and **Michiko Otaki**, piano

March 9

Special Event ✦ *Cancer: The Emperor of All Maladies* ✦ **Arnold Levine**, Professor Emeritus, Simons Center for Systems Biology, School of Natural Sciences, and **Barak Goodman**, Director

March 13

Princeton Symphony Orchestra Concert ✦ *Behind the Music Discussion* ✦ **Rossen Milanov**, Music Director, Princeton Symphony Orchestra, and **Sebastian Currier**, Artist-in-Residence

March 14

Princeton Symphony Orchestra Concert ✦ *Cello Masterclass* ✦ **Zuill Bailey**, cello

March 19

Public Lecture ✦ *Ancient Human Genomes Suggest Three Ancestral Populations for Present-Day Europeans* ✦ **Johannes Krause**, Professor of Archaeology and Paleogenetics, University of Tübingen; Director, Max Planck Institute for the Science of Human History

March 20–21

Edward T. Cone Concert Series ✦ *Late Beethoven and American Modernism* ✦ **Peter Serkin**, piano; **Fred Sherry**, cello

Edward T. Cone Concert Series Talk ✦ **Peter Serkin**, **Fred Sherry**, and **Sebastian Currier**, Artist-in-Residence

April 8

Artists Present ✦ *My Erotic Body* ✦ **Michele Beck**, Artist

April 10

Public Lecture ✦ *Cut Loose, 1815–1817: Napoleon Returns, David Crosses Borders, and Géricault Wanders Outcast Rome* ✦ **Thomas Crow**, Rosalie Solow Professor of Modern Art, New York University

April 12

Princeton Symphony Orchestra Concert ✦ *Soprello* ✦ **Alistair MacRae**, cello and **Allison Pohl**, soprano

April 14

Public Lecture ✦ *Of Particles, Stars, and Eternity* ✦ **Cedric Villani**, Professor, Université Lyon; Director, Institut Henri Poincaré

April 22

Friends Forum ✦ *Fifty Years of Reforming Urban Schools: What Should We Have* ✦ **Charles Payne**, Friends of the Institute for Advanced Study Member, School of Social Science

May 1

Public Lecture ✦ *Is the Abstract Mathematics of Topology Applicable to the Real World?* ✦ **Robert MacPherson**, Hermann Weyl Professor, School of Mathematics; **Randall Kamien**, Vicki and William Abrams Professor in the Department of Physics and Astronomy, University of Pennsylvania; **Raúl Rabadán**, Associate Professor in the Department of Systems Biology, Columbia University

May 8

Public Lecture ✦ *Our Mathematical Universe* ✦ **Max Tegmark**, Professor, Massachusetts Institute of Technology

May 15

Public Lecture ✦ *Tales from the Data Trenches of Display Advertising* ✦ **Claudia Perlich**, Chief Scientist, Dstillery

May 27

Friends Annual Meeting and Picnic

May 29

Staff Picnic

ACKNOWLEDGMENTS

(for the year ended June 30, 2015)

The Institute for Advanced Study is indebted to its Founders and to all of its subsequent benefactors for providing a strong financial foundation from which to pursue its mission of fundamental research in the sciences and humanities without pressure for immediate results. We are deeply grateful to the Simons Foundation and the Charles and Lisa Simonyi Fund for Arts and Sciences for their $100 million challenge grant, the largest gift to the Institute since those made by its Founders, Louis Bamberger and Caroline Bamberger Fuld. This challenge grant raised a total of $212 million from Trustees, former Members, Faculty, Staff, the Friends of the Institute, and foundations since 2011, strengthening its position for future generations of scholars and scientists.

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Anonymous (3)

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Abraham Flexner · Frank Aydelotte

J. Robert Oppenheimer · Carl Kaysen · Harry Woolf

Marvin L. Goldberger · Phillip A. Griffiths · Peter Goddard · Robbert Dijkgraaf

PRESENT AND PAST FACULTY

(2014–2015 Faculty and Faculty Emeriti are in black)

Stephen L. Adler · James W. Alexander · Andrew E. Z. Alföldi · Danielle Allen

Nima Arkani-Hamed · Michael F. Atiyah · John N. Bahcall · Arne K. A. Beurling · Yve-Alain Bois

Enrico Bombieri · Armand Borel · Jean Bourgain · Glen W. Bowersock

Caroline Walker Bynum · Luis A. Caffarelli · Angelos Chaniotis · Harold F. Cherniss · Marshall Clagett

Giles Constable · Patricia Crone · José Cutileiro · Roger F. Dashen · Pierre Deligne

Nicola Di Cosmo · Freeman J. Dyson · Edward M. Earle · Albert Einstein · John H. Elliott

Didier Fassin · Patrick J. Geary · Clifford Geertz · Felix Gilbert · James F. Gilliam · Peter Goddard

Kurt Gödel · Hetty Goldman · Peter Goldreich · Oleg Grabar · Phillip A. Griffiths · Christian Habicht

Harish-Chandra · Ernst Herzfeld · Albert O. Hirschman · Helmut Hofer · Lars V. Hörmander · Piet Hut

Jonathan Israel · Ernst H. Kantorowicz · George F. Kennan · Robert P. Langlands · Irving Lavin

Tsung-Dao Lee · Stanislas Leibler · Arnold J. Levine · Elias A. Lowe · Robert MacPherson

Juan Maldacena · Avishai Margalit · Eric S. Maskin · Jack F. Matlock, Jr. · Millard Meiss

Benjamin D. Meritt · John W. Milnor · David Mitrany · Deane Montgomery · Marston Morse

J. Robert Oppenheimer · Abraham Pais · Erwin Panofsky · Peter Paret · Tullio E. Regge

Winfield W. Riefler · Dani Rodrik · Marshall N. Rosenbluth · Peter Sarnak · Sabine Schmidtke

Joan Wallach Scott · Nathan Seiberg · Atle Selberg · Kenneth M. Setton · Carl L. Siegel

Thomas Spencer · Walter W. Stewart · Bengt G. D. Strömgren · Richard Taylor · Homer A. Thompson

Scott Tremaine · Kirk Varnedoe · Oswald Veblen · Vladimir Voevodsky · John von Neumann

Heinrich von Staden · Michael Walzer · Robert B. Warren · André Weil · Hermann Weyl · Morton White

Hassler Whitney · Avi Wigderson · Frank Wilczek · Edward Witten · Ernest Llewellyn Woodward

Chen Ning Yang · Shing-Tung Yau · Matias Zaldarriaga

Institute for Advanced Study—
Louis Bamberger and Mrs. Felix Fuld Foundation

Financial Statements
June 30, 2015 and 2014

(With Independent Auditors' Report Thereon)

Independent Auditors' Report

The Board of Trustees
Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation:

We have audited the accompanying financial statements of Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation (the Institute), which comprise the statements of financial position as of June 30, 2015 and 2014, and the related statements of activities and cash flows for the years then ended, and the related notes to the financial statements.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with U.S. generally accepted accounting principles; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditors' Responsibility

Our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditors' judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation as of June 30, 2015 and 2014, and the changes in its net assets and its cash flows for the years then ended, in accordance with U.S. generally accepted accounting principles.

KPMG LLP

October 30, 2015

Assets		2015	2014
Cash and cash equivalents	$	6,108,320	3,287,954
Accounts receivable and other assets		917,848	1,564,127
Grants receivable		1,534,494	2,003,544
Contributions receivable—net		28,506,760	25,279,921
Unamortized debt issuance costs—net		518,544	570,689
Funds held by bond trustee		2,299,649	2,286,964
Beneficial interest in remainder trust		2,629,823	2,559,277
Land, buildings and improvements, equipment and rare book collection—net		83,092,279	82,274,435
Investments		774,023,403	738,283,288
Total assets	$	899,631,120	858,110,199

Liabilities and Net Assets			
Liabilities:			
Accounts payable and accrued expenses	$	7,914,349	7,846,617
Deferred revenue		5,310,557	3,745,905
Liabilities under split-interest agreements		2,136,528	2,347,588
Postretirement benefit obligation		15,262,863	15,086,961
Asset retirement obligation		1,060,476	1,035,257
Bond swap liability		4,131,660	4,275,176
Note payable		147,861	219,614
Long-term debt, net of discount		61,237,580	63,656,953
Total liabilities		97,201,874	98,214,071
Net assets:			
Unrestricted		387,032,882	384,445,157
Temporarily restricted		182,703,391	173,035,092
Permanently restricted		232,692,973	202,415,879
Total net assets		802,429,246	759,896,128
Total liabilities and net assets	$	899,631,120	858,110,199

See accompanying notes to financial statements.

STATEMENT OF ACTIVITIES
YEAR ENDED JUNE 30, 2015

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Operating revenues, gains, and other support:				
Private contributions and grants	$ —	8,331,412	—	8,331,412
Government grants	—	6,038,775	—	6,038,775
Endowment spending policy	22,457,949	16,862,951	—	39,320,900
Auxiliary activity	6,762,376	—	—	6,762,376
Net assets released from restrictions—				
satisfaction of program restrictions	31,233,138	(31,233,138)	—	—
Total operating revenues, gains, and other support	60,453,463	—	—	60,453,463
Expenses:				
School of Mathematics	10,561,754	—	—	10,561,754
School of Natural Sciences	10,995,815	—	—	10,995,815
School of Historical Studies	7,899,091	—	—	7,899,091
School of Social Science	4,218,369	—	—	4,218,369
Libraries and other academic	7,222,313	—	—	7,222,313
Administration and general	14,540,577	—	—	14,540,577
Auxiliary activity	7,929,359	—	—	7,929,359
Total expenses	63,367,278	—	—	63,367,278
Change in net assets from operations, including depreciation	(2,913,815)	—	—	(2,913,815)
Other revenues, gains, and other support:				
Private contributions and grants	837,108	524,196	30,277,094	31,638,398
Endowment change after applying spending policy	4,536,336	9,144,103	—	13,680,439
Change in fair value of bond swap liability	143,516	—	—	143,516
Loss on sale of plant assets	(15,420)	—	—	(15,420)
Change in net assets	2,587,725	9,668,299	30,277,094	42,533,118
Net assets—beginning of year	384,445,157	173,035,092	202,415,879	759,896,128
Net assets—end of year	$ 387,032,882	182,703,391	232,692,973	802,429,246

See accompanying notes to financial statements.

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Operating revenues, gains, and other support:				
Private contributions and grants	$ —	8,780,594	—	8,780,594
Government grants	—	6,340,907	—	6,340,907
Endowment spending policy	20,673,193	16,650,307	—	37,323,500
Auxiliary activity	6,688,932	—	—	6,688,932
Net assets released from restrictions— satisfaction of program restrictions	31,771,808	(31,771,808)	—	—
Total operating revenues, gains, and other support	59,133,933	—	—	59,133,933
Expenses:				
School of Mathematics	11,349,539	—	—	11,349,539
School of Natural Sciences	11,404,746	—	—	11,404,746
School of Historical Studies	7,832,661	—	—	7,832,661
School of Social Science	4,507,979	—	—	4,507,979
Libraries and other academic	8,598,160	—	—	8,598,160
Administration and general	13,850,905	—	—	13,850,905
Auxiliary activity	8,004,591	—	—	8,004,591
Total expenses	65,548,581	—	—	65,548,581
Change in net assets from operations, including depreciation	(6,414,648)	—	—	(6,414,648)
Other revenues, gains, and other support:				
Private contributions and grants	204,916	1,246,501	20,005,093	21,456,510
Endowment change after applying spending policy	26,176,791	24,531,205	—	50,707,996
Change in fair value of bond swap liability	200,773	—	—	200,773
Loss on sale of plant assets	(6,069)	—	—	(6,069)
Change in net assets	20,161,763	25,777,706	20,005,093	65,944,562
Net assets—beginning of year	364,283,394	147,257,386	182,410,786	693,951,566
Net assets—end of year	$ 384,445,157	173,035,092	202,415,879	759,896,128

See accompanying notes to financial statements.

	2015	2014
Cash flows from operating activities:		
Change in net assets	$ 42,533,118	65,944,562
Adjustments to reconcile change in net assets to net cash used in operating activities:		
Depreciation	4,684,153	5,126,046
Contributions restricted for endowment and plant	(27,324,031)	(28,872,055)
Net realized and unrealized gains	(55,034,872)	(90,373,231)
Change in fair value of bond swap liability	(143,516)	(200,773)
Loss on sale of plant assets	15,420	6,069
Amortization of debt issuance costs	52,145	54,801
Amortization of bond discount	20,627	21,919
Changes in assets/liabilities:		
Accounts receivable, grants receivable, and other assets	1,115,329	600,335
Contributions receivable	(3,226,839)	7,981,956
Beneficial interest in remainder trust	(70,546)	162,055
Accounts payable and accrued expenses	67,732	(28,579)
Deferred revenue	1,564,652	(1,570,403)
Postretirement benefit obligation	175,902	1,911,869
Asset retirement obligation	25,219	30,187
Net cash used in operating activities	(35,545,507)	(39,205,242)
Cash flows from investing activities:		
Proceeds from sale of plant assets	1,916,909	217,377
Purchase of plant assets	(7,434,326)	(13,126,997)
Proceeds from sale of investments	308,624,724	350,126,682
Purchase of investments	(289,329,967)	(326,664,421)
Net cash provided by investing activities	13,777,340	10,552,641
Cash flows from financing activities:		
Contributions restricted for endowment and plant	27,324,031	28,872,055
(Decrease) increase in liabilities under split-interest agreements	(211,060)	102,124
Principal payments on long-term debt	(2,440,000)	(2,415,000)
Principal payments on note payable	(71,753)	(70,340)
Decrease in funds held by bond trustee	(12,685)	(5,884)
Net cash provided by financing activities	24,588,533	26,482,955
Net increase (decrease) in cash and cash equivalents	2,820,366	(2,169,646)
Cash and cash equivalents—beginning of year	3,287,954	5,457,600
Cash and cash equivalents—end of year	$ 6,108,320	3,287,954
Supplemental data:		
Interest paid	$ 1,954,592	2,022,055

See accompanying notes to financial statements.

(1) Organization and Summary of Significant Accounting Policies

Organization

The Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation (the Institute), an independent, private institution devoted to the encouragement, support, and patronage of learning, was founded in 1930 as a community of scholars where intellectual inquiry could be carried out in the most favorable circumstances.

Focused on mathematics and classical studies at the outset, the Institute today consists of the School of Historical Studies, the School of Mathematics, the School of Natural Sciences and the School of Social Science. Each school has a small permanent faculty, and some 190 fellowships are awarded annually to members visiting the Institute from other research institutions and universities throughout the world.

The Founders' original letter to the first Trustees described the objectives of the Institute as follows: "The primary purpose is the pursuit of advanced learning and exploration in fields of pure science and high scholarship to the utmost degree that the facilities of the institution and the ability of the faculty and students will permit."

Summary of Significant Accounting Policies

Basis of Presentation

The accompanying financial statements, which are presented on the accrual basis of accounting, have been prepared to focus on the Institute as a whole and to present net assets and revenues, expenses, gains, and losses based on the existence or absence of donor-imposed restrictions. Accordingly, net assets and changes therein are classified as follows:

- Permanently restricted net assets—net assets subject to donor-imposed stipulations that they be maintained permanently by the Institute. Generally, the donors of these assets permit the Institute to use all or part of the income earned on related investments for general or specific purposes.

- Temporarily restricted net assets—net assets subject to donor-imposed stipulations that will be met by actions of the Institute and/or by the passage of time.

- Unrestricted net assets—net assets not subject to donor-imposed stipulations. Unrestricted net assets may be designated for specific purposes by action of the board of trustees.

Revenues are reported as increases in unrestricted net assets unless use of the related asset is limited by donor-imposed restrictions. Expenses are reported as decreases in unrestricted net assets. Expiration of donor-imposed stipulations that simultaneously increase unrestricted net assets and decrease temporarily restricted net assets are reported as net assets released from restrictions.

(a) Contributions and Grants

Contributions and grants, including unconditional promises to give, are recognized initially at fair value as revenues in the period received. Conditional promises to give are not recognized until they become unconditional, that is when the conditions on which they depend are substantially met. Contributions of assets other than cash are recorded at their estimated fair value. Pledges of contributions to be received after one year are discounted at a risk-adjusted discount rate. The discount rates range from 0.11% to 2.07%. Amortization of discount is recorded as additional contribution revenue in accordance with donor-imposed restrictions, if any, on the contributions. The inputs to the fair value estimate are considered Level 3 in the fair value hierarchy.

Contributions of long-lived assets are reported as unrestricted revenue. Contributions restricted for the acquisition of grounds, buildings, and equipment are reported as temporarily restricted revenues. These contributions are reclassi-fied to unrestricted net assets upon acquisition of the assets.

(b) Cash and Cash Equivalents

Cash and cash equivalents consist of cash on hand and all highly liquid investments with an original maturity of three months or less, except for those managed as a component of the Institute's investment portfolio.

(c)   *Investments*

Investments in marketable securities are reported in the financial statements at fair value based on published market quotations. Investments in limited partnerships and hedge funds are reported in the financial statements at estimated fair value using net asset value (NAV) or its equivalent as a practical expedient, based upon values provided by external investment managers or general partners, unless it is probable that all or a portion of the investment will be sold for an amount different from NAV. The Institute reviews and evaluates the values provided by external investment managers and general partners and agrees with the valuation methods and assumptions used in determining the fair value of funds. These estimated fair values may differ significantly from the values that would have been used had a ready market for these securities existed. As of June 30, 2015 and 2014, the Institute had no plans or intentions to sell investments at amounts different from NAV.

The statements of activities recognize unrealized gains and losses on investments as increases and decreases, respectively, in unrestricted net assets unless their use is temporarily or permanently restricted by explicit donor stipulation or law. Gains and losses on the sale of investment securities are calculated using the specific identification method.

The Institute regularly offers first mortgages on primary residences to full-time faculty and senior administrative employees who have met certain requirements stipulated by the board of trustees.

(d)   *Fair Value Measurements*

Fair value is defined as the exchange price that would be received for an asset or paid to transfer a liability (an exit price) in the principal or most advantageous market for the asset or liability in an orderly transaction between market participants on the measurement date. The fair value hierarchy requires an entity to maximize the use of observable inputs and minimize the use of unobservable inputs when measuring fair value. A financial instrument's level within the fair value hierarchy is based on the lowest level of any input that is significant to the fair value measurement. The three levels of inputs used to measure fair value are as follows:

- Level 1: Quoted prices in active markets for identical assets or liabilities.

- Level 2: Observable inputs other than Level 1 prices such as quoted prices for similar assets or liabilities; quoted prices in markets that are not active; or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities and certain alternative investments that can be redeemed at or near the statement of financial position date.

- Level 3: Unobservable inputs that are supported by little or no market activity and that are significant to the fair value of the asset or liabilities and certain alternative investments that are not redeemable in the near term.

Fair value estimates are made at a specific point in time, based on available market information and judgments about the financial asset, including estimates of timing, amount of expected future cash flows, and the credit standing of the issuer. In some cases, the fair value estimates cannot be substantiated by comparison to independent markets. In addition, the disclosed fair value may not be realized in the immediate settlement of the financial asset and does not reflect any premium or discount that could result from offering for sale at one time an entire holding of a particular financial asset. Potential taxes and other expenses that would be incurred in an actual sale or settlement are not reflected in amounts disclosed.

Because the net asset value reported by limited partnerships and hedge funds is used as a practical expedient to estimate fair value of the Institute's interest therein, classification of such investments in the fair value hierarchy as Level 2 or 3 is based on the Institute's ability to redeem its interest at or near the statement of financial position date. If the interest can be redeemed in the near term (generally within 90 days), the investment is classified as Level 2.

(e)   *Plant Assets and Depreciation*

Proceeds from the sale of plant assets, if unrestricted, are transferred to operating funds, or, if restricted, to amounts temporarily restricted for plant acquisitions. Depreciation is provided over the estimated useful lives of the respective assets on a straight-line basis (buildings and capital improvements 20–40 years, equipment 3–6 years).

(f)   *Deferred Revenue*

Amounts received on conditional grants are recorded initially as deferred revenue and are reported as revenues when expended in accordance with the terms of the condition.

(g)   *Split-Interest Agreements*

The Institute is the beneficiary of various unitrusts, pooled income funds and a gift annuity fund. The Institute's interest in these split-interest agreements is reported as a contribution in the year received and is calculated as the difference between the fair value of the assets contributed to the Institute and the estimated liability to the beneficiary.

This liability is computed using actuarially determined rates and is adjusted annually to reflect changes in the life expectancy of the donor or annuitant, amortization of the discount, and other changes in the estimates of future payments. The assets held by the Institute under these arrangements are recorded at fair value as determined by quoted market prices and are included as a component of investments.

(h)   *Unamortized Debt Issuance Costs*

Debt issuance costs represent costs incurred in connection with debt financing. Amortization of these costs is provided on the effective interest method extending over the remaining term of the applicable indebtedness. Debt issuance costs at June 30, 2015 and 2014 were net of accumulated amortization of $1,018,159 and $966,014, respectively.

(i)   *Other Revenues, Gains, and Other Support*

A portion of long-term investment income and gains and losses is allocated to operating revenue each year in accordance with the Institute's spending policy for investments held for endowment and similar purposes, as more fully discussed in note 4. All other investment income earned and gains and losses on investments held for long-term purposes, change in fair value of bond swap liability, and nonrecurring revenue and expenses are considered other revenues, gains and other support in the statements of activities. Private contributions and grants budgeted for operations are included in operating revenues, gains, and other support. All other private contributions and grants are considered other revenues, gains, and other support.

(j)   *Asset Retirement Obligation*

The Institute recognizes the fair value of a liability for legal obligations associated with asset retirements in the period in which the obligation is incurred, if a reasonable estimate of the fair value of the obligation can be made. When the liability is initially recorded, the Institute capitalizes the cost of the asset retirement obligation by increasing the carrying amount of the related long-lived asset. The liability is accreted to its present value each period and the capitalized cost associated with the retirement obligation is depreciated over the useful life of the related asset. Upon settlement of the obligation, any difference between the cost to settle the asset retirement obligation and the liability recorded is recognized as a gain or loss in the statements of activities.

(k)   *Fund Raising Expenses*

Fund raising expenses incurred by the Institute amounted to $1,919,089 and $1,955,984 for the years ended June 30, 2015 and 2014, respectively. This amount is included in administration and general expenses in the accompanying statements of activities.

(l)   *Functional Allocation of Expenses*

The costs of providing program services and support services of the Institute have been summarized on a functional basis in the statements of activities. Accordingly, certain operating costs have been allocated among the functional categories.

(m)   *Tax Status*

The Institute is exempt from federal income taxes pursuant to Section 501(c)(3) of the Internal Revenue Code (the Code) and is listed in the Internal Revenue Service Publication 78. The Institute has been classified as a public charity under Section 509(a) of the Code.

There are certain transactions that could be deemed unrelated business income and would result in a tax liability. Management reviews transactions to estimate potential tax liabilities using a threshold of more likely than not. It is management's estimation that there are no material tax liabilities that need to be recorded.

(n)   *Use of Estimates*

The preparation of financial statements in conformity with U.S. generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Estimates also affect the reported amounts of revenues and expenses during the reported period. Actual results could differ from those estimates.

(2) Contributions Receivable

Unconditional promises to give at June 30, 2015 and 2014 were as follows:

		2015	2014
Unconditional promises to give:			
Less than one year	$	9,879,564	7,955,522
One to five years		20,162,838	18,110,308
		30,042,402	26,065,830
Discount on promises to give		(1,535,642)	(785,909)
Total	$	28,506,760	25,279,921

At June 30, 2015, 88% of gross contributions receivable and 63% of contributions revenue are from four donors. At June 30, 2014, 97% of gross contributions receivable and 59% of contributions revenue are from four donors.

During fiscal 2011, the Institute received two conditional pledges totaling $100 million to enhance the Institute's endowment fund. The pledges are conditioned on the Institute raising an additional $100 million in cash or pledges from third-party donors in the period January 1, 2011 through June 30, 2015. The conditional pledge payments began in June 2011 and will continue through June 30, 2015. As of June 30, 2015 and 2014, the Institute has recorded revenue totaling approximately $72.5 million and $58 million, respectively, relating to these conditional pledges.

(3) Investments, Funds Held by Bond Trustee, and Beneficial Interest in Remainder Trust

(a) Overall Investment Objective

The overall investment objective of the Institute is to invest its assets in a prudent manner that will achieve a long-term rate of return sufficient to fund a portion of its annual operating activities and capital preservation. The Institute diversifies its investments among various managers and investment opportunities. Substantially all of the investments are pooled with each individual fund subscribing to or disposing of units on the basis of the market value per unit, determined on a quarterly basis. Major investment decisions are authorized by the Board's Investment Committee, which oversees the Institute's investment program in accordance with established guidelines.

(b) Allocation of Investment Strategies

In addition to traditional stocks and fixed-income securities, the Institute may also hold shares or units in traditional institutional funds as well as in alternative investment funds involving hedged strategies, private equity, and real asset strategies. Hedged strategies involve funds whose managers have the authority to invest in various asset classes at their discretion, including the ability to invest long and short. Funds with hedged strategies generally hold securities or other financial instruments for which a ready market exists and may include stocks, bonds, put or call options, swaps, currency hedges, and other instruments, and are valued accordingly. Private equity funds employ buyout and venture capital strategies and focus on investments in turn-around situations. Real asset funds generally hold interests in public real estate investment trusts (REITS) or commercial real estate through sole-member entities. Private equity and real asset strategies therefore often require the estimation of fair values by the fund managers in the absence of readily determinable market values. Because of the inherent uncertainties of valuation, these estimated fair values may differ significantly from values that would have been used had a ready market existed, and the differences could be material. Such valuations are determined by fund managers and generally consider variables such as operating results, comparable earnings multiples, projected cash flows, recent sales prices, and other pertinent information, and may reflect discounts for the illiquid nature of certain investments held.

The following tables summarize the Institute's investments and other assets at fair value by major category in the fair value hierarchy as of June 30, 2015 and 2014, as well as related strategy, liquidity, and funding commitments:

		June 30, 2015		
	Level 1	Level 2	Level 3	Total
Investments:				
Long-term investment strategies:				
Hedge funds—onshore:				
Emerging markets	$ —	—	1,508,662	1,508,662
Equities—long bias	—	8,485,482	—	8,485,482
Equities—long/short	—	5,721,238	—	5,721,238
Multiple strategies	—	—	59,487,770	59,487,770
Total	—	14,206,720	60,996,432	75,203,152
Hedge funds—offshore:				
Structured credit	—	—	12,756,659	12,756,659
Distressed/high-yield	—	—	8,280,232	8,280,232
Emerging markets	—	—	40,160	40,160
Equities—long bias	—	—	17,337,942	17,337,942
Equities—long/short	—	36,825,641	49,727,841	86,553,482
Event driven strategies	—	10,530,247	—	10,530,247
Fixed income arbitrage	—	—	9,693,180	9,693,180
Multiple strategies	—	119,455,692	132,213,964	251,669,656
Quantitative/CTA	—	28,628,451	—	28,628,451
Quantitative equity long short	—	11,972,947	—	11,972,947
Insurance	—	—	10,195,080	10,195,080
Bio tech/health care	—	11,506,856	—	11,506,856
Total	—	218,919,834	240,245,058	459,164,892
Limited partnerships	—	—	160,693,468	160,693,468
Cash and cash equivalents	68,141,954	—	—	68,141,954
Other investments:				
Assets held under split-interest agreements:				
Cash and cash equivalents	43,011	—	—	43,011
Fixed income securities	—	—	4,033,210	4,033,210
Mortgages from faculty and staff	—	—	6,743,716	6,743,716
Total investments	$ 68,184,965	233,126,554	472,711,884	774,023,403
Other assets:				
Beneficial interest in remainder trust	$ —	—	2,629,823	2,629,823
Funds held by bond trustee:				
U.S. government obligations	—	2,299,649	—	2,299,649
Total other assets	$ —	2,299,649	2,629,823	4,929,472

| | June 30, 2014 | | | |
	Level 1	Level 2	Level 3	Total
Investments:				
Long-term investment strategies:				
Hedge funds—onshore:				
Emerging markets	$ —	—	1,519,295	1,519,295
Equities—long bis	—	7,580,025	—	7,580,025
Equities—long/short	—	—	4,936,757	4,936,757
Multiple strategies	—	—	60,426,517	60,426,517
Total	—	7,580,025	66,882,569	74,462,594
Hedge funds—offshore:				
Commercial mortgage backed	—	—	8,259,150	8,259,150
Distressed/high-yield	—	—	9,563,493	9,563,493
Emerging markets	—	—	41,744	41,744
Equities—long bias	—	8,581,558	—	8,581,558
Equities—long/short	—	26,455,377	65,332,156	91,787,533
Event driven strategies	—	10,040,460	—	10,040,460
Fixed income arbitrage	—	—	28,624,392	28,624,392
Multiple strategies	—	98,082,924	120,709,432	218,792,356
Quantitative/CTA	—	7,378,670	—	7,378,670
Quantitative equity long short	—	16,663,265	—	16,663,265
Structured credit	—	—	12,370,566	12,370,566
Bio tech/health care	—	8,964,222	—	8,964,222
Total	—	176,166,476	244,900,933	421,067,409
Limited partnerships	—	—	152,438,300	152,438,300
Cash and cash equivalents	77,329,844	—	—	77,329,844
Other investments:				
Assets held under split-interest agreements:				
Cash and cash equivalents	—	—	(38,153)	(38,153)
Fixed income securities	—	—	4,393,952	4,393,952
Mortgages from faculty and staff	—	—	8,629,342	8,629,342
Total investments	$ 77,329,844	183,746,501	477,206,943	738,283,288
Other assets:				
Beneficial interest in remainder trust	$ —	—	2,559,277	2,559,277
Funds held by bond trustee:				
U.S. government obligations	—	2,286,964	—	2,286,964
Total other assets	$ —	2,286,964	2,559,277	4,846,241

The following tables present the Institute's activities for the years ended June 30, 2015 and 2014 for investments classified in Level 3:

2015

Level 3 roll forward	Hedge funds	Limited partnerships	Assets held under split-interest agreements Fixed income securities	Mortgages from faculty and staff	Beneficial interest in remainder trust	Total
Fair value at June 30, 2014	$ 311,783,502	152,438,300	4,355,799	8,629,342	2,559,277	479,766,220
Acquisitions	31,734,218	29,850,431	—	800,000	—	62,384,649
Dispositions	(38,326,203)	(44,997,012)	(307,167)	(2,685,626)	—	(86,316,008)
Transfers in/out of Level 3	(20,181,383)	—	—	—	—	(20,181,383)
Net realized and unrealized gains	16,231,356	23,401,749	(15,422)	—	70,546	39,688,229
Fair value at June 30, 2015	$ 301,241,490	160,693,468	4,033,210	6,743,716	2,629,823	475,341,707

2014

Level 3 roll forward	Hedge funds	Limited partnerships	Assets held under split-interest agreements Fixed income securities	Mortgages from faculty and staff	Beneficial interest in remainder trust	Total
Fair value at June 30, 2013	$ 315,527,317	117,080,539	4,077,332	8,787,133	2,721,332	448,193,653
Acquisitions	51,687,782	19,884,690	—	761,000	—	72,333,472
Dispositions	(79,732,383)	(20,656,601)	(376,571)	(918,791)	—	(101,684,346)
Transfers in/out of Level 3	(11,253,449)	—	—	—	—	(11,253,449)
Net realized and unrealized gains	35,554,235	36,129,672	655,038	—	(162,055)	72,176,890
Fair value at June 30, 2014	$ 311,783,502	152,438,300	4,355,799	8,629,342	2,559,277	479,766,220

The Institute's accounting policy is to recognize transfers between levels of the fair value hierarchy on the date of the event or change in circumstances that caused the transfer. There were no transfers between investments classified as Level 1 and Level 2 for the years ended June 30, 2015 or 2014. During fiscal year 2015, approximately $20 million was transferred from Level 3 to Level 2 due to expiration of lock-up restrictions. During fiscal year 2014, approximately $11 million was transferred into Level 3 from Level 2.

Private equity and venture capital investments are generally made through limited partnerships. Under the terms of such agreements, the Institute may be required to provide additional funding when capital or liquidity calls are made by fund managers. These partnerships have a limited existence, and they may provide for annual extensions for the purpose of disposing portfolio positions and returning capital to investors. However, depending on market conditions, the inability to execute the fund's strategy, or other factors, a manager may extend the terms of a fund beyond its originally anticipated existence or may wind the fund down prematurely. The Institute cannot anticipate such changes because they generally arise from unforeseeable events, but should they occur they could reduce liquidity or originally anticipated investment returns. Accordingly, the timing and amount of future capital or liquidity calls in any particular future year are uncertain. As of June 30, 2015, the Institute is obligated under certain limited partnership agreements to advance additional funding in the amount of $77,712,343, which is anticipated to be called over the next 10 years.

Investment liquidity as of June 30, 2015 is aggregated below based on redemption or sale period:

	Investment fair values
Investment redemption or sale period:	
Daily	$ 68,141,954
Monthly	84,568,915
Quarterly	126,418,768
Semi-annually	22,138,871
Annually	99,490,361
Subject to rolling lock ups or other restrictions	190,668,525
Illiquid	182,596,009
Total as of June 30, 2015	$ 774,023,403

(c) Funds Held by Bond Trustee

Funds held by bond trustee represent the balance of the proceeds from the 2006 and 2008 New Jersey Educational Facilities Authority (NJEFA or the Authority) bonds and the 2012 taxable bonds that have not yet been expended for construction purposes or debt service payments. These funds are being held in trust by The Bank of New York. Such funds are invested in U.S. government obligations with maturities of less than one year.

(d) Redemption Restrictions—Hedge Funds

At June 30, 2015, the Institute had hedge fund investments of approximately $534,368,000, of which approximately $66,374,600 was restricted from redemption for lock-up periods. At June 30, 2014, the Institute had hedge fund investments of approximately $495,530,000, of which approximately $124,207,000 was restricted from redemption for lock-up periods. Some of the investments with redemption restrictions allow early redemption for specified fees. The terms and conditions upon which an investor may redeem an investment vary, usually with the majority requiring 30 to 180 days' notice after the initial lock-up period.

The expirations of redemption lock-up periods are summarized in the table below:

	Amount
Fiscal year:	
2015	$ 37,401,206
2016	17,890,826
2017 and thereafter	11,082,602
Total	$ 66,374,634

(e) Redemption Restrictions—Limited Partnerships

At June 30, 2015 and 2014, the Institute had limited partnership investments of approximately $160,693,500 and $152,438,300, respectively, which were restricted from redemption for lock-up periods. Some of the investments with redemption restrictions allow early redemption for specified fees. The terms and conditions upon which an investor may redeem an investment vary, usually with the majority requiring 30 to 180 days' notice after the initial lock-up period.

The expirations of redemption lock-up periods are summarized in the table below:

	Amount
Fiscal year:	
2016	$ 11,712,755
2017	8,697,500
2018	43,976,191
2019	6,469,441
2020	4,897,810
2021 and thereafter	84,939,770
Total	$ 160,693,467

(f)   Contingencies

The Institute has an investment in the Ariel Fund Limited (the Fund), which on June 30, 2015 and 2014 had a fair value of approximately $6,917,200 and $8,053,900, respectively. During fiscal year 2009, the fund became subject to the oversight of a receiver appointed by the Attorney General of New York for the principal purposes of marshalling and preserving the assets of the Fund, for ultimate distribution of the proceeds to the respective investors of the Fund. During fiscal years 2015 and 2014, the Institute received distributions of $2,026,385 and $1,592,159, respectively, from the receiver. There is a potential for litigation to recover amounts from investors who have received previous distributions from the Fund. Management does not expect this to have a significant impact on the Institute's financial statements.

(4)   Investment Return and Endowment Spending Policy

Investment return consists of interest, dividends, and realized and unrealized gains and losses on investments. Each year, the Institute includes a portion of its endowment return in its operating budget, with the amount of such planned support determined using its spending policy. The policy of the Institute is to distribute for current spending a percentage of the fair value of pooled investments which is determined by the Board of Trustees annually. The spending rate for operating and capital purposes was 6.8% and 6.9% for 2015 and 2014, respectively.

The following tables summarize the investment return and its classification in the statements of activities for the years ended June 30, 2015 and 2014:

	2015		
	Unrestricted	Temporarily restricted	Total
Dividends and interest, net of investment expenses	$ (982,458)	(1,051,075)	(2,033,533)
Net realized and unrealized gains	27,976,743	27,058,129	55,034,872
Total investment return	26,994,285	26,007,054	53,001,339
Endowment spending policy for use in operations	22,457,949	16,862,951	39,320,900
Endowment change after applying spending policy	$ 4,536,336	9,144,103	13,680,439

	2014		
	Unrestricted	Temporarily restricted	Total
Dividends and interest, net of investment expenses	$ (1,003,764)	(1,337,971)	(2,341,735)
Net realized and unrealized gains	47,853,748	42,519,483	90,373,231
Total investment return	46,849,984	41,181,512	88,031,496
Endowment spending policy for use in operations	20,673,193	16,650,307	37,323,500
Endowment change after applying spending policy	$ 26,176,791	24,531,205	50,707,996

Total investment management and advisory fees were $2,390,633 and $2,147,159 for the years ended June 30, 2015 and 2014, respectively.

(5) Endowment

The Institute's endowment consists of approximately 100 individual funds established for a variety of purposes including both donor-restricted endowment funds and funds designated by the Board of Trustees to function as endowments. Net assets associated with endowments, including funds designated by the Board of Trustees to function as endowments, are classified and reported based on the existence or absence of donor-imposed restrictions.

(a) Interpretation of Relevant Law

The Institute has interpreted the New Jersey-enacted version of the Uniform Prudent Management of Institutional Funds Act (UPMIFA) as allowing the Institute to appropriate for expenditure or accumulate so much of a donor-restricted endowment fund as the Institute determines is prudent for the uses, benefits, purposes, and duration for which the endowment fund is established, subject to the intent of the donor as expressed in the gift instrument. Unless stated otherwise in the gift instrument, the assets in a donor-restricted endowment fund are donor-restricted assets until appropriated for expenditure by the Board of Trustees of the Institute. As a result of applicable accounting guidance, the Institute classifies as permanently restricted net assets (a) the original value of gifts donated to the permanent endowment, (b) the original value of subsequent gifts to the permanent endowment, and (c) accumulations to the permanent endowment made in accordance with the direction of the applicable donor gift instrument at the time the accumulation is added to the fund. The remaining portion of the donor-restricted endowment fund that is not classified as permanently restricted net assets is classified as temporarily restricted net assets until those amounts are appropriated for expenditure in a manner consistent with the standard of prudence prescribed by UPMIFA.

From time to time, the fair value of assets associated with individual donor-restricted endowments may fall below the original corpus the fund included in permanently restricted net assets due to unfavorable market fluctuations subsequent to the investment of the gift. Deficiencies of this nature, which are reported in unrestricted net assets, totaled approximately $1,895,000 and $1,968,000, at June 30, 2015 and 2014, respectively. Subsequent gains that restore the fair value of the assets of the donor-restricted endowment fund are classified as an increase in unrestricted net assets.

Endowment net assets consisted of the following at June 30, 2015 and 2014:

		2015		
	Unrestricted	Temporarily restricted	Permanently restricted	Total
Donor restricted	$ (1,895,141)	182,062,449	232,692,973	412,860,281
Board designated	373,545,516	—	—	373,545,516
	$ 371,650,375	182,062,449	232,692,973	786,405,797

		2014		
	Unrestricted	Temporarily restricted	Permanently restricted	Total
Donor restricted	$ (1,968,353)	172,496,180	202,415,879	372,943,706
Board designated	368,315,514	—	—	368,315,514
	$ 366,347,161	172,496,180	202,415,879	741,259,220

Changes in endowment net assets for the fiscal years ended June 30, 2015 and 2014 were as follows:

		Unrestricted	Temporarily restricted	Permanently restricted	Total
Net assets, June 30, 2013	$	353,426,513	146,712,480	182,410,786	682,549,779
Dividends and interest income, net		(1,003,764)	(911,309)	—	(1,915,073)
Realized and unrealized gains		47,853,748	42,098,815	—	89,952,563
Contributions		243,528	1,246,501	20,005,093	21,495,122
Appropriation for expenditure— operations		(20,673,193)	(16,650,307)	—	(37,323,500)
Appropriation for expenditure— capital and other		(13,499,671)	—	—	(13,499,671)
Net assets, June 30, 2014	$	366,347,161	172,496,180	202,415,879	741,259,220
Dividends and interest income, net		(982,458)	(989,771)	—	(1,972,229)
Realized and unrealized gains		27,976,743	26,994,796	—	54,971,539
Contributions		880,715	424,196	30,277,094	31,582,005
Appropriation for expenditure— operations		(22,458,009)	(16,862,952)	—	(39,320,961)
Appropriation for expenditure— capital and other		(113,777)	—	—	(113,777)
Net assets, June 30, 2015	$	371,650,375	182,062,449	232,692,973	786,405,797

(b) *Return Objectives and Risk Parameters*

The Institute has adopted investment and spending policies for endowment assets that attempt to provide a predictable stream of funding to programs supported by its endowment while seeking to maintain the purchasing power of the endowment assets.

(c) *Strategies Employed for Achieving Objectives*

The Institute manages its investments in accordance with a total return concept and the goal of maximizing returns within acceptable levels of risk. The Institute relies on a total return strategy in which investment returns are achieved through both capital appreciation (realized and unrealized) and current yield (dividends and interest). The Institute's spending policy is designed to provide a stable level of financial support and to preserve the real value of its endowment.

(6) Physical Plant

Physical plant and equipment are stated at cost at date of acquisition, less accumulated depreciation.

A summary of plant assets at June 30, 2015 and 2014 follows:

		2015	2014
Land	$	377,470	377,470
Land improvements		2,360,368	2,187,449
Buildings and improvements		126,342,840	122,142,553
Equipment		33,552,683	32,485,104
Rare book collection		203,508	203,508
Joint ownership property		4,487,887	4,528,124
		167,324,756	161,924,208
Accumulated depreciation		(84,232,477)	(79,649,773)
Net book value	$	83,092,279	82,274,435

(7) Long-Term Debt

A summary of long-term debt at June 30, 2015 and 2014 follows:

	2015	2014
2006 Series B—NJEFA	$ 24,500,000	25,500,000
2006 Series C—NJEFA	16,500,000	17,000,000
2008 Series C—NJEFA	3,910,000	4,455,000
2012 Taxable	16,530,000	16,925,000
Less unamortized bond discount	(202,420)	(223,047)
Total long-term debt	$ 61,237,580	63,656,953

Interest expense on long-term debt for the years ended June 30, 2015 and 2014 was $1,916,444 and $1,774,657, respectively.

(a) 2006 Series B

In July 2006, the Institute received proceeds of the Authority offering of $29,600,000 Revenue Bonds, 2006 Series B of the Institute for Advanced Study Issue. The 2006 Series B Bonds were issued to finance the advance refunding of the outstanding 1997 Series G Bonds, the partial advance refunding of the 2001 Series A Bonds, and to pay a portion of certain costs incidental to the sale and issuance of the 2006 Series B Bonds.

(b) 2006 Series C

In March 2007, the Institute received proceeds of the Authority offering of $20,000,000 Revenue Bonds, 2006 Series C of the Institute for Advanced Study Issue. Proceeds are being used to finance the costs of construction, renovating and equipping certain educational facilities of the Institute, to fund capitalized interest on the 2006 Series C Bonds during the renovation and construction, and to pay certain costs incidental to the sale and issuance of the 2006 Series C Bonds.

(c) 2008 Series C

In March 2008, the Institute received proceeds of the Authority offering of $11,255,000 Revenue Bonds, 2008 Series C of the Institute for Advanced Study Issue. The 2008 Series C Bonds were issued to finance the advance refunding of outstanding 1997 Series F Bonds, the advance refunding of outstanding 1997 Series G, and to pay a portion of certain costs incidental to the sale and issuance of the 2008 Series C Bonds.

(d) 2012 Taxable

In December 2012, the Institute received proceeds of $17,320,000 Taxable Bonds, 2012 Series of the Institute for Advanced Study Issue, which were issued at a discount of approximately $92,000. The 2012 Taxable Bonds were used to finance the advance refunding of outstanding 2001 Series A Bonds, to fund renovations to the Members Housing facility and the costs of renovation and equipping certain educational facilities of the Institute, and to pay certain costs incidental to the sale and issuance of the 2012 Taxable Bonds.

(e) Interest Rates

The 2006 Series B and C Bonds bear interest at variable rates. The bonds were issued in the weekly mode with weekly rates determined by Lehman Brothers Inc, as Remarketing Agent and paid monthly. The maximum interest rate on the 2006 Bonds shall be twelve percent (12%) per annum. The 2006 bonds are subject to redemption at various prices and require principal payments and sinking fund installments through July 1, 2036. The obligation to pay the Authority on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation of the Institute. On September 18, 2008, the Institute entered into a contract with JPMorgan Chase Bank to take over as Remarketing Agent, replacing Lehman Brothers Inc.

The 2008 Series C Bonds bear interest at rates ranging from 3% to 5% per annum, payable semi-annually, are subject to redemption at various prices and require principal payments and sinking fund installments through July 1, 2021. The obligation to pay the Authority on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation of the Institute.

The 2012 Taxable bonds bear interest at rates ranging from 0.388% to 3.892% per annum, payable semi-annually, are subject to redemption at various prices and require principal payments and sinking fund installments through December 1, 2042. The obligation to make the interest payments on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation to the Institute.

(f)   *Bond Swap Agreement*

On December 22, 2008, the Institute entered into a swap agreement with Wells Fargo Bank covering $28,800,000 of outstanding Series B Bonds that required the Institute to pay a fixed rate of 3.7702% to Wells Fargo Bank in exchange for Wells Fargo Bank agreeing to pay the Institute a variable rate equal to 67% of the USD–LIBOR–BBA rate with a term of three months, payable monthly, on an identical notional amount. The effective date of the swap was December 22, 2008 and the termination date of the swap agreement coincides with the maturity of the bonds, which is July 1, 2031.

The Institute entered into this swap agreement with the intention of lowering its effective interest rate. At June 30, 2015 and 2014, the fair value of the interest rate swap was ($4,131,660) and ($4,275,176), respectively. The unrealized gain recognized during the year ended June 30, 2015 and 2014 in the amount of $143,516 and $200,773 respectively, is reported in the statements of activities in change in fair value of bond swap liability. The swap agreement utilizes Level 2 inputs to measure fair value. The fair value of the interest rate swap was determined using pricing models developed based on the LIBOR swap rate and other market data. Under the swap agreement, the Institute may be required to post collateral to the counterparty if certain triggering events (rates and dollar thresholds) are met. As of June 30, 2015 and 2014, there was no requirement to post collateral imposed by the swap counterparty.

The bonds are repayable as follows at June 30, 2015:

	Amount
Year ending June 30:	
2016	$ 2,575,000
2017	2,605,000
2018	2,845,000
2019	3,280,000
2020	3,415,000
2021 through 2043	46,720,000
Total	$ 61,440,000

The 2006 Series B, 2006 Series C, and 2008 Series C bonds are secured by a pledge of revenues pursuant to the respective Loan Agreements.

(g)   *Lines of Credit*

As of June 30, 2015 and 2014, the Institute had unsecured loan agreements representing a line of credit. As of June 30, 2015 and 2014, the agreements provide for borrowings up to $50,000,000 and are available through April 2016. Interest payments are due on demand and interest accrues at the LIBOR rate plus 90 basis points, which was 1.67% as of June 30, 2015. There were no borrowings in fiscal year 2015 or 2014 against the lines of credit. No interest expense was incurred for the years ended June 30, 2015 and 2014.

(8)   Pension Plans and Other Postretirement Benefits

Separate voluntary defined contribution retirement plans are in effect for faculty members and eligible staff personnel, both of which provide for annuities, which are funded, to the Teachers Insurance and Annuity Association and/or the College Retirement Equities Fund. Contributions are based on the individual participant's compensation in accordance with the formula set forth in the plan documents on a nondiscriminatory basis. Contributions for the years ended June 30, 2015 and 2014 totaled approximately $2,251,400 and $2,318,400, respectively.

In addition to providing pension benefits, the Institute provides certain health care and life insurance benefits for retired employees and faculty. Substantially, all of the Institute's employees may become eligible for these benefits if they meet minimum age and service requirements. The Institute accrues these benefits over a period in which active employees become eligible under existing benefit plans.

The following table provides a reconciliation of the change in benefit obligation of the plan at June 30, 2015 and 2014. There are no plan assets at June 30, 2015 and 2014.

		2015	2014
Postretirement benefit obligation:			
Retirees	$	5,273,118	4,976,817
Fully eligible active plan participants		1,644,181	1,911,518
Other active plan participants		8,345,564	8,198,626
Postretirement benefit obligation	$	15,262,863	15,086,961
Change in benefit obligation:			
Benefit obligation at beginning of year	$	15,086,961	13,175,092
Service cost		774,586	615,504
Interest cost		647,226	624,254
Benefits paid		(356,662)	(352,809)
Actuarial (gain) loss		(889,248)	1,024,920
Benefit obligation at end of year	$	15,262,863	15,086,961
Components of net periodic benefit cost:			
Service cost	$	774,586	615,504
Interest cost		647,226	624,254
Amortization of net (gain) loss		(889,248)	1,024,920
Net periodic postretirement benefit cost	$	532,564	2,264,678

	2015	2014
Benefit obligation weighted average assumptions at June 30, 2015 and 2014:		
Discount rate	4.46%	4.35%
Periodic benefit cost weighted average assumptions for the years ended June 30, 2015 and 2014:		
Discount rate	4.35%	4.81%

The healthcare trend rate is assumed to be 7.5% in fiscal 2015, trending up to an ultimate rate of 5% in 2026 and thereafter.

The effects of a 1% increase or decrease in trend rates on total service and interest cost and the postretirement benefit obligation are as follows:

		2015		2014	
		Increase	Decrease	Increase	Decrease
Effect on total service and interest cost	$	478,350	(316,756)	383,514	(255,447)
Effect on the postretirement benefit obligation		3,862,157	(2,649,492)	3,834,620	(2,625,796)

Projected payments for each of the next five fiscal years and thereafter through 2023 are as follows:

	Amount
Year ending June 30:	
2016	$ 434,000
2017	452,000
2018	468,000
2019	480,000
2020	495,000
2021 through 2025	2,902,000

The Institute funds claims as they are incurred. The Institute does not expect to contribute any amounts in fiscal 2015, except as needed to provide for benefit payments.

(9) Temporarily and Permanently Restricted Assets

Restricted net assets are available for the following purposes at June 30, 2015 and 2014:

	2015	2014
Temporarily restricted net assets are restricted to:		
School of Mathematics	$ 34,269,453	34,256,552
School of Natural Sciences	19,045,637	17,484,612
School of Historical Studies	41,068,809	40,181,870
School of Social Science	61,224,425	59,936,776
Libraries and other academic	6,612,801	5,848,752
Administration and general	20,482,266	15,326,530
	$ 182,703,391	173,035,092
Permanently restricted net assets are restricted to:		
Investments to be held in perpetuity, the income from which is expendable to support academic services	$ 232,692,973	202,415,879

(10) Disclosures About Fair Value of Financial Instruments

The carrying amount of the Institute's financial instruments not carried at fair value approximates fair value due to the short maturity, except for long-term indebtedness. The inputs fall within Level 3 of the fair value hierarchy. The estimated fair value of the Institute's long-term indebtedness, based on the discounted future cash payments to be made using observable inputs that fall within Level 2 of the fair value hierarchy, was approximately $67,043,000 and $67,700,000 at June 30, 2015 and 2014, respectively.

(11) Subsequent Events

The Institute evaluated events subsequent to June 30, 2015 through October 30, 2015, the date on which the financial statements were issued and determined there were no subsequent events required to be disclosed.

INSTITUTE FOR ADVANCED STUDY
EINSTEIN DRIVE
PRINCETON, NEW JERSEY 08540
(609) 734-8000
www.ias.edu