IAS

Institute for Advanced Study

Report for the Academic Year 2012–2013

It is fundamental in our purpose, and our express desire, that in the appointments to the staff and faculty as well as in the admission of workers and students, no account shall be taken, directly or indirectly, of race, religion, or sex. We feel strongly that the spirit characteristic of America at its noblest, above all the pursuit of higher learning, cannot admit of any conditions as to personnel other than those designed to promote the objects for which this institution is established, and particularly with no regard whatever to accidents of race, creed, or sex.

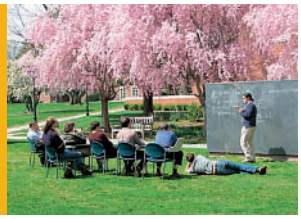
Extract from the letter addressed by the Institute's Founders, Louis Bamberger and Caroline Bamberger Fuld, to the first Board of Trustees, dated June 4, 1930

Newark, New Jersey

Cover: Lunchtime at the Institute in Simons Hall
Photo: Dan Komoda

The Institute for Advanced Study exists to encourage and support curiosity-driven research in the sciences and humanities—the original, often speculative thinking that produces advances in knowledge that change the way we understand the world.

THE SCHOOL OF HISTORICAL STUDIES, established in 1949 with the merging of the School of Economics and Politics and the School of Humanistic Studies, is concerned principally with the history of Western European, Near Eastern, and East Asian civilizations. The School actively promotes interdisciplinary research and cross-fertilization of ideas.



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. The School sponsors, jointly with Princeton University, the Program for Women and Mathematics.

THE SCHOOL OF NATURAL SCIENCES, established in 1966, supports research in broad areas of theoretical physics, astronomy, and systems biology. Areas of current interest include elementary particle physics, string theory, quantum theory, and quantum gravity; investigating the origin and composition of the universe; and conducting research at the interface of molecular biology and the physical sciences. The School sponsors Prospects in Theoretical Physics, a program for graduate students and postdoctoral scholars.

THE SCHOOL OF SOCIAL SCIENCE, founded in 1973, takes as its mission the analysis of societies and social change and is devoted to a multidisciplinary, comparative, and international approach to social research and the examination of historical and contemporary problems.

SPECIAL PROGRAMS include the Program in Interdisciplinary Studies, which explores different ways of viewing the world; the Artist-in-Residence Program; Director's Visitors; the IAS/Park City Mathematics Institute, which aims to increase awareness of the roles of professionals in all mathematics-based occupations; and the Science Initiative Group, dedicated to building science capacity in the developing world.

IAS

Institute for Advanced Study

Contents

CLIFF COMPTON

The campus of the Institute for Advanced Study provides a tranquil environment for scholars engaged in theoretical research and intellectual inquiry.

Background and Purpose

The Institute for Advanced Study was founded in 1930 with a major gift from New Jersey businessman and philanthropist Louis Bamberger and his sister Caroline Bamberger Fuld, who wished to use their fortunes to make a significant and lasting contribution to society. They sought the advice of educator Abraham Flexner, who developed the concept of the Institute as a community of scholars whose primary purpose would be the pursuit of advanced learning and scholarly exploration. The Institute for Advanced Study has remained committed to its founding principles, and its record of definitive scholarship and scientific achievement is unsurpassed.

The Institute fills a unique role in postgraduate education and scientific and scholarly research. As "the university to universities," in the words of Trustee Vartan Gregorian, the Institute serves all colleges and universities by providing a place where scholars can hone their skills and do their best work, thereby adding substantially to their ability to contribute as both teachers and scholars to the academic institutions where they base their careers. For young scholars just entering the academic world, an opportunity to work at the Institute can set the direction for lifelong research interests and thereby determine professional careers. The Institute provides more mature scholars with the opportunity to take new directions in their research or to complete a major piece of work away from the many obligations of working life at a university. At a time when pure research and scholarly activities are undervalued, the opportunities that the Institute provides have never been more necessary. The Institute's foremost objective is the advancement of knowledge and the deepening of understanding across a broad range of the humanities, sciences, and social sciences.

The Institute's foremost objective is the advancement of knowledge and the deepening of understanding across a broad range of the humanities, sciences, and social sciences.

One of the Institute's unique strengths is its permanent Faculty of no more than twenty-eight eminent scholars, whose broad interests and extensive ties to the larger academic world are reflected in their own work and also in the guidance and direction they provide to the Institute's visiting scholars.

The Faculty defines the major themes and questions that become the focus of each School's seminars and other activities, and selects and works closely with visiting Members. Organized in four Schools (Historical Studies, Mathematics, Natural Sciences, and Social Science), the Faculty and Members interact with one another without any departmental or disciplinary barriers.

Each year the Institute awards fellowships to some 190 visiting Members from about one hundred universities and research institutions throughout the world. The Institute's more than six thousand former Members hold positions of intellectual and scientific leadership in the United States and abroad. Some thirty-three Nobel Laureates and thirty-eight out of fifty-two Fields Medalists, as well as many winners of the Wolf and MacArthur prizes, have been affiliated with the Institute. The Institute does not receive income from tuition or fees; resources for operations come from endowment income, grants from private foundations and government agencies, and gifts from corporations and individuals.

Report of the Chairman

The Board of Trustees is honored and delighted that Robbert Dijkgraaf has joined the Institute for Advanced Study as its ninth Director and first Leon Levy Professor. Last summer, we were truly fortunate to welcome Robbert, his wife Pia, and their family to the Institute.

Robbert is a dynamic, creative, and forward-thinking leader who understands intimately the mission of the Institute and has an innate talent for elucidating the value of theoretical research. A mathematical physicist who has made significant contributions to string theory and the advancement of science education, he is admired as a scientist, administrator, communicator, and advocate. He is a worthy successor to Peter Goddard, who provided such astute leadership as Director of the Institute for nearly a decade and who is now a Professor in the School of Natural Sciences. We look forward to the many ways that Robbert will continue the brilliant tradition of directorships since the founding of the Institute in 1930.

The ability of the Institute to provide scholars with the freedom to pursue curiosity-driven research in the sciences and humanities depends crucially on our financial independence. We are immensely grateful for the generous gifts from Faculty, Trustees, Friends, Members and Visitors, foundations, and other supporters of the Institute's work. As of June 30, 2013, more than $64 million had been raised toward the $100 million unrestricted challenge grant from the Simons Foundation and the Charles and Lisa Simonyi Fund for Arts and Sciences, announced in 2011. The grant, which must be matched by funds from donors by 2015, serves as the basis for a $200 million campaign to support academic freedom at the Institute. All irrevocable gifts and grants of endowment or operating support are counted toward the campaign goal and the Simons and Simonyi challenge.

CLIFF MOORE

We are particularly thankful to Robert and Luisa Fernholz who have generously endowed a Professorship in the Institute's School of Mathematics. The first Robert and Luisa Fernholz Professor is Richard Taylor, one of the world's leading number theorists who has been a Professor at the Institute since 2012. A Trustee of the Institute since 2010, Robert Fernholz is Founder and Chairman of the Investment Committee of INTECH Investment Management, and Luisa Fernholz is Professor Emerita of Statistics at Temple University. Luisa currently serves as Director of the Minerva Research Foundation, which the couple founded in 1993.

During the last academic year, the Board was very pleased to welcome Jeffrey A. Harvey, Enrico Fermi Distinguished Service Professor at the University of Chicago, to the Board of Trustees, effective July 1, 2013. Harvey was nominated by the Institute's School of Natural Sciences and succeeds Curtis Callan, James S. McDonnell Distinguished University Professor of Physics at Princeton University, whose five-year term for the School broadened our viewpoint and deepened our purpose.

In May, we also celebrated Vartan Gregorian, who was elected Trustee Emeritus after twenty-six years of extraordinary service. Vartan first joined the Board in 1987, the same year that Marvin L. Goldberger became the Institute's sixth Director. During his tenure, Vartan was instrumental in identifying and securing each subsequent Director: Phillip Griffiths, Peter Goddard, and Robbert Dijkgraaf. During the Institute's most recent search, which led to Robbert's appointment, Vartan provided inestimable leadership as Chairman of the Search Committee. The Board is indebted to Vartan, whose deep understanding of the Institute, unfaltering dedication to excellence, and deep concern for humanity has enriched the Institute immeasurably.

We were deeply saddened by Ike Kohn's death in March. Ike was a Trustee from 1997 to 2006 after which he served as Trustee Emeritus. While Ike served on the Board for more than a decade, his connections with the Institute stretched back more than half a century to 1948 when his father, Hans Kohn, was a Member in the School of Historical Studies. Ike and his wife Vera have been longtime Friends of the Institute, since 1981, and are among our most generous individual benefactors.

Abraham Flexner, our founding Director, believed that curiosity is the outstanding characteristic of modern thinking, going back to Galileo, Francis Bacon, and Isaac Newton. The Institute exists to support unrestricted curiosity into the unknown, believing that the cultivation of curiosity benefits not only the advancement of knowledge but also human welfare. It is our privilege and obligation to provide scientists and scholars with this increasingly rare opportunity.

Charles Simonyi
Chairman

Report of the Director

Taking up my appointment as the ninth Director of the Institute last summer felt profoundly humbling but also a bit like coming home. The warmness of the welcome that my family and I have felt has surpassed our highest expectations.

My first visit to the Institute was as a graduate student in 1988. I still remember driving at night along Olden Lane and seeing Fuld Hall fully lit from a distance. I felt like I was entering a new world. When I came to the Institute as a Member (1991–92) and a Visitor (2002) in the School of Natural Sciences, I learned that the Institute is indeed a magical place. Looking back, the Institute years clearly set the course for my career, both in terms of research topics and contacts. This formative period also made me, as a physicist, appreciate the power and attractiveness of mathematics.

At the Institute, "it" can happen, although nobody will or can tell you in advance what "it" is. Unfortunately, places that allow such unrestricted academic freedom are becoming more rare, with so much emphasis today on short-term returns. Our Trustees must be complimented that they have kept this clear vision intact over the years.

As envisioned by our founders in 1930, the Institute brings together scholars of the highest level and serves as an example across the world for the importance of supporting curiosity-driven research. J. Robert Oppenheimer, our third Director, liked to use the word "inspiriting," which aptly describes the Institute's distinct environment of curiosity, freedom, and comradeship.

ANDREA KANE

A great moment during my first year as Director took place in July when four of our Faculty in the School of Natural Sciences—Nima Arkani-Hamed, Juan Maldacena, Nathan Seiberg, and Edward Witten—received the inaugural Fundamental Physics Prize of the Milner Foundation for their significant and path-breaking contributions to fundamental physics. The prizes are well-deserved recognition of the power of visionary ideas by daring individuals, and of the current strength and excellent future prospects of research in theoretical physics at the IAS.

In May, King Harald V of Norway presented the Abel Prize of the Norwegian Academy of Science and Letters to Pierre Deligne, Professor Emeritus in the School of Mathematics, for his "seminal contributions to algebraic geometry and for their transformative impact on number theory, representation theory, and related fields." In his acceptance speech, Pierre articulated the essential role of freedom and curiosity in research—as the source of most of the important applications of sciences and as a powerful incentive to do the best work possible. The Institute is exceptionally grateful to Pierre, who donated a portion of his monetary prize to support research in the Institute's School of Mathematics.

In the School of Social Science, we were immensely pleased to announce the appointment of Dani Rodrik, a political economist whose work combines rigorous research with an innovative examination of ideas across the field of economics, as the Albert O. Hirschman Professor, with effect from July 1, 2013. Dani comes to the Institute from Harvard University, where he was Rafiq Hariri Professor of International Political Economy at the John F. Kennedy School of Government. In December, we were deeply saddened by the death of Albert Hirschman, a founder of the Institute's School of Social Science and Professor Emeritus, whose highly influential work in economics and politics has had profound impact on economic thought and practice in the United States and beyond. An impassioned observer who sought to understand the world as well as change it, Albert will be sorely missed.

The Institute community has benefited greatly from the musical presence and inquisitive nature of Derek Bermel, who served as the Institute's Artist-in-Residence from 2009–13. In 2013–14, Sebastian Currier will serve as Artist-in-Residence, continuing a tradition that dates to the program's origins in 1994.

I am especially thankful to Peter Goddard, my predecessor, who worked as hard to honor the history and ideals of the Institute as he did to aid the aims of his successors. Our founders and subsequent benefactors—Trustees, Faculty, Members and Visitors, Friends, foundations, and other supporters—must also be congratulated for enabling the precious freedom that Faculty and Members at the Institute experience. Fundamental research at the Institute furthers our grasp of a world of diverse facts, structures, ideas, and cultures. We share the conviction of our founders that such limitless deep thinking will change this world, but where and how is always a surprise.

Robbert Dijkgraaf
Director and Leon Levy Professor

ANDREA KANE

Professor Patrick Geary (left) with Ittai Weinryb, Member in the School of Historical Studies, and Jessica Golberg (right), Member in the School of Social Science and Member (2009–10) in the School of Historical Studies, outside of Fuld Hall

School of Historical Studies

Faculty

Yve-Alain Bois

Angelos Chaniotis

Patricia Crone, Andrew W. Mellon Professor

Nicola Di Cosmo, Luce Foundation Professor in East Asian Studies

Patrick J. Geary

Jonathan Israel

Professors Emeriti

Glen W. Bowersock

Caroline Walker Bynum

Giles Constable

Christian Habicht

Irving Lavin

Peter Paret

Heinrich von Staden

Morton White

The School of Historical Studies is concerned principally with the history of Western European, Near Eastern, and East Asian civilizations. Both inside and outside these broad areas of study, Faculty and Members have pursued a wide range of topics. The emphasis has been traditionally on Greek and Roman civilization; medieval, early modern, and modern European history; the history of art; and the history of science, but over time the School's interests have been expanded to include Islamic culture, the history of China and Japan, modern international relations, and more recently, music studies. Over two thousand scholars have come to the School since its founding, and their work in these and other areas of research regularly has been enriched by the fruitful interaction of disciplines in a small and collegial community.

The School's broad interpretation of the meaning of "Historical Studies" continued to be reflected in the research projects pursued by the fifty-one Members and three Visitors who joined the School for the academic year 2012–13. Societies as diverse as the Chosun Kingdom of Korea, El Salvador in the late twentieth century, ancient Greece, and modern Mongolia were the focus of projects that examined a broad spectrum of the human experience, from religion, philosophy, art, and music, to terrorism, politics, and the scientific revolution. The periods studied ranged from as far back as the fourth millennium B.C.E. to the late twentieth century. The scholars themselves came from universities throughout the United States and Europe, and from as far away as Mongolia and Hong Kong. Members received support both from the Institute's own funds and from a variety of external sources, including the National Endowment for the Humanities, the Andrew W. Mellon Foundation, the Gerda Henkel Stiftung, and the Gladys Krieble Delmas Foundation.

Beyond the individual research projects pursued, many events drew groups of scholars together for lectures and discussions that facilitated the exchange of ideas across fields and regions. These included a regular series of presentations by individual Members to the School as a whole at the Monday Lunchtime Colloquia, as well as

AMY RAMSEY

Visiting Professor Michael van Walt van Praag gave a public lecture on how to address the multiple realities in intrastate conflicts (video available at http://video.ias.edu/van-Walt-lecture-3-13).

invited lectures, seminars, and a number of smaller groups that met on a regular basis to present and discuss topics of mutual interest. Michael van Walt van Praag, who spent the second of his three years as Visiting Professor in the School, organized a seminar series on modern international relations and history and hosted a three-day conference titled "The Nature of the Manchu Qing Empire and of its Relations with Other Polities in Asia," which focused on East- and Inner-Asian relations.

ACADEMIC ACTIVITIES

In 2012–13, Professor **Yve-Alain Bois** pursued his work on the catalogue raisonné of the paintings and sculpture of the American artist Ellsworth Kelly, on which he also published an essay in a special issue of the journal *Cahiers d'Art* devoted to his work. He also published essays on Picasso, on Mondrian, and on De Stijl in the catalogue of the exhibition "Inventing Abstraction" at the Museum of Modern Art, and he coedited the special issue of the journal *October* devoted to abstraction (to which he contributed two essays). He also wrote an essay on the painter Cheyney Thompson in the catalogue of his exhibition at the Massachusetts Institute of Technology's List Visual Arts Center, and, in French, an introduction to a collection of interviews of Hubert Damisch. He gave lectures in October, on Matisse at the Barnes Foundation (Philadelphia); in November, on Picasso at a symposium about the artist organized by the University of São Paulo; and in April, on color in modern art in a symposium on painting at Harvard University. He also participated in symposia on abstract art at Princeton University (April), on "Art in Public Spaces" at the Barnes Foundation (May), and on the "Afterlives of Soviet Constructivism" at Princeton University. In June, he chaired six evenings (talks and round tables) at the Centre Pompidou in Paris devoted to the theme "The Contemporary Return of the Sixties," and he took part in a workshop on "Post-contextualism" organized by Professors Lorraine Daston and Brooke Holmes at the Max-Planck-Institut für

From left: Member Nathanael Andrade, Professor Angelos Chaniotis, film directors Oliver Stone and Gary Leva, and Member Yannis Hamilakis discuss historiography in the context of cinema.

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Wissenschaftsgeschichte in Berlin. At the Institute for Advanced Study, he organized a series of art history seminars either at lunch and reserved to Members or in the evening and open to scholars from neighboring institutions. He also organized the fifth series of public lectures cosponsored with the Department of Art and Archaeology of Princeton University.

ANDREA KANE

Professor Patricia Crone (front center) organized an Islamicist Seminar that included talks about the magic bowls of pre-Islamic Iraq and a Zoroastrian school of enlightened thought that flourished in seventeenth-century India.

At the Institute, Professor **Angelos Chaniotis** organized the Ancient Studies Seminar, in which Members presented their work (October–December 2012 and January–April 2013); a panel discussion with the director Oliver Stone, "(Ancient) History on Screen" (January 2013); and the workshop "Epigraphic Friday" (February 2013). He also lectured in Amsterdam, Athens, Bochum, Cincinnati, Geneva, Jerusalem, London, Philadelphia, Tel Aviv, Thessaloniki, and Venice. In connection with his project *The Social and Cultural Construction of Emotions: The Greek Paradigm*, which is funded by the European Research Council, he co-organized the conference "Emotion and Psychiatry: Neuroscience, History, and Culture" at the Royal Society of Medicine in London (May 2012) and the workshop "The Study of Emotions in the Greek World" in Oxford (May 2012).

Chaniotis coedited *Supplementum Epigraphicum Graecum* LVIII (Leiden, 2012), edited the volume *Unveiling Emotion: Sources and Methods for the Study of Emotions in the Greek World* (Stuttgart, 2012), and completed the editorial work for the collective volume *Emotions in Greece and Rome: Texts, Images, Material Culture* (forthcoming). He also worked on his book "The Greek World from Alexander to Hadrian." In August 2012, he participated in the excavation at Aphrodisias, studying inscriptions for his books "Epigraphic Research at Aphrodisias, 1995–2012" and "From the City of Aphrodite to the City of the Cross: Constructions and Transformations of Identity in Aphrodisias."

As a member of the Italian Comitato Nazionale dei Garanti per la Ricerca, he contributed to the development of regulations for the evaluation of research projects funded by the Italian Ministry of Research.

Patricia Crone, Andrew W. Mellon Professor, spent much of the academic year 2012–13 writing an article on the old question of how far Jewish Christianity is reflected in the Qur'an (arguing in favor of the view that it is reflected, with new evidence from both the Qur'an itself and external sources). She hopes to complement this article with another on the relationship between Jews, including "believing Jews" (i.e., Jewish Christians), and Arabs on the ground in the locality reflected in the Qur'an. She also wrote a short notice on Empedocles' oath and Zoroastrianism, for which she needs to find an academic home, and another on Enoch and Idris in the Qur'an, which needs some finishing touches in light of some articles she had not read at the time. Four of her articles (or five, given that one was published in two parts) appeared in print.

Crone presided over the usual Islamicist Seminar, which met whenever a

Professor Bois pursued his work on the catalogue raisonné of the paintings and sculpture of the American artist Ellsworth Kelly, on which he also published an essay in a special issue of the journal Cahiers d'Art *devoted to his work.*

ANDREA KANE

Professor Nicola Di Cosmo (center right) co-organized the conference "Worlds in Motion," which explored the connections, comparable processes, movements of peoples, and cultural exchange between Rome and China in the period roughly from 300 to 600 C.E.

member of the Islamicist group felt moved to give a talk about his or her subject. Actually "Islamicist" is not the right word, as one of the talks was about the magic bowls of pre-Islamic Iraq and another about a Zoroastrian school of enlightened thought that flourished in seventeenth-century India. In addition, the group met for Arabic text reading, which went well until they started reading Ibn Arabi: Adam Sabra was soon the only participant who understood what was going on.

On the honors front, the most notable event was the award of an honorary doctorate to Michael Cook and Crone in Leiden, Netherlands, which was treated as a much more momentous matter than Crone's receipt of an honorary doctorate in Copenhagen in 2009. In addition, Crone's heart was warmed by her receipt of an honorary membership of Gonville and Caius College, her old college in Cambridge, of which she greatly enjoyed being a member and of which she still treasures the fondest memories.

In 2012–13, **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, was involved in several collaborative research initiatives. First, he worked on a project funded by the National Science Foundation and begun in January 2013 titled "Pluvials, Droughts, Energetics, and the Mongol Empire." Born as a joint effort with scientists from West Virginia, Columbia University, and Mongolia, the project aims to understand the relationship between weather patterns in twelfth- to thirteenth-century Mongolia and the phenomenal changes that occurred in that period, culminating in the empire created by Chinggis Khan. The project's central question is the relationship between natural resources and political transformations in a premodern nomadic society. Past historians have suspected that a worsening of environmental and climate conditions may have "pushed" the Mongols out, but recent discoveries based on tree-ring analysis argue instead for an abundance of resources.

Together with Member Helmut Heit, Professor Israel organized the international colloquium "Nietzsche's Naturalism Reconsidered," held at the Institute, in which several of the world's leading Nietzsche specialists participated.

A second collaborative project resulted in the conference "Worlds in Motion," organized jointly with Professor Michael Maas of Rice University and held at the Institute May 29–June 1, 2013. The conference brought together twenty-four speakers and eight discussants from various intellectual worlds: late antique history, early medieval Europe, Sasanian Iran, Central Asian and Chinese history, and archaeology. Central to the conference was the exploration of connections, comparable processes, movements of peoples, and cultural exchange between Rome and China in the period roughly from 300 to 600 C.E.

A third area of collaboration concerns working with advanced graduate students. In February 2013, he began a three-year Visiting Professorship at Princeton University's Department of East Asian Studies. The appointment entails teaching one seminar per year and an advisory relationship with graduate students. He has also been advising students and visiting scholars as a senior fellow at the Institute for the Study of the Ancient World at New York University.

At the Institute, he participated in the roundtable conference organized by Visiting Professor Michael van Walt van Praag (December 2012), where he presented a paper on early Manchu concepts of sovereignty. His yearly East Asian Studies Seminar within the School included sixteen talks. Several studies were completed: on "truth" in traditional Chinese historiography, on the category of "elite" in history and archaeology, and on empire formation among nomads. Among his essays that appeared in print, one may note "Connecting Maritime and Continental History: The Black Sea Region at the Time of the Mongol Empire" in *The Sea: Thalassography and Historiography* (University of Michigan Press, 2013).

Professor **Patrick J. Geary** continues to direct a long-term, collaborative, and interdisciplinary project that brings together geneticists, historians, and archaeologists from the United States, Germany, Italy, Austria, Hungary, and the Czech Republic to study early medieval population demographics through the analysis of ancient DNA. The project has taken him to Florence, Italy, where the laboratory work is being conducted, as well as to Hungary, Austria, and Moravia to arrange for collection of samples from these areas, and also to Germany to consult with archaeologists and physical anthropologists. To date, his team has collected close to eight hundred samples and is in the process of extracting and sequencing their DNA.

He published two books in the 2012–13 academic year: *Writing History: Identity, Conflict, and Memory in the Middle Ages* (Kubon & Sagner, 2012) and *Language and Power in the Early Middle Ages* (Brandeis University Press, 2013).

He also participated in conferences and lectured at the Norwegian Academy in Rome, the University of Heidelberg, the University of Vienna, the Central European University in Budapest, and the Humboldt University in Berlin. In 2013, he chaired the committee that provided a comprehensive evaluation of the teaching, research, and administration of the University of Paris IV, the Sorbonne.

At the Institute for Advanced Study, he organized a series of lunchtime seminars for Members, hosted a lecture by Professor Rosamond McKitterick of the University of Cambridge, and participated in the IAS–Collège de France workshop on borders and in the "Worlds in Motion" conference organized by Professor Nicola Di Cosmo and Michael Maas of Rice University. He also presented his research project on medieval genetics at the Simons Center for Systems Biology in the School of Natural Sciences.

During 2012–13, Professor **Jonathan Israel** completed his book *Revolutionary Ideas: An Intellectual History of the French Revolution from the Rights of Man to Robespierre*,

ANDREA KANE

Member Derek Krueger (fourth from left) during a Medieval Seminar organized by Professor Patrick Geary

scheduled to be published by Princeton University Press in the spring of 2014. It attempts a fundamental reinterpretation of this key historical event. He also began work on a short book comparing the American and French revolutions and on the recently commissioned fourth part of his Enlightenment survey, a follow-up to *Democratic Enlightenment* (Oxford University Press, 2011) covering the last phase and political defeats of the Enlightenment in the period 1780–1848. He also published several academic articles.

During the year, he chaired the Institute workshop on modern history, which met monthly from October to April to discuss work-in-progress papers precirculated by Members in the School of Historical Studies who work in this field. Each two-hour workshop was followed by informal discussion, drinks, and dinner. Between September and May, Israel also jointly chaired the Eighteenth-Century Seminar with colleagues from the History Department of Princeton University, which jointly organized and funded the seminar with the Institute and featured speakers from all over the United States and abroad. Together with Member Helmut Heit, Israel also jointly organized the international colloquium "Nietzsche's Naturalism Reconsidered," held at the Institute April 5 and 6, in which several of the world's leading Nietzsche specialists participated.

On February 25, Israel gave the keynote at the City University of New York's Ph.D. program in a history seminar on the Radical Enlightenment, a debate about the three volumes he has published on this topic thus far. During the 2012–13 academic year, he also delivered public lectures on the Enlightenment and the French Revolution in Providence, Rhode Island; Houston, Texas; and Portland, Maine, and at the universities of Haifa, Tel Aviv, Almeria, Murcia, Madrid, and Oslo and at the Ax:son Johnson Foundation in Sweden. During May 2013, he also held a visiting lectureship at the Brussels Vrije Universiteit, where he gave three public lectures, and he helped organize and gave the keynote at an international conference in Brussels, "The Radical Enlightenment: The Big Picture and Its Details" (May 16–17).

Professor Emeritus **Glen W. Bowersock** published two books in 2012–13. One, *Empires in Collision in Late Antiquity* (Brandeis University Press, 2012), comprised the annotated texts of three lectures he delivered in Jerusalem in April

BENTLEY DREZNER

Member Adam Sabra (right) led an Early Modern History Workshop, chaired by Professor Jonathan Israel (left), on the bureaucratization of succession.

2011 at the Israel Historical Society in memory of Menahem Stern. The second, *The Throne of Adulis: Red Sea Wars on the Eve of Islam* (Oxford University Press, 2013), examined the sixth-century conflict between the Jewish kingdom of Himyar in southwestern Arabia and the Christian kingdom of Ethiopia centered at Axum. In October, Bowersock supplemented some of the material in these two books at a seminar on pagan angels in late antiquity for curators at the Getty Museum in Malibu. He offered this seminar in connection with an invitation from the President and CEO of the Getty Trust to address its Board of Trustees on possible future directions for its various enterprises.

ANDREA KANE

Member Maria Hsiuya Loh (left), who studied ghost stories and the pathos of portraiture, with Professor Emeritus Glen Bowersock

In June and October, Bowersock went to Brussels to complete his six-year term of service to the European Research Council as chair of a panel in humanities and social science. This panel awarded substantial grants to senior scholars who work in countries within or associated with the European Union. He also continued to serve on the Advisory Committee for New York University's Institute for the Study of the Ancient World, which was founded by IAS Trustee Shelby White.

Bowersock traveled to Naples in March and had the opportunity to see nearly a thousand inscribed marble fragments discovered in work on the city's subway system. These extraordinary fragments, from a huge public inscription, record the names of victors in the ancient Neapolitan athletic, literary, and musical competitions, known as the Sebasta, in the first century A.D. From Naples, Bowersock went to Cologne to give the opening lecture in a conference, organized by former Institute Member Walter Ameling, on the Christianization of Asia Minor in late antiquity. Over the past academic year, Bowersock published several reviews in the *New York Review of Books* and the *New Republic*, as well as a paper he had delivered before the Académie des Inscriptions et Belles-Lettres in Paris on Hector and Julian the Apostate. He devoted one of his *New Republic* reviews to a history of opera written jointly by former Institute Member Carolyn Abbate and former Director's Visitor Roger Parker.

Professor von Staden continued to focus his research efforts on two major editions of Greek medical texts as well as a book on the role of animals in ancient science and medicine.

Professor Emerita **Caroline Walker Bynum** continued to work on late medieval topics that fall at the intersection of art history and the history of Christianity. She published an article comparing late medieval and nineteenth-century pieties in the *Furrow*; an article on sacred objects seen from a comparative perspective in the *Irish Theological Quarterly*; a short piece on medieval materiality for the *Art Bulletin*'s "Notes from the Field"; and a long autobiographical essay titled "Why Paradox?" commissioned by the *Catholic Historical Review*. She also published three reviews and two occasional pieces, one in the American Historical Association's newsletter *Perspectives* on the implications of retirement for the historical profession and one on changes in professional opportunities for women in the sixties and early seventies, written for the *Chronicle of Higher Education*. She lectured at the Getty Museum in Los Angeles, at Northwestern University, and at Johns Hopkins University, and she spoke at conferences organized by the American Academy in Berlin and the Bard

ANDREA KANE

Member Aihe Wang gave a Lunchtime Colloquium on underground art production in China during the Cultural Revolution.

Graduate Center in conjunction with the Institute of Fine Arts. In June, she was inducted into the Orden Pour le Mérite für Wissenschaften und Künste of the Federal Republic of Germany. Bynum also continues her work as a victims' advocate in two New York City hospitals and is now a certified rape crisis counselor.

During the academic year 2012–13, Professor Emeritus **Giles Constable** published four articles. A book is in course of publication, as are translations of two works into Japanese. His book on Antonio Rinaldeschi, written in collaboration with William Connell, was translated into Romanian. He spoke at conferences on canon law in Toronto, on monastic history in Le Monastier-La Chaise Dieu, in memory of James Powell in Syracuse, and on the Crusades in Pittsburgh, and he attended a number of other meetings. He continued to serve on the editorial boards of several series and scholarly journals, as a reviewer for the American Philosophical Society, and on the selection committee of the Gladys Krieble Delmas Foundation.

Professor Emeritus **Christian Habicht** continued his work on the history of ancient Cyzicus (Sea of Marmara). His publications were the sixth and final volume of the *Histories* of Polybius, books 28–40, published by Harvard University Press in the fall of 2012, and a paper on a new *strategos* of the Achaean League in the second century B.C., "Ainetidas," in *Chiron* 42, 2012. Six other papers, accepted by various journals or publishers, still await publication.

Professor Emeritus **Irving Lavin** published the third and final volume in the series of his collected works on the Roman Baroque sculptor, architect, and painter Gianlorenzo Bernini, *Visible Spirit: The Art of Gianlorenzo Bernini* (Pindar Press, 2013). The volume, soon to be available as an ebook, is titled *Bernini at St. Peter's: The Pilgrimage*. Professor Lavin is now working on a projected two-volume publication of his writings on non-Bernini subjects ranging from late antiquity, the Italian Renaissance, and Baroque periods to twentieth-century

art. Currently in proof is a major essay on the form and meaning of the autograph inscription on Michelangelo's only signed work, the famous Pietà in St. Peter's: "Divine Grace and the Remedy of the Imperfect: Michelangelo's Signature on the St. Peter's Pietà." A study by Lavin and Marilyn Aronberg Lavin on the history, design, and significance of the Institute's seal, titled *Truth and Beauty at the Institute for Advanced Study*, has been published by the Institute.

During the academic year, Professor Emeritus **Peter Paret** wrote a number of essays on the cultural history of efforts in the late eighteenth and early nineteenth centuries to understand war, which together with previously published essays on related subjects will be published under the title "Clausewitz in His Time." He also expanded the lecture he gave at the conference on German émigré historians in Washington, D.C., in 2012, "External Events, Inner Drives," which will appear in the proceedings of the conference, *The Second Generation*, edited by Andreas Daum, Hartmut Lehmann, and James Sheehan.

In October 2012, Professor Emeritus **Heinrich von Staden** gave a lecture, "Medicinal 'Brands' in the Ancient World," at the University of California, Davis, School of Law. The talk was presented at an interdisciplinary workshop on branding, mainly focusing on the modern world. In November 2012, he gave a lecture in Paris at the Académie des Inscriptions et Belles-Lettres on notions of "evidence" in the Hippocratic writings. The context was the fourteenth international Colloque Hippocratique, organized partly under the auspices of the Academy. In April 2013, he participated in a workshop at the Humboldt University in Berlin on editing ancient fragments, and in May 2013, he participated in the annual meeting of the American Association for the History of Medicine in Atlanta. His publications in 2012–13 included several reviews and "Writing the Animal: Aristotle, Pliny the Elder, Galen" in *Writing Science: Medical and Mathematical Authorship in Ancient Greece*, edited by Markus Asper in collaboration with Anna-Maria Kanthak, volume 1 in the series Science, Technology, and Medicine in Ancient Cultures (de Gruyter, 2013). His principal research efforts continued to focus on two major editions of Greek medical texts as well as a book on the role of animals in ancient science and medicine.

Professor Emeritus **Morton White** has completed a manuscript of a short book titled "Necessary Truth in Descartes, Hobbes, Leibnitz, and Kant." It is a work that he has been occupied with for the last year or two.

Members participated in an international relations seminar on a new history of Christian democracy.

ANDREA KANE

MEMBERS AND VISITORS

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

Nathanael Andrade
Roman Imperial Near East ✦ University of Oregon
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

George Boys-Stones
Ancient Philosophy ✦ Durham University ✦ *s*

Alessandro Maria Bruni
Byzantium and Eastern Christianity ✦ Institute for Advanced Study
Edward T. Cone Member in Music Studies

Christer Bruun
Roman History ✦ University of Toronto ✦ *f*
The Gladys Krieble Delmas Foundation Member

Mayke de Jong
Medieval History ✦ Utrecht University ✦ *f*
Funding provided by the Herodotus Fund

André Dombrowski
Nineteenth-Century European Art ✦ University of Pennsylvania
Funding provided by the Herodotus Fund

Mark William Driscoll
East Asian Intellectual and Political History ✦ University of North Carolina
Elizabeth and J. Richardson Dilworth Fellow; additional funding provided by the Andrew W. Mellon Foundation

Marco Fantuzzi
Classics, Greek Literature ✦ Università degli Studi di Macerata ✦ *f*
Funding provided by The Andrew W. Mellon Foundation

Ingrid Maren Furniss
Chinese Art and Archaeology, Musicology ✦ Lafayette College ✦ *s*
Edward T. Cone Member in Music Studies; additional funding provided by the Hetty Goldman Membership Fund

Alex Gottesman
Classics ✦ Temple University ✦ *s*
Funding provided by the Herodotus Fund

Jeffrey Lawrence Gould
Latin American History ✦ Indiana University
George Kennan Member

Yannis Hamilakis
Greek Archaeology, Classical Reception ✦ University of Southampton
Hetty Goldman Member

James A. Harris
Eighteenth-Century British Intellectual History ✦ University of St. Andrews
Hans Kohn Member; additional funding provided by the Elizabeth and J. Richardson Dilworth Fellowship Fund

Charles Hartman
Chinese History ✦ University at Albany, State University of New York ✦ *s*
The Starr Foundation East Asian Studies Endowment Fund Member

Helmut Heit
Philosophy ✦ Technische Universität Berlin
Dilthey Fellowship funded by Volkswagen Stiftung

Yitzhak Hen
Early Medieval History ✦ Ben-Gurion University of the Negev
Friends of the Institute for Advanced Study Member; additional funding provided by the Herodotus Fund

Yonglin Jiang
Chinese History ✦ Bryn Mawr College
Frederick Burkhardt Fellowship funded by the American Council of Learned Societies

Mark Jurdjevic
Italian Renaissance ✦ York University
Felix Gilbert Member; additional funding provided by the National Endowment for the Humanities

David Kennedy
Roman Archaeology ✦ University of Western Australia ✦ *v, f*

Jungwon Kim
Korean History ✦ University of Illinois at Urbana-Champaign
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Derek Krueger
Religion, Late Ancient and Byzantine Studies ✦ The University of North Carolina at Greensboro
Funding provided by the National Endowment for the Humanities; additional funding provided by the Herodotus Fund

Anna Krylova
Modern Russian History ✦ Duke University ✦ *s*
George Kennan Member

Stephen D. Lambert
Ancient History, Greek Epigraphy ✦ Cardiff University
Funding provided by the Patrons' Endowment Fund

Renée Levine Melammed
Medieval History, Jewish Studies ✦ The Schechter Institute of Jewish Studies ✦ *s*
Funding provided by The Andrew W. Mellon Foundation

Munkh-Erdene Lhamsuren
Central Eurasian Studies ✦ National University of Mongolia
George Kennan Member

Maria Hsiuya Loh
History of Art ✦ University College London
Willis F. Doney Member; additional funding provided by the Herodotus Fund

Carolyn Merchant
History of Science, Environmental History ✦ University of California, Berkeley ✦ *f*
Funding provided by The Andrew W. Mellon Foundation

Christian Meyer
East Asian Studies ✦ Friedrich-Alexander-Universität Erlangen-Nürnberg
Gerda Henkel Stiftung Member; additional funding provided by the Herodotus Fund

Jan-Werner Mueller
Modern Intellectual History ✦ Princeton University ✦ *s*

Hyun Ok Park
East Asian Studies ✦ York University ✦ *v, f*

Marcus M. Payk
Modern European History ✦ Humboldt-Universität zu Berlin
Dilthey Fellowship funded by Volkswagen Stiftung

Roberta Pergher
European History, Fascism, Empire ✦ Indiana University ✦ *s*
Elizabeth and J. Richardson Dilworth Fellow

Anne-Lise Rey
Philosophy, History of Science ✦ Université Lille 1
Funding provided by the Florence Gould Foundation Fund

Juhyung Rhi
Art History ✦ Seoul National University
Edwin C. and Elizabeth A. Whitehead Fellow; additional funding provided by the Herodotus Fund

Marijana Ricl
Ancient History, Greek Epigraphy ✦ University of Belgrade
Martin L. and Sarah F. Leibowitz Member

Bruce Rusk
Cultural History of Early Modern China ✦ The University of British Columbia ✦ *f*
The Starr Foundation East Asian Studies Endowment Fund Member

Ortal-Paz Saar
Middle Eastern History, Judaic Studies ✦ Tel Aviv University
AMIAS Member; additional funding provided by the Herodotus Fund

Adam Sabra
Islamic Studies ✦ University of California, Santa Barbara
Funding provided by the National Endowment for the Humanities; additional funding provided by the Herodotus Fund

Ron Sela
History, Historiography of Islamic Central Asia ✦ Indiana University ✦ *f*
Funding provided by the Herodotus Fund

Mitra Sharafi
History of Law and Medicine in South Asia ✦ University of Wisconsin–Madison ✦ *f*
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Weirong Shen
History, Philology, Buddist Studies ✦ Renmin University of China
The Starr Foundation East Asian Studies Endowment Fund Member

Evrydiki Sifnaiou
Economic and Social History ✦ The National Hellenic Research Foundation ✦ *f*
Elizabeth and J. Richardson Dilworth Fellow

Nigel Scott Smith
Comparative Literature and History ✦ Princeton University

Jörg Sonntag
Medieval History ✦ Technische Universität Dresden ✦ *f*
George William Cottrell, Jr., Member; additional funding provided by the Herodotus Fund

Nicola Terrenato
Roman Art and Archaeology ✦ University of Michigan ✦ *s*
William D. Loughlin Member; additional funding provided by the Hetty Goldman Membership Fund

Stephen V. Tracy
Greek History and Epigraphy ✦ The American School of Classical Studies at Athens ✦ *v*

Francesca Trivellato
Early Modern European History ✦ Yale University ✦ *f*
Hans Kohn Member

Frans van Liere
Medieval History ✦ Calvin College
Agnes Gund and Daniel Shapiro Member

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

Anthony Vidler
Architecture and Urban Studies ✦ The Cooper Union for the Advancement of Science and Art ✦ *s*

Adelheid Voskuhl
History of Technology ✦ Harvard University ✦ *s*
Funding provided by the Herodotus Fund

Aihe Wang
Chinese Studies ✦ The University of Hong Kong ✦ *s*
Willis F. Doney Member; additional funding provided by The Andrew W. Mellon Foundation

Ittai Weinryb
History of Art ✦ Bard Graduate Center
The Andrew W. Mellon Foundation Fellowships for Assistant Professors

Laura Sanguinetti White
Medieval History and Literature ✦ Rutgers, The State University of New Jersey ✦ *v, s*

Frédérique Woerther
Islamic Philosophy ✦ Centre National de la Recherche Scientifique
Willis F. Doney Member

Chen-Pang Yeang
History of Science and Technology ✦ University of Toronto
Funding provided by the Herodotus Fund

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September 25

East Asian Studies Seminar ✦ *China, Food, and the World of Goods in the Long Eighteenth Century* ✦ **Joanna Waley-Cohen**, New York University

October 1

Historical Studies Lunchtime Colloquia Series ✦ *First Term Introductions* ✦ **Angelos Chaniotis**, Professor, School of Historical Studies

October 2

Medieval Seminar ✦ *Epitaph for an Era: Paschasius Radbertus and His Lament for Wala* ✦ **Mayke de Jong**, Utrecht University; Member, School of Historical Studies

Early Modern History Workshop ✦ *Introductory Meeting* ✦ **Jonathan Israel**, Professor, School of Historical Studies

October 3

Art History Seminar ✦ *Introductions* ✦ **Yve-Alain Bois**, Professor, School of Historical Studies ✦ *Work in Progress* ✦ **Maria Hsiuya Loh**, University College London; Member, School of Historical Studies ✦ *Work in Progress* ✦ **Juhyung Rhi**, Seoul National University; Member, School of Historical Studies ✦ *Work in Progress* ✦ **Ittai Weinryb**, Bard Graduate Center; Member, School of Historical Studies

October 8

Historical Studies Lunchtime Colloquia Series ✦ *Jerome's Choices and Their Medieval Repercussions* ✦ **Frans van Liere**, Calvin College; Member, School of Historical Studies

October 9

Medieval Seminar ✦ *Western Arianism: Politics and Religious Culture in the Early Medieval West* ✦ **Yitzhak Hen**, Ben-Gurion University of the Negev; Member, School of Historical Studies

East Asian Studies Lecture ✦ *Dynamics of Communication and Exchange along the "Steppe Highway" in the Late Iron Age* ✦ **Ursula Brosseder**, Universität Bonn

October 10

Art History Seminar ✦ *Impressionism and the Measure of Time* ✦ **André Dombrowski**, University of Pennsylvania; Member, School of Historical Studies

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East Asian Studies Seminar ✦ *Religion and Law in a Miao Borderland* ✦ **Yonglin Jiang**, Bryn Mawr College; Member, School of Historical Studies

October 15

Medieval Seminar ✦ *Mesopotamian Magic Bowls* ✦ **Ortal-Paz Saar**, Tel Aviv University; Member, School of Historical Studies

Historical Studies Lunchtime Colloquia Series ✦ *Conceptualizing Noise in the Early Twentieth Century: From Discordant Sound to Random Fluctuations* ✦ **Chen-Pang Yeang**, University of Toronto; Member, School of Historical Studies

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Historical Studies Lunchtime Colloquia Series ✦ *Ingot We Trust? Imagining Fake Silver in Early Modern China* ✦ **Bruce Rusk**, The University of British Columbia; Member, School of Historical Studies

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Medieval Seminar ✦ Adam's Lament *in Ninth-Century Byzantium* ✦ **Derek Krueger**, The University of North Carolina at Greensboro; Member, School of Historical Studies

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Early Modern History Workshop ✦ *Hume's Intellectual Biography: An Overview* ✦ **James A. Harris**, University of St Andrews; Member, School of Historical Studies

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East Asian Studies Seminar ✦ *Market Utopia: From Korean Unification to Transnational Korea* ✦ **Hyun Ok Park**, York University; Member, School of Historical Studies

October 31

Seminar on International Relations ✦ *Making Mongolia Multiethnic: Knowledge, Power, and Identity* ✦ **Munkh-Erdene Lhamsuren**, National University of Mongolia; Member, School of Historical Studies

November 5

Historical Studies Lunchtime Colloquia Series ✦ *Controlling Nature: History, Philosophy, and Gender* ✦ **Carolyn Merchant**, University of California, Berkeley; Member, School of Historical Studies

November 6

Medieval Seminar ✦ *Recovering the Liturgy of Jerusalem through Georgian Manuscripts* ✦ **Alessandro Maria Bruni**, Member, School of Historical Studies

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Art History Seminar ✦ *Veronese's Story of the Eye* ✦ **Maria Hsiuya Loh**, University College London; Member, School of Historical Studies

November 8

Seminar on International Relations ✦ *The Role of International Law and Lawyers at the Paris Peace Treaties of 1919–20* ✦ **Marcus M. Payk**, Humboldt-Universität zu Berlin; Member, School of Historical Studies

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Historical Studies Lunchtime Colloquia Series ✦ *Monks and Nuns as Generators, Mediators and Interpreters of Entertainment Games in Medieval Society* ✦ **Jörg Sonntag**, Technische Universität Dresden; Member, School of Historical Studies

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Ancient Studies Seminar ✦ *Georgian Hirmologion as Source for the Study of Greek Music and Poetry: An Integrated Approach to Hymnographic Neumed Manuscripts* ✦ **Alessandro Maria Bruni**, Member, School of Historical Studies

Medieval Seminar ✦ *Hebraica Veritas in the Twelfth Century* ✦ **Frans van Liere**, Calvin College; Member, School of Historical Studies

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East Asian Studies Seminar ✦ *History through Textual Criticism: Tibetan Tantric Buddhism in Central Eurasia and China* ✦ **Weirong Shen**, Renmin University of China; Member, School of Historical Studies

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Ancient Studies Seminar ✦ *Anything to Do with Democracy? What Inferences Can We Draw from the Pattern of Proposers of Inscribed Decrees in the Final Stages of the Classical Athenian Democracy (354–322 B.C.)?* ✦ **Stephen A. Lambert**, Cardiff University, Member, School of Historical Studies

December 5

Islamicist Seminar ✦ *Incantation Texts as a Witness to the Mandaean Scriptures* ✦ **Charles Häberl**, Rutgers, The State University of New Jersey

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Workshop: The Nature of the Manchu Qing Empire and of Its Relations with Other Polities in Asia ✦ *Perceptions of the Manchu Qing Dynasty during the Edo Period Japan* ✦ **Yoshimichi Kusunoki**, University of Tsukuba ✦ *Qing China as Viewed by Its Neighbors* ✦ **Peter Perdue**, Yale University ✦ *Mirror for the Emperor: Muslim Images of China's Ruler during Manchu Times* ✦ **Zvi Ben-Dor Benite**, New York University ✦ *Discussant* ✦ **Ron Sela**, Indiana University; Member, School of Historical Studies ✦ *Two Emperors' Understandings of the Relationship between Qing Officials and Tibetan Buddhism Leaders "In the Middle Period" of the "Qing" Dynasty* ✦ **Nobuaki Murakami**, Soka University ✦ *Seeing the Qing: Tibetan Perspectives on China's Rulers during the Early Eighteenth Century* ✦ **Matthew Kapstein**, Divinity School, The University of Chicago ✦ *Discussant* ✦ **Weirong Shen**, Renmin University of China; Member, School of Historical Studies ✦ *Maps and Their Significance: Facilitated*

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Ancient Studies Seminar ✦ *Civic Identity in Ostia* ✦ **Christer Bruun**, University of Toronto; Member, School of Historical Studies

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Medieval Seminar ✦ *A Medieval Conflict Resolution* ✦ **Giles Constable**; Professor Emeritus, School of Historical Studies

Art History Seminar ✦ *Images in the Showcase: Where Were Images Installed in Gandharan Buddhist Monasteries* ✦ **Juhyung Rhi**, Seoul National University; Member, School of Historical Studies

Early Modern History Workshop ✦ *Odessa* ✦ **Evrydiki Sifnaiou**, The National Hellenic Research Foundation; Member, School of Historical Studies

Seminar on International Relations ✦ *Remapping Odessa: A "Peripatetic" Approach to a Port-City* ✦ **Evrydiki Sifnaiou**, The National Hellenic Research Foundation; Member, School of Historical Studies

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East Asian Studies Seminar ✦ *Law and Legal Professionals in Chosŏn Korea: Evidences from Case Studies* ✦ **Jungwon Kim**, University of Illinois at Urbana-Champaign; Member, School of Historical Studies

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Historical Studies Lunchtime Colloquia Series ✦ *Marriage in an Early Modern Egyptian Noble Family* ✦ **Adam Sabra**, University of California, Santa Barbara; Member, School of Historical Studies

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Seminar on International Relations ✦ *Dialects, Speech, and Information: Chao Yuen Ren's Route to Cybernetics* ✦ **Chen-Pang Yeang**, University of Toronto; Member, School of Historical Studies

East Asian Studies Seminar ✦ *Zheng He's Thermos: Ming Artifacts, Ming Relics, and Some Problems of Provenance* ✦ **Bruce Rusk**, The University of British Columbia; Member, School of Historical Studies

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Art History Seminar ✦ *Material Iconology of Bronze Doors in Medieval Italy* ✦ **Ittai Weinryb**, Bard Graduate Center; Member, School of Historical Studies

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Historical Studies Lunchtime Colloquia Series ✦ *Second Term Introductions* ✦ **Angelos Chaniotis**, Professor, School of Historical Studies

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Medieval Seminar ✦ *Jewish Love Magic and Some Non-Jewish Parallels* ✦ **Ortal-Paz Saar**, Tel Aviv University; Member, School of Historical Studies

East Asian Studies Seminar ✦ *The Song Dynasty Shapes Its Past: Politics and History in Twelfth-Century China* ✦ **Charles Hartman**, University at Albany, State University of New York; Member, School of Historical Studies

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Art History Seminar ✦ *Informal Discussion of Talks by Elizabeth Bolman and André Dombrowski* ✦ **André Dombrowski**, University of Pennsylvania; Member, School of Historical Studies

Early Modern History Workshop ✦ *Le Leibnizo-Newtonianisme et l'Invention et Épistémologique au 18e Siècle* ✦ **Anne-Lise Rey**, Université Lille I; Member, School of Historical Studies

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Medieval Seminar ✦ *Women Seen through the Cairo Genizah* ✦ **Renée Levine Melammed**, The Schechter Institute of Jewish Studies; Member, School of Historical Studies

Historical Studies Lunchtime Colloquia Series ✦ *Women's Lives in Mediterranean Society as Reflected in the Cairo Genizah* ✦ **Renée Levine Melammed**, The Schechter Institute of Jewish Studies; Member, School of Historical Studies

January 23

Art History Seminar ✦ *Barnett Newman's* The Wild ✦ **Yve-Alain Bois**; Professor, School of Historical Studies

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Historical Studies Lunchtime Colloquia Series ✦ *Roman Imperialism: Modern Perceptions and Archaeological Realities* ✦ **Nicola Terrenato**, University of Michigan; Member, School of Historical Studies

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Medieval Seminar ✦ *Commerce under Mongol Rule: Revisiting Asian Trade between the Mediterranean and China (ca. 1300–60)* ✦ **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, School of Historical Studies

January 30

Eighteenth Century Seminar ✦ *"I Live Almost Wholly in the Fields": Artistic Practice and Agricultural Process in John Constable's "Wheat Field," 1815–16* ✦ **Timothy Barringer**, Yale University

January 31

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Historical Studies Lunchtime Colloquia Series ✦ *Indistinct Images: Reading Buddha Images from Gandharan Monasteries* ✦ **Juhyung Rhi**, Seoul National University; Member, School of Historical Studies

February 5

Medieval Seminar ✦ *Magic in the Early Medieval West?* ✦ **Yitzhak Hen**, Ben-Gurion University of the Negev; Member, School of Historical Studies

February 6

Seminar on International Relations ✦ *Addressing Perceptions of History in Intrastate Conflicts* ✦ **Michael van Walt van Praag**, Visiting Professor, School of Historical Studies

Art History Seminar ✦ *Walter Benjamin's Two Angels* ✦ **Anthony Vidler**, The Cooper Union for the Advancement of Science and Art; Member, School of Historical Studies

February 11
Historical Studies Lunchtime Colloquia Series ✦ *Alternative Modernism: Underground Art Production during the Cultural Revolution* ✦ **Aihe Wang**, The University of Hong Kong; Member, School of Historical Studies

February 12
Ancient Studies Seminar ✦ *Geography, Movement, and the Acts of Thomas* ✦ **Nathanael Andrade**, University of Oregon; Member, School of Historical Studies

East Asian Studies Seminar ✦ *Dialects, Speech, and Information: Chao Yuen Ren's Route to Cybernetics* ✦ **Chen-Pang Yeang**, University of Toronto; Member, School of Historical Studies

February 13
Early Modern History Workshop ✦ *The Bureaucratization of Succession* ✦ **Adam Sabra**, University of California, Santa Barbara; Member, School of Historical Studies

February 19
Medieval Seminar ✦ *Introductions Written by the Translators of the Commentary to the Mishnah: A Historical Perspective* ✦ **Uri Melammed**, The Hebrew University of Jerusalem

Seminar on International Relations ✦ *Politics, Grassroots Utopias, and Desencuentros in the Salvadoran Revolution* ✦ **Jeffrey Lawrence Gould**, Indiana University; Member, School of Historical Studies

East Asian Studies Seminar ✦ *The Qing Transformation of Mongolia: Structural Tribalization and Ethnicization* ✦ **Munkh-Erdene Lhamsuren**, National University of Mongolia; Member, School of Historical Studies

February 20
Islamicist Seminar ✦ *Who Wrote the Babylonian Incantation Bowls? On Literacy, Pseudo-Script, and the Earnestness of Magic* ✦ **Ortal-Paz Saar**, Tel Aviv University; Member, School of Historical Studies

Eighteenth Century Seminar ✦ *Hume, Rapin, and the Varieties of Whiggism* ✦ **James A. Harris**, University of St Andrews; Member, School of Historical Studies

February 22
Workshop on Greek Epigraphy: Epigraphic Friday ✦ *Altars and Dedications in Palmyra* ✦ **Nathanael Andrade**, University of Oregon; Member, School of Historical Studies ✦ *A New Epitaph from Northern Jordan* ✦ **Glen W. Bowersock**, Professor Emeritus, School of Historical Studies ✦ *New Inscriptions from Aphrodisias* ✦ **Angelos Chaniotis**, Professor, School of Historical Studies ✦ *Observations on an Inscription from Cos* ✦ **Marc Domingo Gygax**, Princeton University ✦ *An Inscription from Attea (Mysia)* ✦ **Christopher Jones**, Harvard University ✦ *Epigraphic Evidence for Ptolemaios Keraunos* ✦ **Pierre Juhel** ✦ *Fourth-Century Athenian Laws and Decrees: Some Interconnected Developments?* ✦ **Stephen Lambert**, University of Cardiff; Member, School of Historical Studies ✦ *New Arbitration Documents from Messene (SEG LVIII 370)* ✦ **Nino Luraghi**, Princeton University ✦ *A Lease of Sacred Lands from Eastern Phokis (IG IX 1.87)* ✦ **Jeremy McInerney**, University of Pennsylvania ✦ *Unpublished Inscriptions from Thebes* ✦ **Nikos Papazarkadas**, University of California, Berkeley, and Princeton University ✦ *Two Honorary Inscriptions from Iulia Gordos* ✦ **Marijane Ricl**, University of Belgrade; Member, School of Historical Studies ✦ *The Lapis Primus of the Athenian Tribute Lists* ✦ **Stephen Tracy**, The American School of Classical Studies at Athens; Visitor, School of Historical Studies ✦ *Proxeny Networks in the Cyclades* ✦ **John Tully**

February 25
Historical Studies Lunchtime Colloquia Series ✦ *A Clash of Archaeologies? Time, Materiality, and Antiquities in the Premodern and Early Modern Eastern Mediterranean* ✦ **Yannis Hamilakis**, University of Southampton; Member, School of Historical Studies

February 26
Ancient Studies Seminar ✦ *The Cult of Men Axiottenos in the Lydian Katakekaumene Region* ✦ **Marijana Ricl**, University of Belgrade; Member, School of Historical Studies

Medieval Seminar ✦ *How Jesus Celebrated Passover: Renaissance Scholars on the Jewish Origins of Christianity* ✦ **Anthony Grafton**, Princeton University

Seminar on International Relations ✦ *Toward a New History of Christian Democracy* ✦ **Jan-Werner Mueller**, Princeton University; Member, School of Historical Studies

February 27
Art History Seminar ✦ *Leonardo's Watery Chaos* ✦ **Irving Lavin**, Professor Emeritus, School of Historical Studies

Islamicist Seminar ✦ *Divine Law, Cosmic Law: An Antinomian Streak in Ibn al-'Arabi?'* ✦ **Adam Sabra**, University of California, Santa Barbara; Member, School of Historical Studies

February 28
East Asian Studies Seminar ✦ *Righting the Ruan: A Reassessment of the History of the "Chinese" Round-Bodied Lute* ✦ **Ingrid Maren Furniss**, Lafayette College; Member, School of Historical Studies

March 4
Historical Studies Lunchtime Colloquia Series ✦ *A History of the "Soviet": The Lingua Franca of Soviet Modernity* ✦ **Anna Krylova**, Duke University; Member, School of Historical Studies

March 5
Medieval Seminar ✦ *Liturgies of the Monastic Self in Symeon the New Theologian* ✦ **Derek Krueger**, The University of North Carolina at Greensboro; Member, School of Historical Studies

Early Modern History Workshop ✦ *Literature, Politics, and Religion in the Dutch Republic: "True Freedom" and an Anglo-Dutch Perspective* ✦ **Nigel Scott Smith**, Princeton University; Member, School of Historical Studies

East Asian Studies Seminar ✦ *Liberation Sinology and Decolonial Terror in Japan: 1862–89* ✦ **Mark William Driscoll**, University of North Carolina; Member, School of Historical Studies

March 11
Historical Studies Lunchtime Colloquia Series ✦ *Music from the Margins: The Art and Archaeology of Lutes in Premodern Chinese Society* ✦ **Ingrid Maren Furniss**, Lafayette College; Member, School of Historical Studies

March 12
Ancient Studies Seminar ✦ *Greco-Roman Binding Spells and Babylonian Magic Bowls: Similarities and Differences* ✦ **Ortal-Paz Saar**, Tel Aviv University; Member, School of Historical Studies

East Asian Studies Seminar ✦ *Art and Community during the Cultural Revolution* ✦ **Aihe Wang**, The University of Hong Kong; Member, School of Historical Studies

Seminar on International Relations ✦ *Toward a History of the "Soviet": The Lingua Franca of Soviet Modernity* ✦ **Anna Krylova**, Duke University; Member, School of Historical Studies

March 13
Art History Seminar ✦ *Color: A User's Guide* ✦ Amy Silman, Artist ✦ *Can a Color Be Egoistic?* ✦ **Yve-Alain Bois**, Professor, School of Historical Studies

March 18
Historical Studies Lunchtime Colloquia Series ✦ *How Brutal Was It? A Gentle Manifesto for "Brutalism" in Architecture* ✦ **Anthony Vidler**, The Cooper Union for the Advancement of Science and Art; Member, School of Historical Studies

March 19

Medieval Seminar ✦ *Jewish Sources and Christian Polemic at St Victor, ca. 1150* ✦ **Frans van Liere**, Calvin College; Member, School of Historical Studies

March 20

Art History Seminar ✦ *Living on Manet's Balcony, or The Right to Privacy* ✦ **André Dombrowski**, University of Pennsylvania; Member, School of Historical Studies

Islamicist Seminar ✦ *How to Read Averroes' Middle Commentary on Aristotle's Nicomachean Ethics* ✦ **Frédérique Woerther,** Centre National de la Recherche Scientifique; Member, School of Historical Studies

March 25

Historical Studies Lunchtime Colloquia Series ✦ *The Leibnizian-Newtonian Synthesis: The Construction of a Composite Natural Philosophy in the First Half of the Eighteenth Century* ✦ **Anne-Lise Rey**, Université Lille I; Member, School of Historical Studies

March 26

Ancient Studies Seminar ✦ *The Role of the Publicity Stunt in Athenian Democratic Politics* ✦ **Alex Gottesman**, Temple University; Member, School of Historical Studies

Medieval Seminar ✦ *Understanding Medieval Migration through Ancient DNA* ✦ **Patrick J. Geary**, Professor, School of Historical Studies

March 27

Islamicist Seminar ✦ *Cyclical Time in Ikhwan al-Safa' and Early Kabbalistic Writings: Preliminary Considerations* ✦ **Ehud Krinis**, University of Pennsylvania

April 1

Historical Studies Lunchtime Colloquia Series ✦ *Moving Syrians and Syrian Culture in the Ancient World* ✦ **Nathanael Andrade**, University of Oregon; Member, School of Historical Studies

April 2

Ancient Studies Seminar ✦ *Fragments and Testimonies of Apollodoros of Pergamon and Theodoros of Gadara: A New Edition* ✦ **Frédérique Woerther**, Centre National de la Recherche Scientifique; Member, School of Historical Studies

Seminar on International Relations ✦ *"Nazione Impero": Nation-Building, Empire, and Population Settlement in the Fascist Era, 1922–43* ✦ **Roberta Pergher**, Indiana University; Member, School of Historical Studies

April 3

Art History Seminar ✦ *Current Work on Michelangelo* ✦ **Maria Loh**, University College London; Member, School of Historical Studies

Early Modern History Workshop ✦ *What Is Science According to Nietzsche?* ✦ **Helmut Heit**, Technische Universität Berlin; Member, School of Historical Studies

April 5

Workshop: Nietzsche's Naturalism Reconsidered ✦ *Nietzsche's Experimental Naturalism* ✦ **Helmut Heit**, Technische Universität Berlin; Member, School of Historical Studies ✦ *Nietzsche's Kind of Naturalism* ✦ **Richard Schacht**, University of Illinois, Urbana-Champaign

April 6

Workshop: Nietzsche's Naturalism Reconsidered ✦ *Nietzsche's Naturalism Reconsidered* ✦ **Brian Leiter**, University of Chicago Law School ✦ *Nietzsche's Naturalism and Values* ✦ **Maudemarie Clark**, Colgate University ✦ *Nietzsche's Naturalized Values* ✦ **John Richardson**, New York University ✦ *Nietzsche and Spinoza* ✦ **Jonathan Israel**, Professor, School of Historical Studies ✦ *Naturalism and the Nietzschean Self* ✦ **R. Lanier Anderson**, Stanford University ✦ *Nietzsche's Naturalism* ✦ **Christa Davis Acampora**, New York University ✦ *Anti-Supernaturalism* ✦ **Alexander Nehamas**, Princeton University

April 9

East Asian Studies Seminar ✦ *Ornament as Dialogue: The Interpretation of Chinese Art in European Palace Displays* ✦ **Gregory M. Thomas**, The University of Hong Kong

April 10

Art History Seminar ✦ *Mistakes and Cultural Limits in Renaissance Vitruvianism: The Case of Antonio da Sangallo the Younger* ✦ **Francesco Benelli**, Columbia University

April 11

East Asian Studies Seminar ✦ *Legal Knowledge and Law Enforcement in Sixteenth- and Seventeenth-Century China* ✦ **Yanhong Wu**, Zhejiang University, China

May 30

Worlds in Motion: Rome, China, and the Eurasian Steppe in Late Antiquity, ca. 250–650 C.E. ✦ *From Anacharsis to the Avars: Roman Views on Migration and the Eurasian Steppe in Historical Perspective* ✦ **Michael Maas**, Rice University ✦ *China–Steppe Relations in Historical Perspective* ✦ **Nicola Di Cosmo**, Luce Foundation Professor in East Asian Studies, School of Historical Studies ✦ *Sasanian Iran and Its Northeastern Frontier: Offense, Defense, and Diplomatic Entente* ✦ **Daniel Potts**, New York University ✦ *Two Approaches to the Representation of the Northern Dynasties: Chinese or Inner Asian* ✦ **Luo Xin**, Peking University ✦ *Peoples and Movements across Europe: The Völkerwanderungen Reconsidered* ✦ **Michael Kulikowski**, The Pennsylvania State University ✦ *Tree Rings, Climate, and People in Central Asia* ✦ **Amy Hessl**, West Virginia University ✦ *Network-Based Approaches to Understanding Economic, Social, and Political Dynamics on and across the Steppe* ✦ **Derek Ruths**, McGill University ✦ *Genetic History and Migrations in Western Eurasia 500–1000* ✦ **Patrick J. Geary**, Professor, School of Historical Studies

May 31

Worlds in Motion: Rome, China, and the Eurasian Steppe in Late Antiquity, ca. 250–650 C.E. ✦ *Mapping the Routes of Eurasia: From Maes Titianus to the Armenian Geography* ✦ **Giusto Traina**, Centre d'Histoire et Civilisation de Byzance, Université Paris-Sorbonne ✦ *Negotiated Power: Ecologies and Modes of Politics in Northern Eurasia, ca. Seventh to Tenth Centuries* ✦ **Naomi Standen**, University of Birmingham ✦ *Aspects of Elite Representation among the Early Türks (before ca. 630 A.D.)* ✦ **Sören Stark**, New York University ✦ *Fall of the Northern Wei: Collapse of a Sino-Altaic Regime* ✦ **Andrew Eisenberg**, Northeastern Illinois University ✦ *Coins and Peoples across the Hindu Kush* ✦ **Michael Alram**, Kunsthistorisches Museum Wien, Austrian Academy of Sciences ✦ *Slavery, Trade, and Cultural Exchange on Rome's Eastern Frontier* ✦ **Noel Lenski**, University of Colorado ✦ *The Circulation of Astrological Lore and Its Political Use between Roman East, Sasanian Iran, Central Asia, India, and the Turks* ✦ **Frantz Grenet**, École Pratique des Hautes Études ✦ *Luminous Markers: Pearl Imagery and the Pearl Trade in Late Antique Eurasia* ✦ **Joel Walker**, University of Washington

June 1

Worlds in Motion: Rome, China, and the Eurasian Steppe in Late Antiquity, ca. 250-650 C.E. ✦ *Byzantium's Eurasian Policy in the Age of the Türk Empire* ✦ **Mark Whittow**, Corpus Christi College, Oxford University ✦ *The Crisis of the State* ✦ **Guy Halsall**, University of York ✦ *Stateless Nomads of Central Asia* ✦ **Peter Golden**, Rutgers, The State University of New Jersey ✦ *Political Formation and Sustentation Among Imperial Nomads: The Early Turkic Empires* ✦ **Michael Drompp**, Rhodes College ✦ *The Patrimonial Political Cultures of the Medieval Tang and Turkic Empires* ✦ **Jonathan Skaff**, Shippensburg University ✦ *Sasanian Persia and the Projection of Power in Late Antique Eurasia: Competing Cosmologies and Political Landscapes Between and Beyond Ctesiphon, Constantinople, and Chang'an* ✦ **Matthew Canepa**, University of Minnesota ✦ *New Lords and the End of the Roman Empire: A Comparative Perspective* ✦ **Bryan Ward-Perkins**, Oxford University ✦ *Conference Summation* ✦ **Glen Bowersock**, Professor Emeritus, School of Historical Studies

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Professor Emeritus Enrico Bombieri (at chalkboard) with Lawrence Guth (Member 2010–11) of the Massachusetts Institute of Technology, who gave a Marston Morse Lecture on unexpected applications of polynomials in combinatorics (video available at http://video.ias.edu/marston-morse/1213).

School of Mathematics

Faculty

Jean Bourgain, IBM von Neumann Professor

Helmut Hofer

Robert MacPherson, Hermann Weyl Professor

Peter Sarnak

Thomas Spencer

Richard Taylor, Robert and Luisa Fernholz Professor

Vladimir Voevodsky

Avi Wigderson, Herbert H. Maass Professor

Professors Emeriti

Enrico Bombieri

Pierre Deligne

Phillip A. Griffiths

Robert P. Langlands

During the academic year 2012–13, the School of Mathematics conducted a special program on a new approach to the foundations of mathematics titled Univalent Foundations of Mathematics. The program was co-organized by Professor **Vladimir Voevodsky** of the School and Members Steve Awodey of Carnegie Mellon University and Thierry Coquand of the University of Gothenburg, Sweden. There were approximately twenty-five participating Members as well as many short-term visitors.

The program provided an alternative to the commonly accepted approach to the foundations of mathematics based on Zermelo-Fraenkel set theory with the axiom of choice. Univalent foundations are based instead on type theory, which has recently experienced renewed interest due to its use in computer proof assistants, for which it is better suited than set theory due to its good computational properties. The idea of univalent foundations of mathematics was proposed by Voevodsky in 2010. His vision is to remake the foundations so that pure mathematicians can take full advantage of computer assistants.

Two discoveries have led to the possibility of a new foundation on the basis of type theory. The first one is Grothendieck's conjecture, proved by Mikhail Kapranov of the Steklov Institute and Voevodsky, which states that the "world" of infinity groupoids is the same as the world of homotopy types. The second one is a method of introducing equality in constructive type theories that goes back to Member Per Martin-Löf of Stockholm University. Two more factors played instrumental roles in making possible the univalent foundations as they are now: the work of Awodey and his coworkers on the homotopy-theoretic interpretation of Martin-Löf identity types, which relates the two discoveries just mentioned and the existence of the proof assistant Coq, which is based on the Martin-Löf type theory.

Voevodsky has worked on computer-based proof assistants since 2004, when the word "univalent" appeared in this context for the first time. Especially important was the 2009 course on programming languages taught by Andrew Appel in Princeton University's computer science department in the fall of 2009, which was based on the use of Coq. The resulting conception of univalent foundations is a foundational system of type theory with an intrinsic homotopical character, augmented by principles of reasoning such as Voevodsky's new univalence

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Member Eric Finster, whose research focused on the connections between homotopy theory, higher category theory, and computer science, gave a tutorial on univalent foundations.

Members of an international team of more than two dozen researchers in computer science, logic, and mathematics participated in a special program co-organized by Professor Vladimir Voevodsky and Members Steve Awodey and Thierry Coquand. During the year, the team developed a new branch of mathematics called homotopy type theory and the related univalent foundations of mathematics, which can be used to verify the correctness of individual mathematical proofs and facilitate the large-scale formalization of mathematics.

axiom, which strengthen this interpretation, and with an accompanying implementation in a computational proof assistant.

In the first term, Voevodsky lectured weekly on the subject of type systems. A working group devoted to the Coq system was organized by Member Andrej Bauer of the University of Ljubljana and focused on modifying the Coq proof assistant to be more useful for univalent foundations. Contributors to this effort were Members Hugo Herbelin, Assia Mahboubi, and Matthieu Sozeau, all from the French National Institute for Research in Computer Science and Control. By the end of the first term, a working system was in place for use during term two.

Another working group was devoted to developing a systematic, informal style of type theory. This project, organized by Member Peter Aczel of the University of Manchester, soon evolved into the large-scale project of writing a book in which the basics of univalent foundations and the results of the special year are developed in an exemplary informal style. A third working group was devoted to formalizing homotopy theory in type theory. The main contributors to this effort were visiting student Guillaume Brunerie of the École Normale Supérieure, Paris, and Members Dan Licata, Peter Lumsdaine, and Michael Shulman.

During the second term, three main directions of work formed, each of which resulted in a noteworthy product. One was the development of basic homotopy theory in univalent foundations, including new type theoretic proofs and their formalization in the Coq system. Many homotopy groups of spheres were calculated and their proofs formalized, as were other classic results of homotopy theory. Another emphasis was the writing of the book on the univalent foundations by Members in the School. This book, available

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free online at www.homotopytypetheory.org/book, is a remarkable collaborative effort and should serve as a useful resource for teaching homotopy type theory and disseminating the results of the special year. As a third area, work on a next-generation proof assistant was started.

Access http://uf-ias-2012.wikispaces.com/seminar for a list of all seminars and http://uf-ias-2012.wikispaces.com/Tutorials for all tutorials.

OTHER SCHOOL ACTIVITIES

In the spring, the thirty-fifth Marston Morse Lectures were delivered by Lawrence Guth of the Massachusetts Institute of Technology. Guth gave three lectures, "Unexpected Applications of Polynomials in Combinatorics," "What Is Special about Polynomials?," and "The Codimension Barrier in Incidence Geometry."

Professor **Helmut Hofer** and Gang Tian of Princeton University organized the joint symplectic geometry seminar. Speakers were short-term visitors Jean-Michel Bismut of the Université Paris-Sud, Mohammed Abouzaid of Columbia University and the Simons Center for Geometry and Physics at Stony Brook University, Kenji Fukaya of the Simons Center for Geometry and Physics, Chiu-Chu Melissa Liu of Columbia University, Emmy Murphy of the Massachusetts Institute of Technology, Ana Rita Pires of Cornell University, Paul Seidel of the Massachusetts Institute of Technology, Richard Kenyon of Brown University, Jean-Pierre Marco of Université Pierre et Marie Curie, Yakov Eliashberg of Stanford University, and Leonid Polterovich of Tel Aviv University and the Simons Center for Geometry and Physics.

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Member Aleksey Zinger (left) with Professor Helmut Hofer (right), who organized a joint symplectic geometry seminar with Princeton University and continued to work on his long-term project on polyfolds and symplectic field theory.

Hofer continued work on his long-term project on polyfolds and symplectic field theory, collaborating with Member Eduard Zehnder from Eidgenössische Technische Hochschule and former Member Kris Wysocki of the Pennsylvania State University.

Mathematical Conversations, organized by Members Marian Gidea of Northeastern Illinois University, Michael Lesnick, and Dan Licata, continues to be a popular weekly event attended by Faculty, Members, short-term visitors, and mathematicians from neighboring universities. This is an informal seminar covering many aspects of mathematics and occasionally physics and biology. The emphasis is on a creating a dialog between the speaker and the audience. Some of the highlights of the seminars included talks by Members Bhargav Bhatt and Assia Mahboubi; Scott Tremaine, Richard Black Professor in the School of Natural Sciences; and Tom Hales of the University of Pittsburg.

The Thursday afternoon joint IAS and Princeton University Number Theory Seminar, which alternates between the two campuses, continues to attract a large audience. Organized by **Richard Taylor**, Robert and Luisa Fernholz Professor, and Professor **Peter Sarnak**, breakthroughs in the field were announced regularly in this seminar. This year there were presentations by Visitor Christopher Skinner of Princeton; Manjul Bhargava, also of Princeton; and Jack Thorne of Harvard University.

In March of 2013, Sarnak organized a one-day mini-workshop at the Institute in analytic methods in number theory. There were four lectures by postdoctoral mathematicians, Adam Harper of Université de Montréal, Miguel Walsh of Universidad de Buenos Aires, Julio Cesar Andrade of the University of Bristol, and Brad Rodgers of the University of California, Los Angeles. Sarnak and Nalini Anantharaman, a von Neumann Fellow in the School, have been

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Member Nalini Anantharaman gave a seminar on quantum ergodicity on large regular graphs.

working with their students on projects connected with quantum chaos. Sarnak's longer-term collaborations have continued with Amit Ghosh of Oklahoma State University; Elena Fuchs of the University of California, Berkeley; Jianya Liu of Shandong University; Zeev Rudnick of Tel Aviv University; Adrián Ubis of Universidad Autónoma de Madrid; Andre Reznikov of Bar-Ilan University; and Alexander Gamburd of the University of California, Santa Cruz, all of whom have been at the Institute in recent years.

Recently the mathematical community learned about a remarkable result of Yitang (Tom) Zhang, a lecturer at the University of New Hampshire. The result demonstrates the existence of an even number k, which is at most 107, for which x and $x+k$ are both prime for infinitely many x. It relies heavily on two ingredients: first, the work from 2005 of former Members Daniel Goldston of San Jose State University, Cem Yalçin Yildirim of Bogaziçi University, and János Pintz of the Alfréd Rényi Institute of Mathematics, and, second, the research of Professor Emeritus **Enrico Bombieri** and former Members John Friedlander of the University of Toronto and Henryk Iwaniec of Rutgers, The State University of New Jersey. Their work on levels of distribution of primes in progressions goes beyond what can be obtained from the generalized Riemann hypothesis.

This year's Analysis Seminar, organized by Member Aynur Bulut, covered a broad range of topics including mathematical physics, partial differential equations, dynamical systems, and geometry. The seminar included talks by Israel Sigal of the University of Toronto on vortices in superconductors, and Member Marian Gidea of Northeastern Illinois University on instability of a general class of driven Hamiltonian systems.

Wilhelm Schlag (far left; Member 1996–97, 2011) of the University of Chicago with Professor Thomas Spencer (far right) and Members following Schlag's analysis seminar on large data dynamics for nonlinear dispersive partial differential equations (video available at http://video.ias.edu/1213/analysis-0201-WilhelmSchlag)

Organized by Member Mark Goresky, the Members Seminar served as a colloquium-style seminar designed to give Members an overview of recent developments in mathematics. Nalini Anantharaman's lecture "Quantum Ergodicity on Large Regular Graphs" and Percy Deift's lecture on Toeplitz matrices and the Ising model were excellent examples of these seminars.

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Jürg Fröhlich from Eidgenössische Technische Hochschule Zürich is at the Institute for two years as a Visiting Professor. He is one of the leading figures in mathematical physics. This year, his research at the Institute focused on the foundations of quantum mechanics, quantum probability, and the Hamiltonian origins of friction.

Professor **Thomas Spencer** continued his work with Margherita Disertori of Université de Rouen and Member Tatyana Shcherbyna on supersymmetric models in statistical mechanics and their relation to random matrix theory. He and Fröhlich have formulated and partially proved a conjecture about the universality of mean field theory in many statistical mechanics models. Shcherbyna proved a sharp result about such mean field behavior for Gaussian band matrices in one dimension. These conjectures are inspired by early work of Eugene Wigner and Freeman Dyson, Professor Emeritus in the School of Natural Sciences.

Professor Spencer and Visiting Professor Fröhlich formulated and partially proved a conjecture about the universality of mean field theory in many statistical mechanics models—a conjecture inspired by the early work of Eugene Wigner and Freeman Dyson, Professor Emeritus in the School of Natural Sciences.

There were a number of interesting results proved in analysis by Members in the School. Using invariant measures, **Jean Bourgain**, IBM von Neumann Professor, and Member Aynur Bulut proved that nonlinear wave and Schrödinger equations are globally well-posed for radial supercritical data. Member Marius Beceanu established new dispersive estimates for the solution of the Schrödinger equation with time-dependent potentials. Veblen Research Instructor Costante Bellettini established new regularity results for calibrations.

Taylor, together with Visitors Sophie Morel and Christopher Skinner of Princeton University, organized a year-long study group on perfectoid spaces. Several mathematicians from Princeton attended the meetings as well as Veblen Research Instructor David Geraghty and Members Xin Wan, Bhargav Bhatt, Stefan Patrikis, and Jun Yu.

A description of the Computer Science and Discrete Mathematics (CSDM) program and all its activities, including two weekly seminars—with links to videos—can be found on the CSDM website, www.math.ias.edu/csdm. As part of CSDM's partnership on the Center for Computational Intractability (CCI), **Avi Wigderson**, Herbert H. Maass Professor, continued his extensive collaborations with Princeton University, Rutgers, and New York University.

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Professor Avi Wigderson gave a seminar on basic approaches to derandomizing probabilistic logspace computations (video available at http://video.ias.edu/csdm/1213/0226-AviWigderson).

A complete listing of all workshops, meetings, and seminars, and video recordings of all events can be found in the CCI website, http://intractability.princeton.edu.

Hermann Weyl Professor **Robert MacPherson** held a weekly graduate course and research seminar on applications of sheaf theory, with participation from Institute postdoctoral Members and students from Princeton University, Rutgers, and the University of Pennsylvania. MacPherson pursued joint research projects centering on applications of topology with Matthew Kahle of the Ohio State University, Menachem Lazar of Columbia University, and Jeremy Mason of Lawrence Livermore National Laboratory, all recent Institute Members, and with Amit

AMY RAMSEY

Member Daniel Grayson (left) with Nima Arkani-Hamed, Professor in the School of Natural Sciences

Patel of Rutgers and David Srolovitz of the University of Pennsylvania.

MacPherson also organized this year's Workshop on Topology: "Identifying Order in Complex Systems" together with Randall Kamien of the University of Pennsylvania and Konstantin Mischaikow of Rutgers. Locations of the workshops alternated between Rutgers and the University of Pennsylvania. Talks by term I speakers were: Robert Behringer, Duke University, "Granular Materials and Their Networks Near Jamming"; Charles Kane, University of Pennsylvania, "Topology and Electronic Phases of Matter"; Govind Menon, Brown University, "Building Polyhedra by Self-Assembly"; Salvatore Torquato, Princeton University, "Continuum Percolation and Duality with Equilibrium Hard-Hyperparticle Systems"; Julia Hockenmaier, University of Illinois at Urbana-Champaign, "Dynamic Programming for Ad-initio Predictions of Protein Folding Routes"; and Greg Huber, University of California, Santa Barbara, "Membranes, Curvature, and the Endoplasmic Reticulum." The last workshop for the term was held in conjunction with the symposium "Through the Looking Glass" at the Princeton Center for Theoretical Science.

During the second term speakers were: Yusu Wang, the Ohio State University, "Visualizing and Exploring Molecular Simulation Data via Protein Energy Landscape Metaphor"; Tsvi Tlusty, Member, School of Natural Sciences, "Loops and Self Reference in Language and Life"; David Srolovitz, University of Pennsylvania, "Properties of Cellular Microstructures: Polycrystals, Foams, and Their Idealizations"; Joshua Plotkin, University of Pennsylvania, "Evolutionary Dynamics on Correlated Fitness

Professor Robert MacPherson (center) held a weekly graduate course and research seminar on applications of sheaf theory and co-organized a topology workshop on identifying order in complex systems.

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Landscapes"; and Stephen Watson, University of Glasgow, "Toward a Covariant Theory of Coarsening via Emergent Symmetries."

Professor Emeritus **Pierre Deligne** was awarded the 2013 Abel Prize for his "seminal contributions to algebraic geometry and for their transformative impact on number theory, representation theory, and related fields." Deligne's novel ideas and resolution of long-standing problems have permeated these fields to the point where a significant portion of current research cannot be formulated without reference to his work.

Bourgain was elected a Foreign Member of the Royal Flemish Academy of Belgium for Science and the Arts, and Wigderson was elected a Member of the National Academy of Sciences.

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OUTREACH

A list of all School activities may be found at www.math.ias.edu/activities. Many of the seminars are recorded and may be viewed at http://video.ias.edu/sm. In the spring of 2013, Sarnak gave the Myhill Lectures at the University of Buffalo. In October, Hofer gave the inaugural lecture at the University of Leipzig for the opening of the Felix Klein College. The title of the lecture was "At the Interface of Dynamics and Symplectic Geometry." During late April and early May, Hofer gave the Aisenstadt Lectures, a series of three lectures, the first one of which was aimed at a general scientific audience. The title of the series was "Hamiltonian Dynamics and Symplectic Rigidity."

The Leonardo da Vinci Lectures in Milan were given by Spencer, whose lecture was titled "Symmetry Statistical Mechanics and Random Matrices," and by Fröhlich, whose lecture was titled "The Problem of Dynamics in Quantum Theory."

Wigderson gave the plenary lecture at the International Congress of Mathematical Physics in Aalborg, Denmark, in August; the public lecture at the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy, in September; the Rademacher Lecture Series at the University of Pennsylvania in November; and the William Mong Distinguished Lecture at the University of Hong Kong. In addition, he participated in the Canada/USA Mathcamp, a summer program for high school students. In April, Goresky delivered a public lecture in Wolfensohn Hall titled "A Hollywood Celebrity, the Bad Boy of Music, and the History of Modern Wireless Communications." The twentieth annual Program for Women and Mathematics was held at the Institute from May 13 to May 24, 2013. The title of this year's program was "Combinatorics and Graph Theory 2013." More information about the program activities follows this report and can also be found at www.math.ias.edu/wam.

The archive containing the unpublished notes of Atle Selberg, who served on the School's Faculty from 1951 until his death in 2007, is now housed in the Shelby White and Leon Levy Archives Center on the campus of the Institute. The archive was prepared by Institute staff with assistance from former Member Dennis Hejhal of the University of Minnesota. A finding aid for the Atle Selberg papers may be found at http://library.ias.edu/finding-aids/selberg.

MEMBERS AND VISITORS

f First Term ✦ *s* Second Term ✦ *m* Long-term Member ✦ *v* Visitor ✦ *vp* Visiting Professor ✦ *j* Joint Member School of Natural Sciences ✦ *vri* Veblen Research Instructorship ✦ *vnf* von Neumann Fellowship

Peter Aczel
Mathematical Logic ✦ The University of Manchester

Benedikt Ahrens
Semantics of Programming Languages ✦ Institute for Advanced Study
Funding provided by the National Science Foundation

Peter Albers
Symplectic Geometry ✦ Westfälische Wilhelms-Universität Münster ✦ *v*

Thorsten Altenkirch
Computer Science, Univalent Foundations ✦ University of Nottingham ✦ *s*

Nalini Anantharaman
Mathematics ✦ Université Paris-Sud 11 ✦ *vnf, s*
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Funding provided by the National Science Foundation

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Working Group on Univalent Foundations

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Working Group on Univalent Foundations

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Working Group on Univalent Foundations

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Univalent Foundations Seminar ✦ *The Simplicial Model of Univalence* ✦ **Peter LeFanu Lumsdaine**, Member, School of Mathematics

Working Group on Algebraic Number Theory

Joint IAS/PU Number Theory Seminar ✦ *Monodromy and Arithmetic Groups* ✦ **T. N. Venkataramana**, Tata Institute of Fundamental Research, Mumbai, India

December 7

Working Group on Univalent Foundations

Analysis Seminar ✦ *Nonlinear Long-Range Resonant Scattering and Kink Dynamics* ✦ **Avy Soffer**, Rutgers, The State University of New Jersey

Joint IAS/PU Symplectic Geometry Seminar ✦ *Open-Closed Gromov-Witten Invariants of Toric Calabi-Yau 3-Orbifolds* ✦ **Chiu-Chu Melissa Liu**, Columbia University

December 10

Computer Science/Discrete Mathematics Seminar I ✦ *Matching: A New Proof for an Ancient Algorithm* ✦ **Vijay Vazirani**, Georgia Institute of Technology

Members Seminar ✦ *A Tricky Problem on Sums of Two Squares* ✦ **Enrico Bombieri**, Professor Emeritus, School of Mathematics

Univalent Foundations Tutorial

December 11

Computer Science/Discrete Mathematics Seminar II ✦ *Combinatorial PCPs with Short Proofs* ✦ **Or Meir**, Member, School of Mathematics

Working Group on Univalent Foundations

Special Lecture ✦ *Quantum Beauty* ✦ **Frank Wilczek**, Massachusetts Institute of Technology ✦ *Beauty in Mathematics* ✦ **Enrico Bombieri**, Professor Emeritus, School of Mathematics

December 12

Univalent Foundations Seminar ✦ *Type Systems* ✦ **Vladimir Voevodsky**, Professor, School of Mathematics

Study Special Lecture ✦ *Universality in Mean Curvature Flow Neckpinches* ✦ **Gang Zhou**, University of Illinois at Urbana-Champaign

Mathematical Conversations ✦ *Derived Methods in Arithmetic Geometry* ✦ **Bhargav Bhatt**, Member, School of Mathematics

December 13

Univalent Foundations Seminar ✦ *Invariance under Isomorphism and Definability* ✦ **Per Martin-Löf**, Stockholm University; Member, School of Mathematics

Working Group on Algebraic Number Theory

Joint IAS/PU Number Theory Seminar ✦ *Local Global Principles for Galois Cohomology* ✦ **Julia Hartmann**, RWTH Aachen University; von Neumann Fellowship, School of Mathematics

December 14

Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Arnold Conjecture for Clifford Symplectic Pencils* ✦ **Doris Hein**, Member, School of Mathematics

December 17

Univalent Foundations Tutorial

December 18

Computer Science/Discrete Mathematics Seminar II ✦ *The SOS (AKA Lassere/Positivestellensatz/Sum-of-Squares) System* ✦ **Raghu Meka**, Member, School of Mathematics, and **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

Working Group on Univalent Foundations

December 19

Univalent Foundations Seminar ✦ *The Type System TS* ✦ **Vladimir Voevodsky**, Professor, School of Mathematics

Working Group on Univalent Foundations

Special Lecture ✦ *Reflection Positivity and Infrared Bounds for Random Loop Models* ✦ **Daniel Ueltschi**, University of Warwick

December 20

Univalent Foundations Seminar ✦ *Constructing HITs in a Realizability Model* ✦ **Andrej Bauer**, University of Ljubljana, Member, School of Mathematics

January 14

Computer Science/Discrete Mathematics Seminar I ✦ *On Bilinear Complexity* ✦ **Pavel Hrubes**, University of Washington

Univalent Foundations Organizational Meeting

January 15

Computer Science/Discrete Mathematics Seminar II ✦ *OSNAP: Faster Numerical Linear Algebra Algorithms via Sparser Subspace Embeddings* ✦ **Jelani Nelson**, Member, School of Mathematics

Working Group on Univalent Foundations

Analysis Seminar ✦ *Dispersive Estimates for Schrödinger's Equation with a Time-Dependent Potential* ✦ **Marius Beceanu**, Rutgers, The State University of New Jersey; Member, School of Mathematics

January 16

Univalent Foundations Seminar ✦ *Simplicial Types* ✦ **Peter LeFanu Lumsdaine**, Member, School of Mathematics

Working Group on Univalent Foundations

Mathematical Conversations ✦ *Duality, Universality, and Random Matrices* ✦ **Thomas Spencer**, Professor, School of Mathematics

January 17

Univalent Foundations Seminar ✦ *State of the New Proof Assistant* ✦ **Daniel Grayson**, University of Illinois at Urbana-Champaign; Member, School of Mathematics

Joint IAS/PU Number Theory Seminar ✦ *Counting Rational Points on Cubic Surfaces* ✦ **Pierre Le Boudec**, Member, School of Mathematics

January 18

Working Group on Univalent Foundations

January 21

Computer Science/Discrete Mathematics Seminar I ✦ *Clique Number of Random Geometric Graphs in High Dimension* ✦ **Sebastien Bubeck**, Princeton University

Univalent Foundations Tutorial

January 22

Computer Science/Discrete Mathematics Seminar II ✦ *Sparsity Lower Bounds for Dimensionality Reducing Maps* ✦ **Jelani Nelson**, Member, School of Mathematics

Working Group on Univalent Foundations

Analysis Seminar ✦ *Hamiltonian Evolution Equations—Where They Come From, What They Are Good For* ✦ **Jürg Fröhlich**, Eidgenössische Technische Hochschule Zürich; Visiting Professor, School of Mathematics

Analysis Seminar ✦ *Sphere Packing Bounds via Spherical Codes* ✦ **Henry Cohn**, Microsoft Research New England and Massachusetts Institute of Technology

January 23

Univalent Foundations Seminar ✦ *Homotopy and Univalence* ✦ **Thorsten Altenkirch**, University of Nottingham; Member, School of Mathematics

Working Group on Univalent Foundations

Mathematical Conversations ✦ *Provable Bounds in Machine Learning* ✦ **Ankur Moitra**, Member, School of Mathematics

January 24

Univalent Foundations Seminar ✦ *Orthogonal Factorization in HoTT* ✦ **Egbert Rijke**, Radboud University Nijmegen

Joint IAS/PU Number Theory Seminar ✦ *Abelian Varieties with Maximal Galois Action on Their Torsion Points* ✦ **David Zywina**, Member, School of Mathematics

January 25

Working Group on Univalent Foundations

January 28

Computer Science/Discrete Mathematics Seminar I ✦ *New Independent Source Extractors with Exponential Improvement* ✦ **Xin Li**, University of Washington

Members Seminar ✦ *Toeplitz Matrices and Determinants under the Impetus of the Ising Model* ✦ **Percy A. Deift**, Courant Institute of Mathematical Sciences, New York University

Univalent Foundations Tutorial

January 29

Computer Science/Discrete Mathematics Seminar II ✦ *The Ribe Program* ✦ **Manor Mendel**, The Open University of Israel; von Neumann Fellow, School of Mathematics

Working Group on Univalent Foundations

Analysis Seminar ✦ *Toeplitz Matrices and Determinants under the Impetus of the Ising Model* ✦ **Percy A. Deift**, Courant Institute of Mathematical Sciences, New York University; Member, School of Mathematics

January 30

Univalent Foundations Seminar ✦ *Weak Infinity Groupoids in HoTT* ✦ **Guillaume Brunerie**, École Normale Supérieure

Working Group on Univalent Foundations

January 31

Univalent Foundations Seminar ✦ *The Calculus of Opetopes* ✦ **Eric Lee Finster**, Member, School of Mathematics

Joint IAS/PU Number Theory Seminar ✦ *Automorphic Levi-Sobolev Spaces, Boundary-Value Problems, and Self-Adjoint Operators* ✦ **Paul Garrett**, University of Minnesota

February 1

Working Group on Univalent Foundations

Analysis Seminar ✦ *Large Data Dynamics for Nonlinear Dispersive PDEs* ✦ **Wilhelm Schlag**, The University of Chicago

Mathematical Conversations ✦ *Quantum Theory and Topos Theory* ✦ **Bas Spitters**, Radboud University Nijmegen; Member, School of Mathematics

February 4

Computer Science/Discrete Mathematics Seminar I ✦ *Influences, Traces, Tribes, and Perhaps Also Thresholds* ✦ **Gil Kalai**, The Hebrew University of Jerusalem and Yale University

Members Seminar ✦ *Quantum Ergodicity on Large Regular Graphs* ✦ **Nalini Anantharaman**, Université Paris-Sud 11; von Neumann Fellowship, School of Mathematics

Univalent Foundations Tutorial

February 5

Computer Science/Discrete Mathematics Seminar II ✦ *Ramsey Theory for Metric Spaces* ✦ **Manor Mendel**, The Open University of Israel; von Neumann Fellowship, School of Mathematics

Working Group on Univalent Foundations

February 6

Univalent Foundations Seminar ✦ *A Quillen Model Structure in Type Theory* ✦ **Peter LeFanu Lumsdaine**, Member, School of Mathematics

Working Group on Univalent Foundations

Workshop on Topology: Identifying Order in Complex Systems ✦ *Visualizing and Exploring Molecular Simulation Data via Protein Energy Landscape Metaphor* ✦ **Yusu Wang**, The Ohio State University

Workshop on Topology: Identifying Order in Complex Systems ✦ *Linear Algebra over Cell Complexes: Applications to Data, Coding, and Sensor Networks* ✦ **Justin Curry**, University of Pennsylvania

Mathematical Conversations ✦ *What Is a Higher-Order Object?* ✦ **Nils A. Baas**, Norwegian University of Science and Technology; Member, School of Mathematics; Member, School of Natural Sciences

February 7

Univalent Foundations Seminar ✦ *Isomorphic Structures of Any Kind Are "Equal" in HoTT: But What Is a Kind of Structure?* ✦ **Peter Aczel**, The University of Manchester; Member, School of Mathematics

Working Group on Algebraic Number Theory ✦ *An Introduction to Motives* ✦ **Joseph Ayoub**, Universität Zürich

Joint IAS/PU Number Theory Seminar ✦ *Relative Artin Motives and the Reductive Borel-Serre Compactification of a Locally Symmetric Variety* ✦ **Joseph Ayoub**, Universität Zürich

February 8

Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Toric B-Symplectic and Origami Manifolds* ✦ **Ana Rita Pires**, Cornell University

February 11

Computer Science/Discrete Mathematics Seminar I ✦ *Mathematical Theories of Interaction with Oracles: Active Property Testing and New Models for Learning Boolean Functions* ✦ **Liu Yang**, Carnegie Mellon University

Members Seminar ✦ *Homological Mirror Symmetry* ✦ **Nick Sheridan**, Princeton University; Veblen Research Instructorship, School of Mathematics

Univalent Foundations Tutorial

February 12

Computer Science/Discrete Mathematics Seminar II ✦ *High Dimensional Expanders and Ramanujan Complexes* ✦ **Alex Lubotzky**, The Hebrew University of Jerusalem

Working Group on Univalent Foundations

February 13

Univalent Foundations Seminar ✦ *The Hopf Fibration via Higher Inductive Types* ✦ **Peter LeFanu Lumsdaine**, Member, School of Mathematics

Mathematical Conversations ✦ *Kozai-Lidov Oscillations* ✦ **Scott Tremaine**, Richard Black Professor, School of Natural Sciences

February 14

Univalent Foundations Seminar ✦ *On Finite Types That Are Not H-Sets* ✦ **Sergey Melikhov**, Steklov Mathematical Institute, Russian Academy of Sciences; Member, School of Mathematics

Working Group on Algebraic Number Theory

Joint IAS/PU Number Theory Seminar ✦ *Regularized Periods of Automorphic Forms* ✦ **Atsushi Ichino**, Kyoto University

February 15

Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Contact Nonsqueezing and Rabinowitz Floer Homology* ✦ **Peter Albers**, Westfälische Wilhelms-Universität Münster; Visitor, School of Mathematics

February 18

Computer Science/Discrete Mathematics Seminar I ✦ *Connectedness, Sperner's Lemma, and Combinatorial Problems* ✦ **Penny Haxell**, University of Waterloo

Univalent Foundations Tutorial

February 19

Computer Science/Discrete Mathematics Seminar II ✦ *The Chasm at Depth 3* ✦ **Shubhangi Saraf**, Rutgers, The State University of New Jersey

Working Group on Univalent Foundations

Analysis Seminar ✦ *New Approximations of the Total Variation, and Filters in Image Processing* ✦ **Haim Brezis**, Rutgers, The State University of New Jersey

February 20

Univalent Foundations Seminar ✦ $\pi_2(s^2)$ *in HoTT* ✦ **Guillaume Brunerie**, École Normale Supérieure

Working Group on Univalent Foundations

February 21

Univalent Foundations Seminar ✦ *Locally Cartesian Closed Infinity Categories* ✦ **Joachim Kock**, Universitat Autònoma de Barcelona

Joint IAS/PU Number Theory Seminar ✦ *Compactifications of PEL-Type Shimura Varieties and Kuga Families with Ordinary Loci* ✦ **Kai-Wen Lan**, University of Minnesota

February 22

Working Group on Univalent Foundations ✦ *The Universe Is Indiscrete* ✦ **Martin Escardo**, University of Birmingham

Joint IAS/PU Symplectic Geometry Seminar ✦ *Symplectic Cohomology and Loop Homology* ✦ **Mohammed Abouzaid**, Columbia University and Simons Center for Geometry and Physics, Stony Brook University, The State University of New York

February 25

André Joyal's Seventieth Birthday ✦ *A Type System with Two Kinds of Identity Types* ✦ **Vladimir Voevodsky**, Professor, School of Mathematics ✦ *Connectedness and the Freudenthal Suspension Theorem* ✦ **Peter LeFanu Lumsdaine**, Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar I ✦ *Polar Codes and Randomness Extraction for Structured Sources* ✦ **Emmanuel Abbe**, Princeton University

Members Seminar ✦ *Collective Phenomena, Collective Motion, and Collective Action in Ecological Systems* ✦ **Simon Levin**, Princeton University

André Joyal's Seventieth Birthday ✦ *Joyal Theorems for Homotopical Species* ✦ **Joachim Kock**, Universitat Autònoma de Barcelona ✦ *Rings and Near Rings in 2-Monoidal Categories* ✦

Marcelo Aguiar, Texas A&M University ✦ *Braid Extended Power Operations in Topology* ✦ **Terry Bisson**, Canisius College

February 26
Computer Science/Discrete Mathematics Seminar II ✦ *Derandomizing BPL?* ✦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

Working Group on Univalent Foundations

February 27
Univalent Foundations Seminar ✦ *Semantics of Higher Inductive Types* ✦ **Michael Shulman**, Member, School of Mathematics

Working Group on Univalent Foundations

Mathematical Conversations ✦ *Local Codes and Symmetry* ✦ **Klim Efremenko**, Member, School of Mathematics

February 28
Univalent Foundations Seminar ✦ *Formal Abstract Homotopy Theory* ✦ **Jeremy Avigad**, Carnegie Mellon University

Working Group on Algebraic Number Theory

Presentation on the History of the Institute and the School of Mathematics ✦ **Christine Di Bella**, Archivist, and **Erica Mosner**, Archival Assistant, Shelby White and Leon Levy Archives Center

Joint IAS/PU Number Theory Seminar ✦ Standard and Nonstandard Comparisons of Relative Trace Formulas ✦ **Yiannis Sakellaridis**, Rutgers, The State University of New Jersey

March 1
Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Intermediate Symplectic Capacities* ✦ **Alvaro Pelayo**, Washington University in St. Louis; Member, School of Mathematics

March 4
Computer Science/Discrete Mathematics Seminar I ✦ *Quasirandom Hypergraphs* ✦ **Dhruv Mubayi**, University of Illinois at Chicago

Members Seminar ✦ *Hodge and Chern Numbers of Algebraic Varieties Sixty Years after Hirzebruch's Riemann-Roch Theorem* ✦ **Dieter Kotschick**, Ludwig-Maximilians-Universität München; Member, School of Mathematics

Univalent Foundations Tutorial

March 5
Computer Science/Discrete Mathematics Seminar II ✦ *Derandomization of Probabilistic Logspace (the Nisan Variations)* ✦ **Avi Wigderson**, Herbert H. Maass Professor, School of Mathematics

Working Group on Univalent Foundations

March 6
Univalent Foundations Seminar ✦ *Cohomology in Homotopy Type Theory* ✦ **Eric Lee Finster**, Member, School of Mathematics

Working Group on Univalent Foundations

Workshop on Topology: Identifying Order in Complex Systems ✦ *Loops and Self Reference in Language and Life* ✦ **Tsvi Tlusty**, Member, School of Natural Sciences ✦ *Locality and Unitarity from Positivity: Beyond the Positive Grassmannian* ✦ **Nima Arkani-Hamed**, Professor, School of Natural Sciences ✦ *The Optimality of the Interleaving Distance on Multidimensional Persistence Modules* ✦ **Michael Lesnick**, Member, School of Mathematics

March 7
Univalent Foundations Seminar ✦ *Setoids, E-Categories, and Exact Completions* ✦ **Richard Garner**, Queen Mary, University of London

Working Group on Algebraic Number Theory

Joint IAS/PU Number Theory Seminar ✦ *Goren-Oort Stratification of Hilbert Modular Varieties Mod P and Tate Conjecture* ✦ **Liang Xiao**, The University of Chicago

March 8
Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Lagrangian Caps in High-Dimensional Symplectic Manifolds* ✦ **Emmy Murphy**, Massachusetts Institute of Technology

March 11
Computer Science/Discrete Mathematics Seminar I ✦ *Intractability in Algorithmic Game Theory* ✦ **Tim Roughgarden**, Stanford University

Members Seminar ✦ *Random Matrices, Dimensionality Reduction, and Faster Numerical Linear Algebra Algorithms* ✦ **Jelani Nelson**, Member, School of Mathematics

Univalent Foundations Tutorial

March 12
Computer Science/Discrete Mathematics Seminar II ✦ *Sensitivity versus Block Sensitivity, I* ✦ **Hao Huang**, Member, School of Mathematics

Working Group on Univalent Foundations

Marston Morse Lectures ✦ *Unexpected Applications of Polynomials in Combinatorics* ✦ **Lawrence Guth**, Massachusetts Institute of Technology

March 13
Univalent Foundations Seminar ✦ *Eilenberg-Mac Lane Spaces in HoTT* ✦ **Dan Licata**, Member, School of Mathematics

Working Group on Univalent Foundations

Marston Morse Lectures ✦ *What Is Special about Polynomials? (Perspectives from Coding Theory and Differential Geometry)* ✦ **Lawrence Guth**, Massachusetts Institute of Technology

March 14
Univalent Foundations Seminar ✦ *Homotopy Colimits and a Descent Theorem* ✦ **Egbert Rijke**, Radboud University Nijmegen

Working Group on Algebraic Number Theory

Joint IAS/PU Number Theory Seminar ✦ *An Analogue of the Ichino-Ikeda Conjecture for Whittaker Coefficients of the Metaplectic Group* ✦ **Erez Lapid**, The Hebrew University of Jerusalem and Weizmann Institute of Science

March 15
Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Resonance for Loop Homology on Spheres* ✦ **Nancy Hingston**, The College of New Jersey; Member, School of Mathematics

Mathematical Conversations ✦ *In Computers We Trust?* ✦ **Tom Hales**, University of Pittsburgh

March 18
Computer Science/Discrete Mathematics Seminar I ✦ *Constant Rate PCPs for Circuit-SAT with Sublinear Query Complexity* ✦ **Eli Ben-Sasson**, Technion–Israel Institute of Technology and Massachusetts Institute of Technology

Members Seminar ✦ *Five Stages of Accepting Constructive Mathematics* ✦ **Andrej Bauer**, University of Ljubljana

Univalent Foundations Tutorial

March 19
Computer Science/Discrete Mathematics Seminar II ✦ *Sensitivity versus Block Sensitivity, II* ✦ **Hao Huang**, Member, School of Mathematics

Working Group on Univalent Foundations

Analysis Seminar ✦ *Dynamics of Gibbs Measure Evolution for the Radial Nonlinear Schrödinger and Wave Equations on the Ball* ✦ **Aynur Bulut**, Member, School of Mathematics

March 20

Univalent Foundations Seminar ✦ *Gluing in Homotopy Type Theory* ✦ **Michael Shulman**, Member, School of Mathematics

Working Group on Univalent Foundations

Mathematical Conversations ✦ *A Trip to the Moon* ✦ **Marian Gidea**, Northeastern Illinois University; Member, School of Mathematics

March 21

Univalent Foundations Seminar ✦ *A Proof Assistant Prototype Based on Algebraic Effects and Handlers* ✦ **Andrej Bauer**, University of Ljubljana

March 22

Univalent Foundations Seminar ✦ *Substructural Type Theory* ✦ **Noam Zeilberger**, IMDEA Software Institute; Member, School of Mathematics

Joint IAS/PU Symplectic Geometry Seminar ✦ *The Hypoelliptic Laplacian* ✦ **Jean-Michel Bismut**, Université Paris-Sud 11

March 25

Computer Science/Discrete Mathematics Seminar I ✦ *New Locally Decodable Codes from Lifting* ✦ **Madhu Sudan**, Microsoft Research

Members Seminar ✦ *Rigidity of Actions on CAT(0) Cube Complexes* ✦ **Alessandra Iozzi**, Eidgenössische Technische Hochschule Zürich; Member, School of Mathematics

Univalent Foundations Tutorial ✦ *Isomorphism of Types: a Simple(-Typed) Viewpoint* ✦ **Sergei Soloviev**, Institut de Recherche en Informatique de Toulouse

March 26

Special Seminar Lecture ✦ *The Hypoelliptic Laplacian: An Introduction* ✦ **Jean-Michel Bismut**, Université Paris-Sud 11

Working Group on Univalent Foundations

Analysis Seminar ✦ *Partial Regularity of Solutions to the Navier-Stokes Equations in High Dimensions* ✦ **Hongjie Dong**, Brown University

March 27

Univalent Foundations Seminar ✦ *The James Construction and $\pi_4(s^3)$* ✦ **Guillaume Brunerie**, École Normale Supérieure

Working Group on Univalent Foundations

Special Lectures in Analysis/Number Theory ✦ *Norm Convergence of Nonconventional Ergodic Averages* ✦ **Miguel Walsh**, Universidad de Buenos Aires ✦ *A Zero-Density Approach to Smooth Numbers* ✦ **Adam Harper**, Université de Montréal ✦ *Mean Values of L-Functions for the Hyperelliptic Ensemble* ✦ **Julio Andrade**, Brown University ✦ *Statistics of the Zeros of the Zeta Function: Mesoscopic and Macroscopic Phenomena* ✦ **Brad Rodgers**, University of California, Los Angeles

March 28

Univalent Foundations Seminar ✦ *Natural Models of Type Theory* ✦ **Steve Awodey**, Carnegie Mellon University; Member, School of Mathematics

Joint IAS/PU Number Theory Seminar ✦ *Non-Archimedean Approximations by Special Points* ✦ **Philipp Habegger**, Goethe-Universität Frankfurt am Main; von Neumann Fellowship, School of Mathematics

March 29

Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Dimers and Integrability* ✦ **Richard Kenyon**, Brown University

Mathematical Conversations ✦ *Constructing Invariants in Symplectic Geometry* ✦ **Alvaro Pelayo**, Washington University in St. Louis; Member, School of Mathematics

April 1

Computer Science/Discrete Mathematics Seminar I ✦ *Device Independence: A New Paradigm for Randomness Manipulation?* ✦ **Thomas Vidick**, Massachusetts Institute of Technology

Members Seminar ✦ *Conformal Dynamics in Pseudo-Riemannian Geometry: Around a Question of A. Lichnerowicz* ✦ **Charles Frances**, Université Paris-Sud 11; Member, School of Mathematics

Univalent Foundations Tutorial

April 2

Computer Science/Discrete Mathematics Seminar II ✦ *An Arithmetic Analogue of Fox's Improved Triangle Removal Lemma* ✦ **Sushant Sachdeva**, Princeton University

Working Group on Univalent Foundations

Analysis Seminar ✦ *Resonances for Normally Hyperbolic Trapped Sets* ✦ **Semyon Dyatlov**, University of California, Berkeley

April 3

Univalent Foundations Seminar ✦ *On the Category of HSets* ✦ **Bas Spitters**, Radboud University Nijmegen; Member, School of Mathematics

Working Group on Univalent Foundations

Workshop on Topology: Identifying Order in Complex Systems ✦ *Properties of Cellular Microstructures: Polycrystals, Foams, and Their Idealizations* ✦ **David Srolovitz**, University of Pennsylvania ✦ Evolutionary *Dynamics on Correlated Fitness Landscapes* ✦ **Joshua Plotkin**, University of Pennsylvania ✦ *Toward a Covariant Theory of Coarsening via Emergent Symmetries* ✦ **Stephen Watson**, University of Glasgow

April 4

Univalent Foundations Seminar ✦ *HoTT Is a Polyvalent Foundation of Mathematics* ✦ **André Joyal**, Université du Québec à Montréal

Working Group on Algebraic Number Theory
Joint IAS/PU Number Theory Seminar ✦ *A Converse to a Theorem of Gross-Zagier-Kolyvagin* ✦ **Christopher Skinner**, Princeton University; Visitor, School of Mathematics

April 5

Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Manifolds with G2 Holonomy and Contact Structures* ✦ **Sema Salur**, University of Rochester and Princeton University

April 8

Members Seminar ✦ *Small Height and Infinite Non-Abelian Extensions* ✦ **Philipp Habegger**, University of Frankfurt; von Neumann Fellowship, School of Mathematics

Univalent Foundations Tutorial

April 9

Computer Science/Discrete Mathematics Seminar II ✦ *What Is Geometric Entropy, and Does It Really Increase?* ✦ **Jozsef Beck**, Rutgers, The State University of New Jersey

Working Group on Univalent Foundations

Analysis Seminar ✦ *Calibrations of Degree Two and Regularity Issues* ✦ **Costante Bellettini**, Princeton University; Veblen Research Instructorship, School of Mathematics

April 10

Univalent Foundations Seminar ✦ *Directed Type Theory* ✦ **Michael A. Warren**, Member, School of Mathematics

Working Group on Univalent Foundations

Special Number Theory Seminar ✦ *Solvability in Polynomials of Pell Equations in a Pencil and a Conjecture of Pink* ✦ **Umberto Zannier**, Scuola Normale Superiore di Pisa

April 11

Univalent Foundations Final Seminar ✦ *Homotopy Theory in Type Theory* ✦ "The Homotopy Group": **Guillaume Brunerie**, École Normale Supérieure; **Dan Licata**, Member, School of Mathematics; and **Peter LeFanu Lumsdaine**, Member, School of Mathematics

Analysis Seminar ✦ *Hamiltonian Instability Driven by Recurrent Dynamics* ✦ **Marian Gidea**, Northeastern Illinois University; Member, School of Mathematics

Joint IAS/PU Number Theory Seminar ✦ *Symmetric Power Functoriality for GL(2)* ✦ **Jack Thorne**, Harvard University

April 12

Working Group on Univalent Foundations

Joint IAS/PU Symplectic Geometry Seminar ✦ *Construction of the Kuranishi Structure on the Moduli Space of Pseudo-Holomorphic Curves* ✦ **Kenji Fukaya**, Simons Center for Geometry and Physics, Stony Brook University, The State University of New York

Working Group on Univalent Foundations

Mathematical Conversations ✦ *Zeros of Zeta Functions and the Riemann Hypothesis* ✦ **Anders Södergren**, Member, School of Mathematics

April 15

Computer Science/Discrete Mathematics Seminar I ✦ *Analytical Approach to Parallel Repetition* ✦ **Irit Dinur**, Weizmann Institute of Science and Radcliffe Institute for Advanced Study, Harvard University

April 18

Working Group on Algebraic Number Theory

Joint IAS/PU Number Theory Seminar ✦ *Most Hyperelliptic Curves over Q Have No Rational Points* ✦ **Manjul Bhargava**, Princeton University

April 19

Joint IAS/PU Symplectic Geometry Seminar ✦ *Examples of Nearly Integrable Systems with Asymptotically Dense Projected Orbits* ✦ **Jean-Pierre Marco**, Université Pierre et Marie Curie

April 22

Computer Science/Discrete Mathematics Seminar I ✦ *Diffuse Decompositions of Polynomials* ✦ **Daniel Kane**, Stanford University

April 23

Computer Science/Discrete Mathematics Seminar II ✦ *Uncertainty Principle* ✦ **Klim Efremenko**, Member, School of Mathematics

Analysis Seminar ✦ *Conformal Invariants from Nodal Sets* ✦ **Dmitry Jakobson**, McGill University

April 25

Special Lecture ✦ *Integrable Stochastic Particle Systems and Macdonald Processes* ✦ **Alexei Borodin**, Massachusetts Institute of Technology

Working Group on Algebraic Number Theory

Joint IAS/PU Number Theory Seminar ✦ *Harmonic Maass Forms of Weight One* ✦ **William Duke**, University of California, Los Angeles

April 26

Analysis Seminar ✦ *New Limiting Theorems for the Mobius Function* ✦ **Yakov Sinai**, Princeton University

April 29

Computer Science/Discrete Mathematics Seminar I ✦ *Cryptography and Preventing Collusion in Second Price (Vickery) Auctions* ✦ **Michael Rabin**, Harvard University and Columbia University

April 30

Computer Science/Discrete Mathematics Seminar II ✦ *Combinatorial Walrasian Equilibrium* ✦ **Michal Feldman**, The Hebrew University of Jerusalem

Analysis Seminar ✦ *A Non-Isotropic Mechanism for the Formation of Trapped Surfaces* ✦ **Sergiu Klainerman**, Princeton University

May 2

Working Group on Algebraic Number Theory

Joint IAS/PU Number Theory Seminar ✦ *Moduli of Representations and Pseudorepresentations* ✦ **Carl Wang Erickson**, Harvard University

May 6

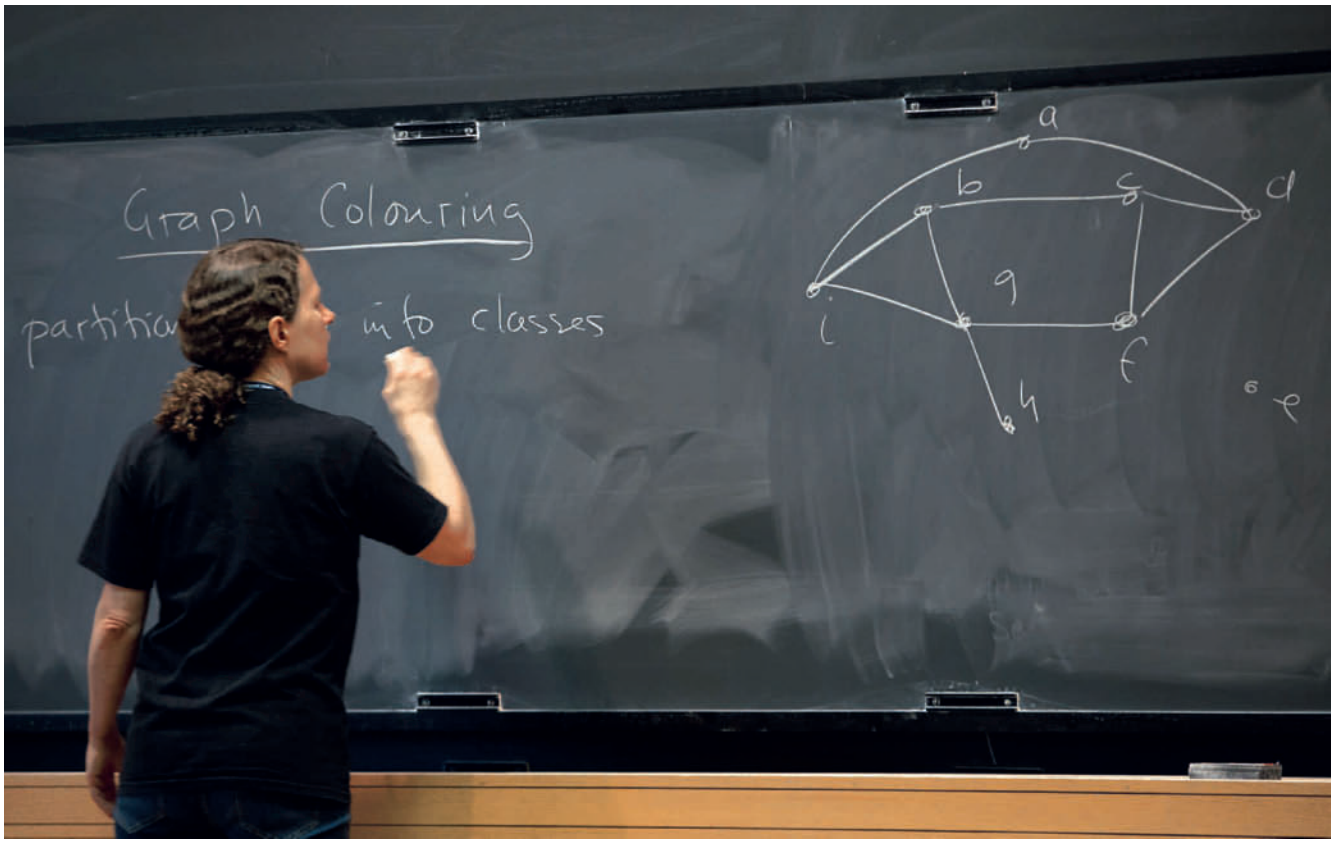
Computer Science/Discrete Mathematics Seminar I ✦ *Tight Bounds for Set Disjointness in the Message-Passing Model* ✦ **Rotem Oshman**, University of Toronto

May 10

Special Mathematical Physics Seminar ✦ *Planar Ising Model: Discrete and Continuous Structures* ✦ **Clement Hongler**, Columbia University

Computer Science/Discrete Mathematics Seminar I ✦ *Nondeterministic Direct Product Reductions and the Success Probability of SAT Solvers* ✦ **Andrew Drucker**, Member, School of Mathematics

Computer Science/Discrete Mathematics Seminar I ✦ *Association Schemes, Noncommutative Polynomials and Lasserre Lower Bounds for Planted Clique* ✦ **Raghu Meka**, Visitor, School of Mathematics



ANDREA KANE

Penny Haxell of the University of Waterloo gave four lectures on basic graph theory.

Program for Women and Mathematics

The twentieth annual Program for Women and Mathematics was held at the Institute for Advanced Study May 13–24, 2013. Program activities were sponsored by the Institute and Princeton University and generously supported by the National Science Foundation.

The program's goal is to encourage undergraduate and graduate students to continue their math education. Research mathematicians give talks and seminars, which focus on a particular topic. "Combinatorics and Graph Theory 2013" was the title of this year's program.

Twenty-one undergraduates, thirty-two graduate students, and eleven postdoctoral mathematicians attended the program.

Program organizers were Dusa McDuff of Barnard College, Christine Taylor of the Institute and Princeton University, Sun-Yung Alice Chang of Princeton University, and Antonella Grassi of the University of Pennsylvania.

Four lectures on polytopes were given by Margaret Readdy of the University of Kentucky, and four lectures in a series titled "Topics in Enumerative Combinatorics" were given by Lauren Williams of the University of California, Berkeley.

Maria Chudnovsky of Columbia University gave four lectures on graph structure, and Penny Haxell of the University of Waterloo gave four lectures on basic graph theory.

Yue Cai of the University of Kentucky and Olya Mandelshtam of the University of California, Berkeley, acted as teaching assistants for combinatorics, and Katherine Edwards of Princeton University and Anita Liebenau of Freie Universität Berlin served as graph theory teaching assistants.

Research seminars were as follows: Deborah Chun, West Virginia University Institute of Technology, "What is a Matroid?"; Martha Yip, University of Pennsylvania, "Walking in Alcoves and Formulas for Macdonald Polynomials"; Kitty Meeks, Queen Mary, University of London, "Flood-filling Games on Graphs"; Radmila

Sazdanovic, University of Pennsylvania, "Categorifications of the Chromatic Polynomials"; Viola Mészáros, University of Szeged, "Long Alternating Paths"; Briana Foster-Greenwood, Idaho State University, "Reflection Length and Codimension Posets for Complex Reflection Groups"; Amanda Redlich, Rutgers, The State University of New Jersey, "Gluing Graphs, Ungluing Graphs, and First-Order Logic with Parity"; Michele Lastrina, Dickinson College, "Sum List Coloring Graphs"; and Shabnam Beheshti, Rutgers, The State University of New Jersey, "Solving Nonlinear PDEs Using Combinatorial Structures."

The first of five Women-in-Science seminars included introductions. Three of the Women-in-Science seminars were panel discussions, "Work-Life Balance in a Mathematics Career"; "Becoming an Academic Mathematician"; and "Succeeding in Graduate School." The fifth seminar, "Bringing Diversity to Mathematics," was given by Rhonda Hughes of Bryn Mawr College. Panel participants were: Shabnam Beheshti, Rutgers, The State University of New Jersey; Patricia Cahn, University of Pennsylvania; Connie Chen, Wandl, Inc.; Cynthia Curtis, The College of New Jersey; Susan Durst, Rutgers, The State University of New Jersey; Antonella Grassi, University of Pennsylvania; Haydee Herrera, Rutgers, The State University of New Jersey; Delaram Kahrobaei, City University of New York; Amand Redlich, Rutgers, The State University of New Jersey; Radmila Sazdanovic, Rutgers, The State University of New Jersey; Christina Sormani, Lehman College, City University of New York; Lisa Traynor, Bryn Mawr College; Katrin Wehrheim, Massachusetts Institute of Technology; and Martha Yip, University of Pennsylvania.

Colloquia were given by Fan Chung of the University of California, San Diego, whose session was titled "Can You Hear the Shape of a Network? New Directions in Spectral Graph Theory"; Michelle Wachs of the University of Miami, whose session was titled "Eulerian Polynomials, Chromatic Quasi-Symmetric Functions, and Hessenberg Varieties"; and Jennifer Chayes of Microsoft, whose session was titled "Age of Networks."

Two special lectures were held. Ruixiang Zhang of Princeton University gave a lecture on "Producing Bipartite Ramanujan Graphs Using the 2-Lifting Method." Richard Ehrenborg of the University of Kentucky and undergraduate students from Princeton University Carolyn Chen, Max Kaplan, Bing Lin, and Daniel Toro, talked about "Mathematical Magic."

During two informal dinners there was a "chat" with Fan Chung of the University of California, San Diego, and an "Introduction to the National Science Foundation and Funding Opportunities" by NSF combinatorics program director Qing Xiang.

On Monday, May 20, participants visited the campus of Princeton University for the day to hear talks by Stefan van Zwam, "Connecticity in Graphs and Matroids"; Zeev Dvir "Arrangements of Points with Many Collinear

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The Program for Women and Mathematics aims to encourage undergraduate and graduate students to continue their math education.

Triples"; Irene Lo, "Excluding a Near-clique and a Near-Anticlique"; and Jing Chen, an Institute Member, "Optimal Waiting Times and Assignments in Healthcare Provision." The afternoon panel discussion focused on "Career Paths for Women in Mathematics." Members of the panel were Alexandra Fradkin, Center for Communications Research; Lisa Goldberg, Coleman Fung Risk Management Research Center; Allyn Jackson, American Mathematical Society; and Tal Rabin, IBM Thomas J. Watson Research Center.

Participants attending the program were from the following universities and colleges: Adam Mickiewicz University, Pozna , Poland; Auburn University; Bryn Mawr College; California State University; Carnegie Mellon University; City College of New York; Concordia University; Dartmouth College; Dickinson College; Emory University; Franciscan University of Steubenville; Freie Universität Berlin; Harvard University; Idaho State University; Iowa State University; Laboratoire d'Informatique, de Robotique et de Microélectronique de Montpellier; Marshall University; Massachusetts Institute of Technology; Michigan State University; New York University; North Carolina State University; Northeastern University; Pomona College; Princeton University; Queen Mary, University of London; Rutgers, The State University of New Jersey; Simon Fraser University; Stanford University; Stony Brook University; Sweet Briar College; The College of New Jersey; Trinity University; University of California, Berkeley; University of Illinois at Urbana-Champaign; University of Kentucky; University of Massachusetts; University of Michigan; University of Minnesota; University of Nebraska; University of Pennsylvania; University of Szeged; University of Warwick; University of Waterloo; University of Wisconsin–Madison;Vanderbilt University; Wesleyan University; West Virginia University of Technology; Wilfrid Laurier University; and York University.

At the conclusion of the program activities, participants were asked to complete a questionnaire regarding the material and level of the lectures, the structure and organization of the program, and the quality of the facilities. Everyone expressed their appreciation for the opportunity to take part in the program and the outstanding talks. Some participant comments follow: "This program has been an incredible opportunity to grow for me; not only as a mathematician, but also as a student and woman overall"; "This was a wonderful experience! It's rare that I encounter women who are technical minded like me, who enjoy math riddles and problem sets. This makes me feel less like I'm strange, or at least, if I am weird, there are other women who are weird like me, and I like them"; "I loved having such a large group of women studying math together. The support network that we created, and the friendships we created are incredibly valuable. The seminars on women in science were very helpful. Throughout the series, I learned important lessons about math, graduate school, working in academia, working in industry, and succeeding in life. Together, these sessions have changed my perspective on many things and have encouraged my goals for the future."

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Professor Juan Maldacena (at chalkboard) with Jürg Fröhlich (center), Visiting Professor in the School of Mathematics, and Members

School of Natural Sciences

Faculty

Nima Arkani-Hamed

Peter Goddard

Stanislas Leibler

Juan Maldacena

Nathan Seiberg

Scott Tremaine, Richard Black Professor

Edward Witten, Charles Simonyi Professor

Matias Zaldarriaga

Professors Emeriti

Stephen L. Adler

Freeman J. Dyson

Peter Goldreich

Arnold J. Levine

In the last year, Professor **Nima Arkani-Hamed** has continued his involvement in physics beyond the Standard Model and more formal properties of gauge theory scattering amplitudes.

The biggest news in particle physics over the last year was the discovery of a particle with properties of the Higgs boson. In the early data, there was a hint of an enhancement in the diphoton decay channel. While it was most likely that this was not pointing to new physics, it was an interesting exercise to take it seriously and understand its new physics ramifications. With his postdocs, Arkani-Hamed realized that the excess was categorically impossible to explain within a wide class of "unnatural" theories, where only one scalar (the Higgs) is fine-tuned to be light, and the only new particles beyond the Standard Model are fermions. This includes a set of ideas for new physics revolving around "split supersymmetry (SUSY)" that Arkani-Hamed has been exploring on and off for almost a decade, which in their minimal version predicted a Higgs mass between 120–135 GeV, and have therefore passed a (mild) first test with the discovery of the Higgs-like boson at 125 GeV. Additional fermions are perfectly possible in this picture, but in order to get a big diphoton enhancement, Arkani-Hamed and his collaborators showed that the needed Yukawa couplings to the Higgs would be so large as to trigger disastrous vacuum instability right around the TeV scale. They concluded that if the diphoton excess remained, these "unnatural" models would be decisively ruled out and there would be a huge boost for "natural" new physics. Alternately, theories like split SUSY, and all of its variants, unambiguously predicted that the diphoton enhancement should disappear. This seems to be what is happening, so these theories continue to be very viable (and, in Arkani-Hamed's view, a very plausible picture for what is happening at the TeV scale).

Along the same lines, with some other collaborators, Arkani-Hamed further elaborated on the minimal picture of split SUSY and described a number of new implications of these ideas. This research sharpened the underlying theoretical structure and gave a more accurate prediction for the Higgs mass as well as gauge coupling unification (which is mildly improved over conventional supersymmetric theories). New smoking guns for heavy scalars and Higgsinos at the LHC were explored and a novel possibility was pointed out for explaining the

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The physics lunch table in Simons Hall

fermion mass hierarchy following from radiative corrections beneath the SUSY breaking scale with interesting implications for quark and lepton flavor-violation signals.

By the end of 2012, together with his collaborators in physics and mathematics, Arkani-Hamed completed a nearly two-year-long effort directly connecting scattering amplitudes in gauge theories to the remarkable mathematical structure known as the "positive Grassmannian." Some of this work has been described in previous reports, but in the interim, they extended the ideas beyond maximally supersymmetric theories to theories with less supersymmetry and lower dimensions, at least in the study of the basic building blocks known as "on-shell diagrams," which help represent amplitudes in a way that makes no reference to the idea of "virtual particles."

Their long paper can be thought of as a culmination of a decade of research by many workers, which focused on more deeply understanding the singularity structure of amplitudes and using these to reconstruct the amplitude itself. This picture exposes all the hidden symmetries of the amplitudes and establishes connections between the amplitude building blocks and some beautiful algebraic geometry. Arkani-Hamed's main motivation for jumping into this business five years ago was to find some totally new formulation of the physics based on new principles, where the symmetries and simplicity of the amplitudes are manifest, while locality and unitarity are seen as emergent phenomena.

At long last, Arkani-Hamed and one of his students discovered how to do this. The picture started emerging last fall, but now they understand the whole object very well and have been intensively studying it through the past winter and spring. They started with two extremely simple geometrical ideas: a triangle and a convex polygon. The triangle generalizes to the positive Grassmannain, which is already well understood. But the generalization of the polygon into the Grassmannian $G(k,k+m)$ turns out to be an object that is totally new to mathematicians, generalizing the notion of "positivity" to a marriage of both "internal" Grassmannian and "external" kinematical variables. If one wishes to consistently ignore particle labels, one finds it is only possible to do canonically if pairs of particles are ignored together, and this leads to $m=4$ as the minimal case, where we consider in addition to the k plane in $k+4$ dimensions, L lines in the 4 dimensional complement of the k plane. We call this general object "the Amplituhedron $A_{n,k,L}$." Amazingly, all the amplitudes of N=4 SYM, to all loop orders, can be thought of as an appropriate "volume" of the Amplituhedron. Tree amplitudes are literally the analog of the area of the polygon, which generalizes to the volume of $A_{n,k,L=0}$. Quantum corrections are nothing but "hiding" particles, and L loop amplitudes are volumes of $A_{n,k,L}$.

Professor Arkani-Hamed further elaborated on the minimal picture of split supersymmetry and described a number of new implications of these ideas. This research sharpened the underlying theoretical structure and gave a more accurate prediction for the Higgs mass as well as gauge coupling unification.

In fact, the problem of computing the integrand of the amplitude is reduced simply to triangulating the Amplituhedron. At tree level, the known BCFW recursion relations give one nice set of triangulations. At loop level, their previous all-loop generalization of BCFW also provides a triangulation, but it is clear there are much better ones. They believe that finding an explicit formula for the integrand of amplitudes to all loop orders is now within sight. Already,

using the new formulation, they have computed several infinite classes of cuts of amplitudes to all loop orders, finding results that are impossible to obtain in any other way.

Thus, as Arkani-Hamed hoped five years ago, they have finally found a new formulation of this quantum field theory with no reference to any of the usual physical concepts—no Lagrangians or path integrals or gauge redundancies, which they have eschewed for some time now, but also not even a reference to words like "factorization," "on-shell diagrams," or "recursion relations." They have instead found a new invariant question that the amplitude answers. And most surprisingly to Arkani-Hamed, they have explicitly seen how both locality and unitarity emerge from this structure, springing in unison from a single, more primitive notion of positivity.

They will have a series of papers out on this subject by the end of the summer of 2013.

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From left, Director Robbert Dijkgraaf, Professor Edward Witten, and Kevin Costello (Member in the School of Mathematics, 2007–08) of Northwestern University who gave a High Energy Theory Seminar on Yangians and supersymmetric gauge theory

Although Professor **Peter Goddard** has been continuing to take some interest in the governance of institutes for advanced study through service on the boards of institutes in Jerusalem, São Paolo, and Vancouver, he has been able to devote most of his time to theoretical physics. He has been studying the relationship between supersymmetric gauge theory and the string theory in twistor space introduced by Nathan Berkovits, continuing work done in collaboration with Louise Dolan over the last few years.

The twistor string theory is believed to be related to N=4 supersymmetric gauge theory coupled to conformal supergravity. Dolan and Goddard's work aimed to provide explicit calculations of tree and one-loop scattering amplitudes in the twistor string theory and compare them with the gauge theory results. They were able to evaluate the twistor string theory amplitudes for a particular class of amplitudes (split-helicity amplitudes) explicitly, showing that they yielded the same expressions previously obtained in gauge theory; subsequently, they extended these techniques to show that this equivalence held for all twistor string tree amplitudes by showing they satisfied recursion relations characterizing the gauge theory tree amplitudes.

Recently, Dolan and Goddard have been considering further the one-loop contribution to the twistor string gluon amplitude, which they previously calculated in detail in the maximally helicity violating case, with a view to determining its relation to gauge theory and conformal supergravity. One objective is to determine whether there are any constraints on the gauge group, because it has long been thought that N=4 supersymmetric gauge theory coupled to conformal supergravity must have a four-dimensional gauge group.

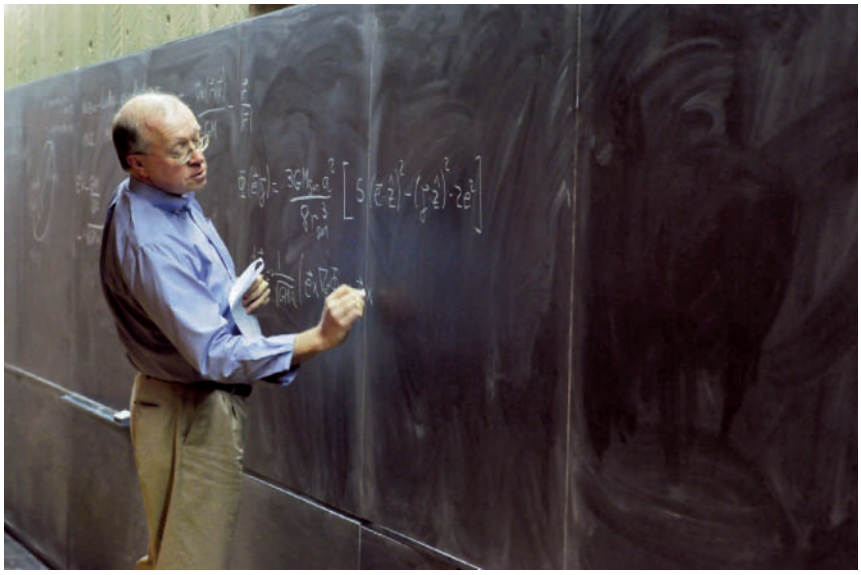
During the 2012–13 academic year, Professor **Stanislas Leibler** continued his work on various theoretical aspects connected to the experiments performed by his collaborators at the Laboratory of Living Matter at the Rockefeller University. This work concerned, in particular, the dynamics of replicated, closed microbial ecosystems and their emergent collective behavior. The behavior of microbes was also the subject of another study, which revealed and quantitatively analyzed new phenomena caused by the interplay between environment and heredity.

In collaboration with Olivier Rivoire, a regular visitor at IAS, Leibler also worked on a general theoretical model for the generation and transmission of variations in evolution.

During the 2012–13 academic year, Professor **Juan Maldacena** mostly researched aspects of quantum entanglement in quantum field theories and gravity. In a paper, he and graduate student Guilherme Pimentel computed the entanglement entropy of a quantum field in de Sitter space. They considered a fixed region in commoving coordinates. The interesting part of the entanglement is due to the particles created by the expansion of the universe.

Separately, with Member Thomas Hartman, Maldacena considered entanglement entropy of quantum field theories with gravity duals. They studied the evolution of the entanglement entropy for some special states. These states were such that they corresponded to black holes in the bulk. If the initial state is such that the entanglement is essentially local at the scale of the temperature, then time evolution spreads it linearly in time. This linear growth comes from the growth of a surface in the interior of the black hole. This suggests that the black hole interior grows as the pattern of entanglement becomes more complex.

Working with graduate student Aitor Lewkowycz, Maldacena presented a proof of the Ryu-Takayanagi formula for the entanglement entropy for theories with a gravity dual. This formula says that the entanglement entropy is computed by the area of a minimal area surface in the bulk of the spacetime.



BENTLEY DREZNER

Professor Scott Tremaine, whose research explored multiplanet systems, dark matter, and thermodynamics of stellar disks orbiting black holes, led a Mathematical Conversation on Kozai-Lidov oscillations.

Maldacena, with Leonard Susskind, presented an interpretation of the wormhole geometry of eternal black holes in terms of quantum entanglement. The wormhole geometry connects two spatially separated regions via the Einstein-Rosen (ER) bridge. They interpreted this geometry as an EPR pair of black holes and called this connection ER=EPR. They discussed the implications of this to modern versions of the black hole information paradox.

Finally, with Member Ofer Aharony, Simone Giombi, Guy Gur-Ari, and Ran Yacoby, Maldacena analyzed the computation of the thermal entropy in large N Chern-Simons theories with fundamental matter. The results were in precise agreement with a proposed bosonizaton duality.

Member Ofer Aharony, Yuji Tachikawa, and Professor **Nathan Seiberg** explored new subtleties in $4d$ gauge theory associated with the choice of line operators. Different consistent choices of these operators correspond to distinct physical theories, with the same correlation functions of local operators in R^4. In some cases, these choices are permuted by shifting the θ-angle by 2π. In other cases, they are labeled by new discrete θ-like parameters. Using this understanding, they gained new insight into the dynamics of four-dimensional gauge theories and their phases. The existence of these distinct theories clarified a number of issues in electric/magnetic dualities of supersymmetric

gauge theories, both for the conformal N=4 theories and for the low-energy dualities of N=1 theories.

Kenneth Intriligator and Seiberg considered various aspects of the dynamics of 3*d* N=2 Chern-Simons gauge theories and their possible phases. Depending on the parameters, there can be noncompact Higgs or Coulomb branches, compact Higgs or Coulomb branches, and isolated vacua. They computed the Witten index of the theories and showed that it does not change when the system undergoes a phase transition. They studied monopole operators and solitons in these theories and clarified subtleties in the soliton collective coordinate quantization. They demonstrated that solitons are compatible with a mirror symmetry exchange of Higgs and Coulomb branches, with BPS solitons on one branch related to the modulus of the other. Among other results, they derived Aharony duality from Giveon-Kutasov duality.

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Patrick Geary (far left), a Professor in the School of Historical Studies who is using genetic data to try to revolutionalize understanding of migration history, organized an informal seminar with Faculty and Members from the Simons Center for Systems Biology and the School of Historical Studies.

Seiberg, Aharony, and Members Shlomo S. Razamat and Brian Willett clarified the origin of dualities in 3*d* N=2 supersymmetric theories. These arise from similar dualities in 4*d* N=1 theories. They reproduced all known 3*d* dualities and found many new ones. They discussed in detail the case of 3*d* $SU(N_c)$ supersymmetric QCD theories, showing how to derive new duals for these theories from the 4*d* duality.

Aharony, Razamat, Willett, and Seiberg also extended their earlier work on the relation of 4*d* and 3*d* dualities to orthogonal gauge groups. The distinction between different SO(N) gauge theories in 4*d* plays an important role in this relation. They showed that the 4*d* duality leads to a 3*d* duality between an $SO(N_c)$ gauge theory with N_f flavors and an $SO(N_f - N+2)$ theory with N_f flavors and extra singlets, and they verified the consistency of this 3*d* duality by various methods, including index computations.

NASA's Kepler spacecraft has found thousands of extrasolar planets by monitoring stars for periodic dips in brightness as the planets pass in front of the star. Among these are many multiplanet systems, which exhibit a curious feature in the distribution of orbital periods: near a resonance such as the 3:2 resonance (where the inner planet orbits the star three times while the outer planet orbits twice), planet pairs are preferentially found just outside the nominal resonance (period ratios slightly bigger than 1.5), while there is a deficit of pairs just inside. With School visitor Renu Malhotra (University of Arizona) and graduate student Cristobal Petrovich (Princeton University), Richard Black Professor **Scott Tremaine** has explored an extremely simple dynamical model that may explain this effect: grow a single massive planet slowly on a fixed orbit and follow the behavior of a swarm of planets of negligible mass near the resonance with the massive planet. They found that the distribution of orbital periods in the swarm develops a characteristic asymmetric peak-trough structure around the resonance, qualitatively similar to the one observed in the Kepler sample. The result suggests that the structures seen in the Kepler planet sample are

Professor Maldacena, with Leonard Susskind, presented an interpretation of the wormhole geometry of eternal black holes in terms of quantum entanglement. The wormhole geometry connects two spatially separated regions via the Einstein-Rosen (ER) bridge. They interpreted this geometry as an EPR pair of black holes and called this connection ER=EPR. They discussed the implications of this to modern versions of the black hole information paradox.

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Members in the lobby of Bloomberg Hall

likely to be generic features of a wide range of planet-formation histories.

So far the evidence for vast quantities of dark matter in the universe relies mostly on cosmological models and dynamical arguments. A massive experimental effort is underway to detect dark-matter particles directly, as they pass through laboratory detectors. The expected rate of detections depends on the local density of dark matter in the halo of the Milky Way galaxy. Thus there was considerable interest last year when a paper from Chilean astronomers claimed to derive a local density of dark matter, from analysis of the kinematics of nearby stars, that was an order of magnitude below standard expectations and consistent with zero. Tremaine and Member Jo Bovy showed that this claim was based on a flawed assumption about the Milky Way rotation. After fixing this error, they found a halo density that is consistent with standard estimates of this quantity. This is the most robust direct measurement of the local dark-matter density to date.

The methods of classical statistical mechanics developed by James Clerk Maxwell, Ludwig Boltzmann, and others have been extremely successful in describing the properties of fluids, gases, and other systems. This success relies on the short-range nature of the forces between molecules. Determining the equilibrium properties of systems of particles interacting via long-range forces is much more difficult, in part because the thermodynamics of such systems exhibit exotic phenomena such as negative specific heat, nonextensive entropy, etc. Understanding nonextensive thermodynamics is particularly relevant to stellar systems, in which the long-range force is gravity; however, until now, most treatments have examined artificial systems with, for example, softened gravity, confining walls, etc. With School visitor Jihad Touma (American University of Beirut), Tremaine is investigating the thermodynamics of stellar disks orbiting black holes. After orbit-averaging, these systems strongly resemble the two-dimension vortex gas investigated by Lars Onsager and others. They show a generic phase transition to nonaxisymmetry that is reproduced in N-body experiments and may be relevant for observations of galaxy centers.

During the academic year 2012–13, Charles Simonyi Professor **Edward Witten** continued his work on superstring perturbation theory. He completed a detailed paper describing the algorithm to compute superstring scattering amplitudes by integration over the moduli space of super Riemann surfaces, as well as two sets of notes on background material. Witten also wrote an expository paper aimed at explaining how the main ideas work out in a concrete example that is known to be illuminating. With Ron Donagi, he showed that the moduli space of super Riemann surfaces is not projected, a foundational result that shows that simplifications that occur in low orders of perturbation theory do not generalize to higher orders—and thus that the more complex algorithm described in Witten's other papers is actually necessary. He is currently studying several other facets of superstring perturbation theory, including the generalization of the Feynman $i\varepsilon$ procedure from ordinary quantum field

theory. One possible goal is to understand the analytic continuation of scattering amplitudes and their Regge behavior.

In another area entirely, Witten has continued his work with a student, Victor Mikhaylov, on a problem that involves branes, supergroups, and electric-magnetic duality.

In 2012–13, Professor **Matias Zaldarriaga** worked on a variety of topics in cosmology ranging from early universe cosmology to the study of large-scale structure in the distribution of matter in the present universe.

With Daniel Green (Member 2009–12) and other collaborators, he analyzed the observational signatures of inflationary models that are coupled to strongly interacting field theories, a basic class of multifield models also motivated by their role in providing dynamically small scales. The signatures uncovered provide a precision test for such sectors when coupled to the inflation via irrelevant operators suppressed by a high mass scale, up to a thousand times higher than the inflationary Hubble scale.

With Members Cora Dvorkin and Kfir Blum, he showed that dark matter annihilation around the time of recombination can lead to growing ionization fraction perturbations, which track the linear collapse of matter over-densities. These effects amplify small-scale cosmological perturbations to the free electron density by a significant factor compared to the usual acoustic oscillations and contribute to the CMB bispectrum from recombination.

DAN KOMODA

Professor Matias Zaldarriaga, who worked on a variety of topics in cosmology ranging from early universe cosmology to the study of large-scale structure in the distribution of matter in the present universe, gave a public lecture on the latest news from the cosmos (video available at http://video.ias.edu/zaldarriaga-lecture-5-13).

Together with Princeton postdoctoral fellow Svetlin Tassev, he presented an N-body method for solving for large-scale structure (LSS) in a frame that is comoving with observers following trajectories calculated in Lagrangian perturbation theory (LPT). The new method can lead to a significant speed up without compromising the necessary accuracy in some applications. Together with Princeton postdoctoral fellow Enrico Pajer, he continued to study the so-called "effective theory of large-scale structure." For example, they showed explicitly that the terms induced by integrating out short scales, neglected in standard calculations, have exactly the right scale dependence to cancel all UV-divergences that appear at one loop for some cosmologies.

Professor Emeritus **Stephen L. Adler** spent several months last summer finishing the camera-ready copy for his book *The Guide to PAMIR: Theory and Use of Parameterized Adaptive Multidimensional Integration Routines*, which has now been published by World Scientific. The PAMIR programs are available online and are free for university research use at Pamir-integrate.com.

With Angelo Bassi and Sandro Donadi of the University of Trieste, Adler returned to the unfinished business of understanding why a calculation of noise-induced radiation by electrons, carried out by Bassi and Detlef Duerr, gave a factor of two larger answer than that found earlier by Qijia Fu and by Adler and Fethi Ramazanoglu, who used standard "Golden Rule" -type methods. Adler, Bassi, and Donadi showed that when Bassi and Duerr's

calculation is repeated with the final electron in a wave packet and the noise is confined to a bounded region, the extra term found by Bassi and Duerr vanishes in the limit of continuum state normalization.

Adler is now returning to the "trace dynamics" program for setting up a pre-quantum theory, which was the subject of his 2004 Cambridge University Press book *Quantum Theory as an Emergent Phenomenon*. In a short paper, Adler elaborated on the brief suggestion made in his book that the doubling of quantum mechanical sectors predicted by trace dynamics may be the origin of the dark matter that makes up around a quarter of the closure density of the universe. In this interpretation, the dark matter sector is a "shadow universe" characterized by the opposite sign of the imaginary unit *i* from that in our sector. In a longer paper just completed, Adler addresses the issue of incorporating gravity into trace dynamics, and shows that to do this, gravity must take the form of a classical rather than a matrix-valued field. Using three space general coordinate invariance and Weyl scaling arguments, Adler derives the general form of the gravitational effective action induced by the ensemble of prequantum fields. It has a very interesting "chameleon-like" form: on the Robertson-Walker cosmological metric, it has exactly the form of a cosmological term, and so could explain the mysterious "dark energy" that is the major component of the closure density of the universe. But in other contexts, such as in a spherically symmetric black hole metric, it has a form very different from a cosmological term and may have significant, unexpected consequences. Adler plans to continue work on this and other aspects of the trace dynamics program.

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Piero Madau of the University of California, Santa Cruz, gave an astrophysics seminar on connecting the dark and light side of galaxy formation.

Professor Emeritus **Freeman J. Dyson** reported last year a piece of research on the prisoner's dilemma, a game-theoretical model that some mathematical biologists consider relevant to the evolution of cooperation. The work was done with William Press, who discovered a new strategy for the Prisoner's Dilemma that he called the "extortion strategy." One of the experts in this subject remarked, "Press and Dyson have shown that cleverness and unfairness triumph after all." Now Dyson is happy to report that their findings have been reversed in a paper with the title "From Extortion to Generosity," published by Alexander Stewart and Joshua Plotkin from the University of Pennsylvania. Stewart and Plotkin turned the extortion strategy upside-down. The players are called Alice and Bob. In the extortion strategy, Alice unilaterally imposes an unfair division of rewards so that Bob always receives less than she does. In the strategy that Stewart and Plotkin call "generous," Alice unilaterally imposes a division of rewards with Bob receiving more than she does. As a result of this generosity, Bob is gently guided into a strategy of cooperation that is evolutionarily stable. Stewart and Plotkin demonstrate a conclusion that happily confirms our wishful thinking, that in a population of creatures driven by self-interest, generosity is the key to cooperation.

During the 2012–13 academic year, Professor Emeritus **Peter Goldreich**, in collaboration with Hilke Schlichting, a Hubble Fellow at the California

Institute of Technology, developed a new model for resonances between pairs of secondary bodies orbiting a dominant central mass. The model explains the surprisingly small number of near commensurate orbits in multiplanet systems. Moreover, it accounts for the deficit of planet pairs at exact resonance and for the corresponding excess of pairs with slightly greater separation. It also provides a plausible description for the episodic heating of tidally flexed satellites. Potential applications include understanding volcanoes on Io, cracks on Europa, and geysers on Enceladus. The common link among these disparate systems is the demonstration that eccentricity damping can drive an instability of the amplitude of libration about exact resonance. Damping promotes instability because the effective potential is maximal at exact resonance. The instability manifests itself in systems for which eccentricity damping occurs more rapidly than semimajor axis migration.

During the 2012–13 academic year, Professor Emeritus **Arnold J. Levine**'s research focused on the influence of external evolutionary pressure on genome organization and cancer and on using new topological methods to study the shape of genomic data. A project with Member Benjamin Greenbaum and former Members Rémi Monasson and Simona Cocco is building a theoretical model using the degree to which a genome subject to particular constraints has its entropy reduced to infer the strength of an external pressure and then comparing the values of these pressures across organisms to measure the relative effect sizes. This follows previous work showing that by constraining certain parameters in the genome of influenza, one could detect pressures from a host's innate immune system.

Professor Levine's research focused on the influence of external evolutionary pressure on genome organization and cancer and on using new topological methods to study the shape of genomic data, employing in particular Betti numbers and barcodes from persistent homology.

A project begun last year with Members Jean-Claude Nicolas and Sergio Lukic studied interactions between endogenous viruses (ERV) and zinc finger genes. Endogenous retroviruses are remnants of ancient retroviral infections of the germ line that can remain capable of replication within the host genome. In the soma, DNA methylation and repressive chromatin keep the majority of this parasitic DNA transcriptionally silent. However, it is unclear how the host organism adapts to recognize and silence novel invading retroviruses that enter the germ line. KRAB associated protein 1 (KAP1) is a transcriptional regulatory factor that drives the epigenetic repression of many different loci in mammalian genomes. Published experimental data were used to provide evidence that human KAP1 is recruited to endogenous retroviral DNA by KRAB-containing zinc finger transcription factors (TFs), many of which exist in clusters associated with human chromosome 19. The study demonstrates that these clusters are located at hotspots for copy number variation (CNV), generating a large and continuing diversity of zinc finger TFs. These zinc finger genes have varied DNA binding affinities, but their role as transcriptional repressors is conserved. A computational study of the different endogenous retroviruses that invaded the genome during primate evolution produced candidate zinc finger repressors that arise in the genome for each endogenous retrovirus family that enters the genomes of primates, showing that repressors that gained their binding affinity to retrovirus sequences at the same time that their targets invaded the human lineage are preferentially located on chromosome 19 (p-value: 3×10^{-3}).

Together with former Member Raúl Rabadán and Member Nils Baas, Levine has been exploring new topological methods to study the shape of genomic data, employing in particular Betti numbers and barcodes from persistent homology.

MEMBERS AND VISITORS

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

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Funding provided by the National Science Foundation

Kathryn Zurek
Particle Physics ✦ University of Michigan ✦ *v, f*

RECORD OF EVENTS

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July 23
Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *General Discussion* ✦ Organizers: **Matias Zaldarriaga**, Professor, School of Natural Sciences, and **David Spergel**, Princeton University

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August 20
Princeton University/Institute for Advanced Study Early Universe/Cosmology Lunch Discussion ✦ *General Discussion* ✦ Organizers: **Matias Zaldarriaga**, Professor, School of Natural Sciences, and **David Spergel**, Princeton University

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February 15
High Energy Theory Seminar ✦ *Quantum Computation vs. Firewalls* ✦ **Daniel Harlow**, Princeton University

February 25
High Energy Theory Seminar ✦ *Wall-Crossing & Quiver Invariants* ✦ **Piljin Yi**, Korea Institute for Advanced Study

March 6
Physics Group Meeting ✦ *Dissipation in Effective Field Theory: Black Holes, Water, and the (Early & Late) Universe* ✦ **Rafael A. Porto**, Member, School of Natural Sciences

March 8
High Energy Theory Seminar ✦ *Loop Corrections to Inflationary Observables* ✦ **Matias Zaldarriaga**, Professor, School of Natural Sciences

March 11
High Energy Theory Seminar ✦ *Closed Strings and Noncommutative/Nonassociative Geometry* ✦ **Dieter Lüst**, Max-Planck-Institut für Physik

March 12
Informal High Energy Theory Seminar ✦ *M5-Brane Indices from 5d Gauge Theories* ✦ **Seok Kim**, Seoul National University

March 13
Physics Group Meeting ✦ *Two Emission Mechanisms in the Fermi Bubbles: A Possible Signal of Annihilating Dark Matter* ✦ **Tracy Slatyer**, Member, School of Natural Sciences

March 15
High Energy Theory Seminar ✦ *Yet Another Dual Description for N=1 SQCD* ✦ **Yuji Tachikawa**, Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo

March 22
High Energy Theory Seminar ✦ *Supersymmetric Observables from Curved Manifolds* ✦ **Thomas Dumitrescu**, Princeton University

March 26
Informal High Energy Theory Seminar ✦ *Superstring Amplitudes as a Mellin Transform of Supergravity* ✦ **Tomasz Taylor**, Northeastern University

March 27
Physics Group Meeting ✦ *On Wilson Loops and Scattering Amplitudes* ✦ **Johannes Henn**, Member, School of Natural Sciences

March 28
Particle Physics Post-Moriond: A Discussion ✦ *Direct stop/sbottom Searches* ✦ **Graham Kribs**, University of Oregon; Member, School of Natural Sciences ✦ *Gluino Searches* ✦ **Mariangela Lisanti**, Princeton University ✦ *GMSB Searches* ✦ **David Shih**, Rutgers, The State University of New Jersey ✦ *R-Parity Violation Searches* ✦ **Yevgeny Kats**, Rutgers, The State University of New Jersey ✦ *Higgs Results* ✦ **Arun Thalapillil**, Rutgers, The State University of New Jersey ✦ *Planck Results* ✦ **Tracy Slatyer**, Member, School of Natural Sciences ✦ *Monojet Searches* ✦ **Anson Z. Y. Hook**, Stanford University; Member, School of Natural Sciences ✦ *CPV in Charm System* ✦ **Jared Evans**, Rutgers, The State University of New Jersey

April 8
High Energy Theory Seminar ✦ *(Why) Is Helicity Lorentz-Invariant?* ✦ **Philip Schuster**, Perimeter Institute for Theoretical Physics

April 9
Informal High Energy Theory Seminar ✦ *Informal Talk on AMS Results* ✦ **Kfir Blum**, Member, School of Natural Sciences

April 10
Physics Group Meeting ✦ *BPS Boundary Conditions of 4d N=4 Yang-Mills Theory* ✦ **Masahito Yamazaki**, Princeton University

April 17
Physics Group Meeting ✦ *Quantum Field Theory on (Complete) Light Cones and Regge Theory* ✦ **Simon Caron-Huot**, Member, School of Natural Sciences

April 19
High Energy Theory Seminar ✦ *Light States in Chern-Simons Matter Theory Coupled to Fundamental Matter* ✦ **Jonathan Maltz**, Stanford University

April 22
High Energy Theory Seminar ✦ *ACME: Obtaining an Electron Electric Dipole Moment from ThO* ✦ **Gerald Gabrielse**, Harvard University

April 23
Informal High Energy Theory Seminar ✦ *Aspects of Three Dimensional N=2 Chern Simons Matter Field Theories* ✦ **Ken Intriligator**, University of California, San Diego

May 8
Physics Group Meeting ✦ *Decrypting the Warped Black Holes* ✦ **Monica Guica**, Laboratoire de Physique Théorique et Hautes Énergies

May 10
High Energy Theory Seminar ✦ *The Entanglement Renyi Entropies of Disjoint Intervals in AdS/CFT* ✦ **Thomas Faulkner**, University of California, Santa Barbara; Member, School of Natural Sciences

May 13
High Energy Theory Seminar ✦ *Classical Conformal Block and Painleve VI* ✦ **Alexander B. Zamolodchikov,** Rutgers, The State University of New Jersey

May 14
Informal High Energy Theory Seminar ✦ *Dark Photons in Cosmology, Astrophysics, and Experiment* ✦ **Josef Pradler**, Johns Hopkins University

May 21
Informal High Energy Theory Seminar ✦ *D-brane Plane Waves, Hyperscaling Violation, and Entanglement Entropy* ✦ **Narayan Krishnan**, Chennai Mathematical Institute

The Simons Center for Systems Biology Activities

August 2
The Simons Center for Systems Biology Seminar ✦ *Adaptive Immunity* ✦ **Arnold J. Levine**, Professor Emeritus, School of Natural Sciences

August 17
The Simons Center for Systems Biology Seminar ✦ *Pattern Formation in Expanding Cell Population* ✦ **Xiongfei Fu**, The University of Hong Kong

September 27
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Marta Luksza**, Columbia University

October 2
The Simons Center for Systems Biology Seminar ✦ *Predicting Outcomes Using Stem Cell Signatures* ✦ **Elke Katrin Markert**, Member, School of Natural Sciences

October 11
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Roy Bar-Ziv**, Weizmann Institute of Science

October 25
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Tiberiu Tesileanu**, Member, School of Natural Sciences

November 5
Joint Lab Meeting on Breast Cancer (The Cancer Institute of New Jersey and Simons Center for Systems Biology Members)

November 7
The Simons Center for Systems Biology Seminar ✦ *Evolutionary Dynamics and the Design of Natural Proteins* ✦ **Frank Poelwijk**, The University of Texas Southwestern Medical Center

November 15
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Sergio Lukic**, Member, School of Natural Sciences

December 6
The Simons Center for Systems Biology Heterogeneity and Anticipation in Li-Fraumeni Syndrome Meeting ✦ *Heterogeneity, Anticipation, and Genotype-Phenotype Correlations in* TP53 *Mutation Carriers: A Survey of IARC* TP53 *Database* ✦ **Pierre Hainaut**, International Prevention Research Institute, Lyon, France ✦ *Estimating Prevalence of Li-Fraumeni Syndrome: Experience from Malaysia* ✦ **Hany Ariffin**, University of Malaya Cancer Research Institute, Kuala Lumpur ✦ *TP53 p.R337H Mutation: High Prevalence and Moderate Penetrance of a Founder Mutant in Brazil* ✦ **Maria Isabel Achatz**, Hospital A. C. Carmargo-Fundação Antonio Prudente, São Paulo, Brazil ✦ *Genetic Basis for Phenotypic Heterogeneity and Anticipation in a Family with Li-Fraumeni Syndrome: High-Resolution Analysis Using Whole Genome Sequencing* ✦ **Chang S. Chan**, The Cancer Institute of New Jersey ✦ *Is Mutant p53 Sufficient to Explain LFS?* ✦ **David Malkin**, University of Toronto ✦ *The NCI Li-Fraumeni Syndrome Study and Genetic Anticipation in Cancer Predisposition Syndromes* ✦ **Sharon A. Savage**, National Cancer Institute

December 10
The Simons Center for Systems Biology Seminar ✦ *Geometry and Topology of an Intracellular Membrane* ✦ **Greg Huber**, Kavli Institute for Theoretical Physics, University of California, Santa Barbara

January 22
The Simons Center for Systems Biology Seminar ✦ *Morse Theory and Stochastic Dynamics* ✦ **Jorge Kurchan**, École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris

January 23
The Simons Center for Systems Biology Seminar ✦ *Order in Amorphous Solids* ✦ **Jorge Kurchan**, École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris

January 25
The Simons Center for Systems Biology Seminar ✦ *Dynamics of HIV Treatment and the Evolution of Resistance* ✦ **Daniel Rosenbloom**, Harvard University

January 25
The Simons Center for Systems Biology Seminar ✦ *The Topology of Evolution* ✦ **Raul Rabadan**, Columbia University

January 31
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Rami Pugatch**, Member, School of Natural Sciences

February 5
The Simons Center for Systems Biology Seminar ✦ *Understanding Medieval Migration through Ancient DNA* ✦ **Patrick J. Geary**, Professor, School of Historical Studies

February 7
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Michael Lesnick**, Member, School of Mathematics

February 13
The Simons Center for Systems Biology Seminar ✦ *Modeling Protein-DNA Specificities from High-Throughput Binding Data (Including p53)* ✦ **Todd Riley**, Columbia University

February 14
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **G. V. Shivashankar**, National University of Singapore

February 19
The Simons Center for Systems Biology Joint Group Meeting ✦ *Longobard DNA Studies*

February 21
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Benjamin Greenbaum**, Member, School of Natural Sciences

February 28
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Suriyanarayanan Vaikuntanathan**, Lawrence Berkeley National Laboratory

March 1
The Simons Center for Systems Biology Seminar ✦ *Two Statistical Models for Biomolecular Network Evolution* ✦ **Chen-Hsiang Yeang**, Institute of Statistical Science, Academia Sinica

March 13
The Simons Center for Systems Biology Seminar ✦ *The Evolution of the p53 Family of Genes and Their Functions in the Origins of Cancers* ✦ **Arnold J. Levine**, Professor Emeritus, School of Natural Sciences

March 28
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Sergio Lukic**, Member, School of Natural Sciences

April 15
The Simons Center for Systems Biology Seminar ✦ *Tracking Virus Emergence and Transmission* ✦ **Elodie Ghedin**, Center for Vaccine Research, University of Pittsburgh

April 17
Governor's Conference on Effective Partnering in Cancer Research ✦ *PI3K Inhibitors in the Therapy of Breast Cancer* ✦ **José Baselga**, Memorial Sloan-Kettering Cancer Center ✦ *Oncoprotein-Induced Feedback—Biological and Therapeutic Implications* ✦ **Neal Rosen**, Memorial Sloan-Kettering Cancer Center ✦ *Overcoming Adaptive Responses to Targeted Therapies That Confer Drug Resistance* ✦ **Joan S. Brugge**, Harvard Medical School ✦ *Future Anti-Cancer Therapeutic Targets: Put the Cart before the Horses?* ✦ **Tak W. Mak**, The Campbell Family Institute for Breast Cancer Research and University of Toronto ✦ *Therapeutic Manipulation of the Immune Microenvironment of Cancer* ✦ **Drew M. Pardoll** ✦ The Sidney Kimmel Comprehensive Cancer Center, Johns Hopkins University School of Medicine

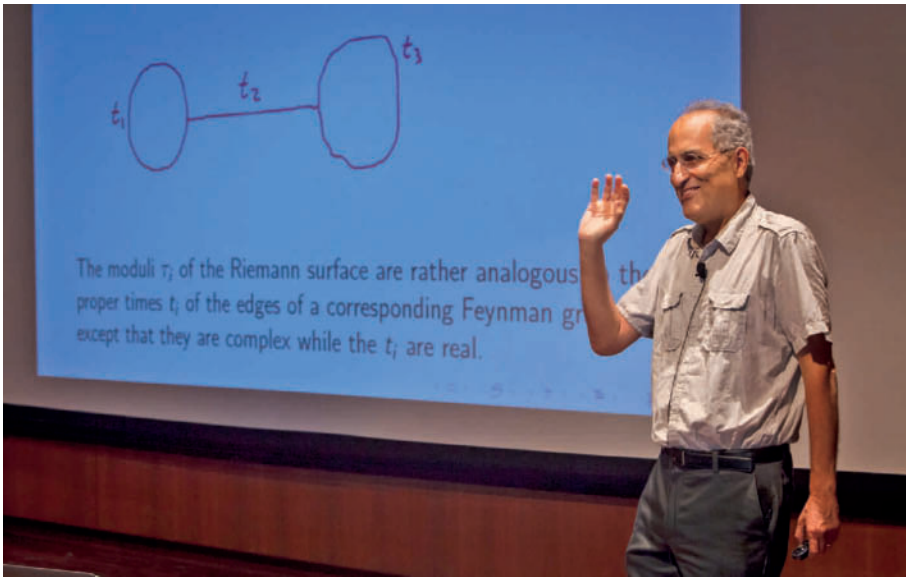
May 13
The Simons Center for Systems Biology Seminar ✦ *Connecting Pathway Thermodynamics to Enzyme Investment* ✦ **Elad Noor**, Weizmann Institute of Science ✦ *DNA Is Not Merely the Secret of Life: Using Chemical Information to Control the Structure of Matter* ✦ **Ned Seeman**, New York University

May 30
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Ethan Akin**, The City College of New York

June 19
The Simons Center for Systems Biology Seminar ✦ *The Shape of Data* ✦ **Gunnar Carlsson**, Stanford University

June 20
The Simons Center for Systems Biology Talks on Abstract/Conceptual/Quantitative Aspects of Biology ✦ **Albert Libchaber**, The Rockefeller University; Visiting Professor, School of Natural Sciences

Prospects in Theoretical Physics



Prospects in Theoretical Physics (PiTP) 2013 was held from July 15 to 26 on the campus of the Institute for Advanced Study. The focus of the 2013 program was LHC Physics. The topic was timely: with the discovery of a Higgs-like boson a year ago, the participants had the opportunity to discuss the latest interpretations and analyses and the implications for the field.

PiTP is an intensive two-week summer program geared specifically to graduate students and postdoctoral scholars considering a career in theoretical physics or astrophysics. First held at the Institute in 2002, Prospects in Theoretical Physics has, in past years, covered topics ranging from Cosmology to String Theory.

One of the Institute's goals in offering PiTP is to contribute to the training of the next generation of physicists. A special effort is made to involve women and minorities, along with graduate students in small universities who typically do not have the same opportunities and access to leaders in the field as graduate students in large research institutions.

Roughly one hundred participants from fifteen countries were officially enrolled in the two-week program. Additionally, the program lectures attracted many students, postdocs, and professors from nearby institutions.

The 2013 Prospects in Theoretical Physics program was jointly organized by Nima Arkani-Hamed, Professor in the School of Natural Sciences, Chiara Nappi of Princeton University, and Scott Thomas of Rutgers, The State University of New Jersey.

In addition to the organizers, lecturers included: Beate Heinemann of the University of California, Berkeley; Elliot Lipeles of the University of Pennsylvania; Juan Maldacena of the Institute for Advanced Study; Michelangelo Mangano of CERN; Patrick Meade of Stony Brook University, The State University of New York; Nathan Seiberg of the Institute for Advanced Study; Sunil Somalwar of Rutgers, The State University of New Jersey; Raman Sundrum of the University of Maryland; Jesse Thaler of the Massachusetts Institute of Technology; Natalia Toro of the Perimeter Institute for Theoretical Physics; Chris Tully of Princeton University; Neal Weiner of New York University; Edward Witten of the Institute for Advanced Study; and Kathryn Zurek of the University of Michigan.

Clockwise from top left: Professor Nima Arkani-Hamed, Professor Edward Witten, Kathryn Zurek of the University of Michigan, and Raman Sundrum of the University of Maryland

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ANDREA KANE

Visiting Professor Marco Battaglini (center) of Princeton University led the School's 2012–13 theme on Economics and Politics, which brought together scholars from economics, political science, and history.

School of Social Science

Faculty

Danielle S. Allen, UPS Foundation Professor

Didier Fassin, James D. Wolfensohn Professor

Joan Wallach Scott, Harold F. Linder Professor

Professors Emeriti

Albert O. Hirschman *(deceased December 10, 2012)*

Michael Walzer

The theme explored by the School of Social Science in 2012–13 was Economics and Politics. Twenty-three scholars from a pool of 211 applicants from the United States and abroad were invited to be part of the School's scholarly community as Members. Seven Visitors also participated in the year's activities. Fields of inquiry of the group included political science, economics, anthropology, sociology, history, literature, and philosophy. Funding is gratefully acknowledged from the Fritz Thyssen Stiftung, which provided support for the theme seminar, the Florence Gould Foundation, and the Wolfensohn Family Foundation, as well as the Friends of the Institute, AMIAS, and Roger W. Ferguson, Jr., and Annette L. Nazareth.

During the 2012–13 academic year, the School conducted two formal seminar series—the Social Science Thursday Lunch Seminar under the guidance of Professor Joan Scott and the Economics and Politics Seminar, which brought together scholars from economics, political science, and history, led by Visiting Professor Marco Battaglini of Princeton University. In addition, two reading groups—Ethnography and Theory, led by Professor Didier Fassin, and Theory Too, led by Professor Danielle Allen—met regularly throughout the year. The School also continued publication of its series Occasional Papers, which can be accessed online from the Institute's website.

In December, the School mourned the passing of one of its founding Faculty members, Emeritus Professor Albert O. Hirschman. On March 24, the School joined together with his family, friends, and colleagues to hold a memorial service in Wolfensohn Hall.

On a happier note, a search for the next Albert O. Hirschman Professor was successfully completed this year. Economist Dani Rodrik will leave his position as Rafiq Hariri Professor of International Political Economy at Harvard University's John F. Kennedy School of Government to join the School in July 2013.

Danielle S. Allen, UPS Foundation Professor, published *Education, Justice, and Democracy* (coedited with Rob Reich, University of Chicago Press, 2013). She completed *Our Declaration: A Reading of the Declaration of Independence in Defense of Equality* (Norton, 2014) as well as a volume on youth, new media, and democratic politics (coedited with Jennifer Light, Northwestern University), "Emergent Politics: New Media, Youth, and the Future of Democracy" (under consideration, MIT Press). In addition, she worked on and published a handful of articles on topics ranging from social connectedness and egalitarianism to late-twentieth-century changes in the law of association in the United States and public-sphere theory. She hosted a workshop at the Institute on new media, youth, and democracy as well as a series of seminars on the intersections of language, history, and political thought, and she gave lectures and papers at Berkeley, Yale, Williams, Princeton, and the University of

Colorado Boulder. Lastly, she launched a collaborative research project on assessment in the humanities and liberal arts (HULA) and published op-eds on educational policy.

Didier Fassin, James D. Wolfensohn Professor, devoted most of the year to the project *Toward a Critical Moral Anthropology*, related to the Advanced Grant "Ideas" he received from the European Research Council, in particular completing ethnographic research in a French prison. Following publication of his reader *La Question Morale: Une Anthologie Critique* by the Presses Universitaires de France (2013), he lectured on moral economies at the Université de Montréal and the École des Hautes Études en Sciences Sociales in Marseille, and on resentment at the Universität Frankfurt and University of the Witwatersrand. On law enforcement, he published *Enforcing Order: An Ethnography of Urban Policing* (Polity Press, 2013) and gave a series of related lectures at New York University, Harvard University, Brown University, the University of Melbourne, and the Université Paris 13. His work on policing was included in two exhibitions in the museums of Annecy and Frankfurt. On asylum and refugees, he had articles in *Public Culture* and the *Revue Française de Sociologie*, organized a symposium in Johannesburg as Mellon Distinguished Visiting Scholar, and gave a keynote lecture for an international conference at the Swinburne Institute of Technology as well as a public lecture at the Institute for Advanced Study. He delivered the Annual Distinguished Lecture on Europe on "The Denial of Racial Discrimination" at the University of Michigan, the keynote lecture "What Is Critique?" at the twelfth European Association of Social Anthropologists Conference, and the

George Mailath (front) of the University of Pennsylvania with Member Venkataraman Bhaskar, economists who collaborated on research involving the curse of long horizons.

ANDREA KANE

Lectio Magistralis on "The History of Public Health" at the Sapienza University in Rome for the First Italian Conference of Medical Anthropology. As Visiting Professor at the University of Hong Kong for the third and last year, he contributed to the scientific conception of the Center for the Humanities and Medicine, gave classes and lectures in the Faculties of Medicine and of Humanities, and helped develop a research program on humanitarianism in East Asia. He also taught courses titled "From the Anthropology of Security to the Ethnography of Policing" at Princeton University and "Social Sciences and Moral Issues" at the École des Hautes Études en Sciences Sociales in Paris. He wrote two essays, "A Case for Critical Ethnography," in *Social Science and Medicine,* and "Why Ethnography Matters," in *Cultural Anthropology,* and two chapters, "The Parallel Lives of Anthropology and Philosophy" for a collective book being published by Duke University Press and "Anthropology as Critical Practice" for an edited volume being published by the Editions de l'EHESS. His book *Humanitarian Reason: A Moral History of the Present* (University of California Press, 2011) received Honorable Mention for the 2012 Bateson Prize.

Joan Wallach Scott, Harold F. Linder Professor, received an honorary degree from the Université du Québec à Montréal. She was the Treaty of 1713 Professor at Utrecht University; the keynote speaker at the conference of Italian historians of women in Padua; and she gave a Max Weber Lecture at the European University Institute (Fiesole, Italy). On the occasion of the publication of a group of her essays translated into Turkish, she gave lectures at Bogaziçi and Sabanci universities in Istanbul. She lectured at the University of Bern (Switzerland), at the Graduate Center of the City University of New York, and at George Washington University. She continues to edit the journal *History of the Present*, which won the 2012 award for the best new journal from the Council of Editors of Learned Journals. She has rejoined the American Association of University Professors' Committee on Academic Freedom and Tenure, and she continues to work with a growing group of scholars, architectural preservationists, students, and many others to oppose the plans to restructure the New York Public Library.

ANDREA KANE

ANDREA KANE

ANDREA KANE

CLIFF MOORE

Professor Danielle Allen; Member Alexander Hirsch; Members Alev Çinar (left) and Deva Woodly; and Professor Didier Fassin

ANDREA KANE

In December, the School mourned the passing of Albert Hirschman, one of its founding Faculty members. On March 24, the School joined together with his family, friends, and colleagues, including James Wolfensohn (at the podium), Chairman Emeritus of the Institute's Board of Trustees, to hold a memorial service in Wolfensohn Hall.

In the academic year 2012–13, Emeritus Professor **Michael Walzer** delivered the Henry L. Stimson Lectures at Yale University on "What Happened to National Liberation?" He gave the Global Society Lecture at the University of Pittsburgh at Johnstown, the B. G. Rudolph Lecture at Syracuse University, and the Bozeman Lecture at Sarah Lawrence College. He also lectured at Harvard, Georgetown, Swarthmore, and Colgate, and at the Gaede Institute of Westmont College (California). In June, he received an honorary degree at the Hebrew University of Jerusalem and gave the keynote lecture for the annual meeting of the Israeli Institute of Asian and African Studies. His book *In God's Shadow: Politics in the Hebrew Bible* appeared in an Italian translation; *Thinking Politically* came out in Japanese; and *Thick and Thin: Political Argument at Home and Abroad* in Polish. A book-length dialogue with Ramin Jahanbegloo was published in Italy under the title *Conversazioni con Michael Walzer: Il Pluralismo, la Libertà, la Sinistra*. He retired this year as the coeditor of *Dissent* magazine.

MEMBERS AND VISITORS

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

Marco Battaglini
Economics ✦ Princeton University ✦ *vp*

Lucas Bessire
Anthropology ✦ University of Oklahoma

Venkataraman Bhaskar
Economics ✦ University College London
Roger W. Ferguson, Jr., and Annette L. Nazareth Member

João Biehl
Anthropology ✦ Princeton University ✦ *v*

Eric Chaney
Economics ✦ Harvard University

Alev Çinar
Political Science ✦ Muğla University

Randall Curren
Philosophy ✦ University of Rochester
Ginny and Robert Loughlin Founders' Circle Member

John M. de Figueiredo
Economics ✦ Duke University
AMIAS Member

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

Vincent Dubois
Political Sociology ✦ Université de Strasbourg
Funding provided by the Florence Gould Foundation Fund

David L. Eng
Literature ✦ University of Pennsylvania

Ruben Enikolopov
Economics ✦ New Economic School, Moscow
Deutsche Bank Member

Sara R. Farris
Sociology ✦ University of Cambridge

Jessica Goldberg
Medieval History ✦ University of Pennsylvania

Neve Gordon
Political Science ✦ Ben-Gurion University of the Negev

Jens Großer
Political Science, Economics ✦ Florida State University

Alexander L. Hinton
Anthropology ✦ Rutgers, The State University of New Jersey ✦ *v*

Alexander V. Hirsch
Political Science ✦ Princeton University

Moon-Kie Jung
Sociology ✦ University of Illinois at Urbana-Champaign

Sheena Kang
Political Theory ✦ The University of Chicago ✦ *a*

Karin Knorr Cetina
Sociology ✦ The University of Chicago ✦ *v*

Patchen Markell
Political Science ✦ The University of Chicago

Jens Meierhenrich
Political Science ✦ London School of Economics and Political Science
Louise and John Steffens Founders' Circle Member

Nicola Perugini
Anthropology ✦ Al Quds Bard Honors College for Liberal Arts and Sciences
Richard B. Fisher Member

Laurence Ralph
Anthropology ✦ Harvard University

Michael Ralph
Anthropology ✦ New York University
The Wolfensohn Family Member

Catherine Rottenberg
Harlem Renaissance Studies, Jewish American Studies ✦ Ben-Gurion University of the Negev ✦ *v*

Wen-Ching Sung
Medical Anthropology ✦ University of Toronto ✦ *v*

Caroline Thomas
Economics ✦ The University of Texas at Austin
Deutsche Bank Member

Peter D. Thomas
Political Philosophy ✦ Brunel University ✦ *v*

Deva Woodly
Political Science ✦ The New School
Friends of the Institute for Advanced Study Member

Everett Zhang
Anthropology ✦ Princeton University

RECORD OF EVENTS

October 4
Social Science Thursday Lunch Seminar ✦ *Reconsidering Risk and the "Maghrib Traders": Agency Relations, Contract Enforcement, and the Economy of the Eleventh-Century Islamic Mediterranean* ✦ **Jessica Goldberg**, University of Pennsylvania; Member, School of Social Science

October 5
Reading Group ✦ Organizational Meeting

October 10
Economics and Politics Seminar ✦ *Communication with Multiple Senders: An Experiment* ✦ **Alistair J. Wilson**, University of Pittsburgh

October 11
Social Science Thursday Lunch Seminar ✦ *The Curse of Uninformed Voting: An Experimental Study* ✦ **Jens Großer**, Florida State University; Member, School of Social Science

October 12
Ethnography and Theory Reading Group ✦ Discussion of papers submitted by **Vincent Dubois**, Université de Strasbourg, and **Everett Zhang**, Princeton University; Members, School of Social Science

October 17
Economics and Politics Seminar ✦ *Do Political Blogs Matter? Corruption in State-Controlled Companies, Blog Postings, and DDoS Attacks* ✦ **Maria Petrova**, New Economic School, Moscow

October 18
Social Science Thursday Lunch Seminar ✦ *The Largest Financial Market: Architecture and Sociology* ✦ **Karin Knorr Cetina**, The University of Chicago; Visitor, School of Social Science

October 24
Economics and Politics Seminar ✦ *Imperfect Public and Private Monitoring in the Infinitely Repeated Prisoner's Dilemma: Experimental Evidence* ✦ **Venkataraman Bhaskar**, University College London; Member, School of Social Science (joint work with Masaki Aoyagi and Guillaume Frechette)

October 25
Social Science Thursday Lunch Seminar ✦ *Cross-Border Media and Nationalism: Evidence from Serbian Radio in Croatia* ✦ **Ruben Enikolopov**, New Economic School, Moscow; Member, School of Social Science

October 26
Theory Too Reading Group ✦ Discussion of paper submitted by **Danielle S. Allen**, UPS Foundation Professor, School of Social Science

November 7
Economics and Politics Seminar ✦ *Other-Regarding Preferences, Group Identity, and Political Participation: An Experiment* ✦ **Arthur Schram**, University of Amsterdam (joint work with Pedro Robalo and Joep Sonnemans)

November 8
Social Science Thursday Lunch Seminar ✦ *The Injury of Nostalgia, or The Stories a Gang Tells about Itself* ✦ **Laurence Ralph**, Harvard University; Member, School of Social Science

November 14
Economics and Politics Seminar ✦ *Electoral Competition, Costly Campaigns, and Independent Political Expenditure* ✦ **Carlo Prato**, Georgetown University

November 15
Social Science Thursday Lunch Seminar ✦ *Education, Justice, and Well-Being* ✦ **Randall Curren**, University of Rochester; Member, School of Social Science

November 28
Economics and Politics Seminar ✦ *Bonus Culture: Competitive Pay, Screening, and Multitasking* ✦ **Roland Benabou**, Princeton University (joint work with Jean Tirole)

November 29
Social Science Thursday Lunch Seminar ✦ *The Racial Constitution of the U.S. Empire-State* ✦ **Moon-Kie Jung**, University of Illinois at Urbana-Champaign; Member, School of Social Science

November 30
Ethnography and Theory Reading Group ✦ Discussion of papers submitted by **Lucas Bessire**, University of Oklahoma, and **Nicola Perugini**, Al Quds Bard Honors College for Liberal Arts and Sciences; Members, School of Social Science

December 5
Economics and Politics Seminar ✦ *Peace Talks, Mediation, and Strategic Militarization* ✦ **Adam Meirowitz**, Princeton University (joint work with Massimo Morelli, Kristopher Ramsay, and Francesco Squintani)

December 6
Social Science Thursday Lunch Seminar ✦ *Competitive Policy Entrepreneurship* ✦ **Alexander V. Hirsch**, Princeton University; Member, School of Social Science

December 13
Social Science Thursday Lunch Seminar ✦ *The Moral World of Law Enforcement* ✦ **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

December 14
Theory Too Reading Group ✦ *The Relationship between Theory and Practice: Remarks Following Deleuze and Guattari's Visit to the West Bank* ✦ **Neve Gordon**, Ben-Gurion University of the Negev; Member, School of Social Science

January 10
Theory Too Reading Group ✦ *An Education in Sustainability* ✦ **Randall Curren**, University of Rochester; Member, School of Social Science

January 16
Economics and Politics Seminar ✦ *Dynamic Legislative Bargaining with Veto Power: Theory and Experiments* ✦ **Salvatore Nunnari**, University of California, San Diego

January 17
Social Science Thursday Lunch Seminar ✦ *The Demographic Transition and the Position of Women: A Marriage Market Perspective* ✦ **Venkataraman Bhaskar**, University College London; Member, School of Social Science

January 23
Economics and Politics Seminar ✦ *Media Power* ✦ **Andrea Prat**, Columbia University

Philosophy/Mentalités ✦ *The Lost Tradition of Equality* ✦ **Daniel Mandell**, Truman State University

January 24
Social Science Thursday Lunch Seminar ✦ *The Long-Term Effects of Exploitation and Ethnic Cleansing: Evidence from the Expulsion of the Moriscos* ✦ **Eric Chaney**, Harvard University; Member, School of Social Science

January 25
Ethnography and Theory Reading Group ✦ Discussion of papers submitted by **Wen-Ching Sung**, University of Toronto, and **Jens Meierhenrich**, London School of Economics and Political Science; Visitor and Member, respectively, School of Social Science

January 31
Social Science Thursday Lunch Seminar ✦ *Toward an Anthropology of Actually Existing Alterity in the Gran Chaco* ✦ **Lucas Bessire**, University of Oklahoma; Member, School of Social Science

February 1
Theory Too Reading Group ✦ *The Political Character of Persuasion* ✦ **Deva Woodly**, The New School; Member, School of Social Science

February 6
Economics and Politics Seminar ✦ *Intergroup Public Goods Games and Experiments* ✦ **Jens Großer**, Florida State University; Member, School of Social Science

February 7
Social Science Thursday Lunch Seminar ✦ *Authority and Free Speech* ✦ **Caroline Thomas**, The University of Texas at Austin; Member, School of Social Science

February 13
Economics and Politics Seminar ✦ *The Transparency Curse: Private Information and Political Freedom* ✦ **John B. Londregan**, Princeton University

February 14
Social Science Thursday Lunch Seminar ✦ *The Presentation of Law in Everyday Life* ✦ **Jens Meierhenrich**, London School of Economics and Political Science; Member, School of Social Science

February 20
Economics and Politics Seminar ✦ *Corruption, Intimidation, and Whistle-Blowing* ✦ **Sylvain Chassang**, Princeton University

February 21
Social Science Thursday Lunch Seminar ✦ *Locating Political Theory: Globalized Intellectual Traditions Merge with Islamic Thought in Turkey* ✦ **Alev Çinar**, Muğla University; Member, School of Social Science

February 27
Economics and Politics Seminar ✦ *War Signals: A Theory of Trade, Trust, and Conflict* ✦ **Fabrizio Zilibotti**, Universität Zürich (joint work with Dominic Rohner and Mathias Thoenig)

February 28
Social Science Thursday Lunch Seminar ✦ *Reparations and the Human* ✦ **David L. Eng**, University of Pennsylvania; Member, School of Social Science

March 1
Ethnography and Theory Reading Group ✦ Discussion of papers submitted by **Karin Knorr Cetina**, The University of Chicago, and **Jens Meierhenrich**, London School of Economics and Political Science; Visitor and Member, respectively, School of Social Science

March 6
Economics and Politics Seminar ✦ *Critical Junctures: Independence Movements and Democracy in Africa* ✦ **Léonard Wantchékon**, Princeton University (joint work with Omar García-Ponce)

Theory Too Reading Group ✦ *Western and Islamic Knowledges* ✦ **Alev Çinar**, Muğla University; Member, School of Social Science

March 7
Social Science Thursday Lunch Seminar ✦ *The Surprising Platonism of Hannah Arendt* ✦ **Patchen Markell**, The University of Chicago; Member, School of Social Science

March 13
Economics and Politics Seminar ✦ *Emotions and Political Unrest* ✦ **Guido Tabellini**, Bocconi University (joint work with Francesco Passarelli)

Philosophy/Mentalités ✦ *Little Rock's "Social Question": Reading Hannah Arendt on School Desegregation and Social Climbing* ✦ **Jill Locke**, Gustavus Adolphus College

March 14
Social Science Thursday Lunch Seminar ✦ *A Tale of Two Movements: How Changing Discourse Changed Politics on Marriage Equality and the Living Wage* ✦ **Deva Woodly**, The New School; Member, School of Social Science

March 21
Social Science Thursday Lunch Seminar ✦ *The "Great Savior" Was Dead: The Beginning of the Change in the Structures of Feeling in China* ✦ **Everett Zhang**, Princeton University; Member, School of Social Science

March 22
Theory Too Reading Group ✦ *Psychic Nowhere: Parachute Children, False Self, and the Politics of Attachment* ✦ **David L. Eng**, University of Pennsylvania; Member, School of Social Science

March 27
Economics and Politics Seminar ✦ *Democratic Councils vs. Traditional Leadership: Experimental Evidence on Local Institutions in Afghanistan* ✦ **Ruben Enikolopov**, New Economics School, Moscow; Member, School of Social Science

April 3
Economics and Politics Seminar ✦ *Reconceiving the Public Sphere* ✦ **Danielle S. Allen**, UPS Foundation Professor, School of Social Science

April 4
Social Science Thursday Lunch Seminar ✦ *The Question of Liability: Debt, Force, and Accountability in Senegal* ✦ **Michael Ralph**, New York University; Member, School of Social Science

April 5
Ethnography and Theory Reading Group ✦ Discussion of papers submitted by **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science, and **Laurence Ralph**, Harvard University; Member, School of Social Science

April 10
Economics and Politics Seminar ✦ *Religion and the Rise and Fall of Islamic Science* ✦ **Eric Chaney**, Harvard University; Member, School of Social Science

April 11
Social Science Thursday Lunch Seminar ✦ *Cheap Talk with Multiple Audiences: An Experimental Analysis* ✦ **Marco Battaglini**, Princeton University; Visiting Professor, School of Social Science

April 17
Economics and Politics Seminar ✦ *Experimentation and Learning in Political Organizations* ✦ **Alexander V. Hirsch**, Princeton University; Member, School of Social Science

April 18
Social Science Thursday Lunch Seminar ✦ *A Coercive Turn in French Welfare? The Paradox of Legal Rigor in Anti-Fraud Policy* ✦ **Vincent Dubois**, Université de Strasbourg; Member, School of Social Science

April 19
Theory Too Reading Group ✦ *Civic Integration, Gender Equality, and Nationalism* ✦ **Sara R. Farris**, University of Cambridge; Member, School of Social Science

April 24
Economics and Politics Seminar ✦ *N-Dimensional Blotto Game with Asymmetric Battlefield Values—The U.S. Presidential Elections* ✦ **Caroline Thomas**, University of Texas at Austin; Member, School of Social Science

April 25
Social Science Thursday Lunch Seminar ✦ *Government Careers and Human Capital: Preliminary Findings from Public-Sector Personnel Records* ✦ **John M. de Figueiredo**, Duke University; Member, School of Social Science

May 1
Economics and Politics Seminar ✦ *Competitive Policy Entrepreneurship* ✦ **Kenneth Shotts**, Stanford University (joint work with Alexander V. Hirsch)

May 2
Social Science Thursday Lunch Seminar ✦ *Settler Appropriations in Palestine/Israel* ✦ **Nicola Perugini**, Al Quds Bard Honors College for Liberal Arts and Sciences; Member, School of Social Science

May 3
Ethnography and Theory Reading Group ✦ Discussion of papers submitted by **Lucas Bessire**, University of Oklahoma, and **Laurence Ralph**, Harvard University; Members, School of Social Science

May 6
Theory Too Reading Group ✦ *To Think What We Are Doing* ✦ **Patchen Markell**, The University of Chicago; Member, School of Social Science

May 8
Economics and Politics Seminar ✦ *Public Sector Personnel Economics* ✦ **John M. de Figueiredo**, Duke University; Member, School of Social Science (joint work with Charles M. Cameron and David E. Lewis)

May 9
Social Science Thursday Lunch Seminar ✦ *Securitizing Human Rights: Lawfare and the Assault on Rights Work in Israel/Palestine* ✦ **Neve Gordon**, Ben-Gurion University of the Negev; Member, School of Social Science

May 15
Economics and Politics Seminar ✦ *Choosing and Enforcing Business Relationships in the Medieval Mediterranean: Reassessing the "Maghribi Traders"* ✦ **Jessica Goldberg**, University of Pennsylvania; Member, School of Social Science

May 16
Social Science Thursday Lunch Seminar ✦ *Femonationalism and the Regular Army of Labor Called Migrant Women* ✦ **Sara R. Farris**, University of Cambridge; Member, School of Social Science

ANDREA KANE

Applicants to the Schools are motivated primarily by their need for free time in which to carry out research and writing.

The Libraries

The Historical Studies–Social Science Library (Marcia Tucker, Librarian) contains some 125,000 volumes and has subscriptions to over one thousand journals. The Library is strongest in classical studies, ancient history, and archaeology, but it contains basic document collections, reference works, and important secondary works of scholarship in most fields of history and the social sciences. The journal collection is extensive, and fairly complete back runs exist to the founding of the Institute. The HS–SS Library has occupied its present building since 1964.

The Institute's rare book collection, the gift of Lessing J. Rosenwald, consists of about two thousand volumes on the history of science and was compiled by Herbert M. Evans in the 1930s. The collection includes numerous first editions of important scientific works in mathematics, astronomy, physics, and the life sciences. Additional volumes have been added through various gifts, most notably through the Leon Levy Fund, expanding the subject scope of the collection. The Library contains a collection of Mongolian and East Asian materials, the library of Walther Heissig, a noted Central Asian studies scholar, which came from the Princeton University East Asian Studies Department and Princeton University Library. The Library holds Giorgio Tonelli's collection of Enlightenment materials as well as collections from past Professors including Ernst H. Kantorowicz, Erwin Panofsky, Kirk Varnedoe, Oleg Grabar, Clifford Geertz, and Harry Woolf. The microfilm collections of the HS–SS Library include a large selection from *Manuscripta*, a collection of early printed books from the Vatican Library, and a microfilm copy of the slips presented for the *Thesaurus Linguae Latinae* from the Bavarian Academy, with additional recent material on CD. The Library has microfilm copies of the papers of Simone Weil.

The Library houses the Shelby White and Leon Levy Archives Center (Christine Di Bella, Archivist). The records in the collection date from the 1930s and consist of official correspondence of the Director's Office, minutes of meetings of the Faculty and the Board of Trustees, correspondence concerning past Faculty and Members, records of the Electronic Computer Project, and the papers of select Faculty members, including astrophysicist John N. Bahcall. The archives also include the Institute's photograph and oral history collections. Digitized copies of many photographs, documents, and other materials from the archives are available online at http://cdm.itg.ias.edu. The reading room for the archives is located in the annex of the HS–SS Library. It provides a space for researchers to consult resources from the archives, as well as a display area featuring selections from the collections. A generous gift from the Leon Levy Foundation supports the ongoing work of the Institute to formally organize and preserve the important historical materials already in its possession and to serve as a repository for essential source materials going forward.

The Mathematics–Natural Sciences Library (Momota Ganguli, Librarian) is located in Fuld Hall, with smaller departmental branches in Bloomberg Hall and compact shelving spread across campus. The collection, which includes about thirty thousand volumes of monographs and bound periodicals as well as 140 print and/or electronic subscriptions, spans pure and applied mathematics, astrophysics, theoretical and mathematical physics, and biology. The M–NS Library has an extensive collection of the collected works of mathematicians, including those of Cauchy, Descartes, Fermat, Gauss, Hardy, and Poincaré. Each year, the M–NS Library adds about three hundred books to its collection.

The Mathematics–Natural Sciences Library supports the three outreach programs of the Institute, namely Women and Mathematics, Prospects in Theoretical Physics, and the IAS/Park City Mathematics Institute held annually, the first two at the Institute and the third in Park City, Utah. Books relevant to the assigned research areas of these programs are collected and made available to the participants.

Both of the Institute's libraries provide individualized services, access to databases, and environments to facilitate research. The Libraries participate in the OCLC Research Libraries Partnership, which affords Institute scholars access to an extensive interlibrary loan system. The Institute's online catalogue is accessible via http://library.ias.edu. Scanners and other support peripherals are available in the Libraries.

All scholars affiliated with the Institute enjoy the same privileges as Princeton University faculty in the Princeton University Library system and also have privileges in the library of the Princeton Theological Seminary. The Librarians and the Faculty of all four Schools at the Institute warmly appreciate gifts of books and publications from former and current Faculty, Members, and Visitors of the Institute.

The IAS Community

For more than eighty years, the Institute for Advanced Study has had a profound influence on the fields of study represented here: historical studies, mathematics, natural sciences, and social science. Any day at lunch or tea, you will hear leading scientists and scholars from around the world discussing topics as diverse as the response to terrorism, understanding the organization of biological systems, ancient DNA analysis, the very latest developments in string theory, the mathematical basis of computer security, morals and morality in contemporary society, and the implications of the discovery of a Higgs-like boson.

Members, who typically stay for one year but may stay for up to five years, live together with their families in housing adjacent to the Institute campus in what might be described as a true academic village. Throughout the year, the Office of the Director hosts a broad array of concerts, lectures, and programs as listed on the following pages. In addition, the Institute offers numerous and varied activities for Members, Visitors, and their families. In the 2012–13 academic year, these included films, play readings, clay modeling, pottery, knitting, yoga, tennis lessons, jazz evenings, trips to museums and other cultural sites, and activities for children in the Institute community.

A range of events is also organized for the Friends of the Institute, including Friends Forums, Fireside Chats, a Culture and Cuisine Series, monthly breakfasts and lunches with IAS Members, a holiday reception, and the annual meeting and barbecue hosted by the Director. Several special gatherings are also held during the year for members of the Founders', Chairman's, and Director's Circles.

ANDREA KANE

RECORD OF EVENTS

September 24
Institute Welcome Reception

September 28
AMIAS Family Barbecue

October 3
Public Lecture ✦ *The Symmetry and Simplicity of the Laws of Nature and the Higgs Boson* ✦ **Juan Maldacena**, Professor, School of Natural Sciences

October 5–6
Edward T. Cone Concert Series ✦ *Across the Continent* ✦ **Derek Bermel**, clarinet, and **Christopher Taylor**, piano

Edward T. Cone Concert Series Talk ✦ **Andreia Pinto-Correia**, **Christopher Taylor**, and **Derek Bermel**, Artist-in-Residence

October 14
Princeton Symphony Orchestra Concert ✦ *Lark Quartet and Percussion* ✦ **Deborah Buck** and **Basia Danilow**, violins; **Kathryn Lockwood**, viola; **Caroline Stinson**, cello; **Yousif Sheronick**, percussion

October 17
Friends Forum ✦ *The Frontiers and Limits of Science* ✦ **Robbert Dijkgraaf**, Director and Leon Levy Professor, Institute for Advanced Study

October 19
Writers Conversation ✦ *Conversation with Kevin Jerome Everson* ✦ **Kevin Jerome Everson**, Filmmaker, Artist, and Professor, University of Virginia

October 23
Art Lecture ✦ *Recognition: Theme and Meta-theme in Northern Renaissance Art* ✦ **Mitch Merback**, Professor, Johns Hopkins University

October 26
Public Lecture ✦ *The Inevitability of Physical Laws: Why the Higgs Has to Exist* ✦ **Nima Arkani-Hamed**, Professor, School of Natural Sciences

November 9
Friends Culture and Cuisine ✦ *Shakespeare's Kitchen* ✦ **Francine Segan**, Food Historian

November 10
American Repertory Ballet Family Program ✦ *Dancing Stories*

November 15
Fertile Crescent Concert ✦ *Songs of the Fertile Crescent* ✦ **Haleh Abghari**, soprano; **Derek Bermel**, clarinet; **Dünya Ensemble**; Mivos Quartet

Fertile Crescent Concert Talk ✦ **Haleh Abghari**, **Olivia De Prato**, **Bushra El-Turk**, **Füsun Köksal**, **Robert Labaree**, **Victor Lowrie**, **Joshua Modney**, **Andreia Pinto-Correia**, **Mariel Roberts**, **Mehmet Ali Sanlikol**, **Betty Shamieh**, and **Derek Bermel**, Artist-in-Residence

November 18
Princeton Symphony Orchestra Concert ✦ *International Tour of Brass Music* ✦ **Jerry Bryant** and **Donald Batchelder**, trumpets; **R. J. Kelley**, horn; **Brian Mahany**, trombone, **Andrew Bove**, tuba

November 28
Friends Forum ✦ *Petrified Emotions: Understanding Graffiti in the City of Aphrodite* ✦ **Angelos Chaniotis**, Professor, School of Historical Studies

November 30–December 1
Edward T. Cone Concert Series ✦ *shifted during flight* ✦ **eighth blackbird**

Edward T. Cone Concert Series Talk ✦ **Andy Akiho**, **Matthew Duvall**, **Lisa Kaplan**, **Yvonne Lam**, **Michael J. Maccaferri**, **Tim Munro**, **Nicholas Photinos**, and **Derek Bermel**, Artist-in-Residence

December 3
AMIAS Talk ✦ *Flexner's Utopia: A Talk for the Institute Community about the History and Relevance of IAS* ✦ **Robert Dijkgraaf**, Director and Leon Levy Professor, Institute for Advanced Study

December 5
Public Policy Lecture ✦ *The Lives of Others* ✦ **Owen M. Fiss**, Sterling Professor Emeritus of Law and Professorial Lecturer in Law, Yale Law School

December 10
Art Lecture ✦ *Up Close and Far Away: Artists, Memorialization, and Uganda's Troubled Past* ✦ **Sidney Kasfir**, Professor Emerita, Emory University

December 11
Children's Holiday Party

December 20
Institute Community Holiday Party

January 12
Princeton Symphony Orchestra BRAVO! Family Concert ✦ *Brass Quintet*

January 20
Princeton Symphony Orchestra Concert ✦ *The Declassified Plays Mozart* ✦ **Owen Dalby**, violin; **Meena Bhasin**, viola; **Hamilton Berry**, cello; **James Austen Smith** and **ToniMarie Marchioni**, oboes; **Alicia Lee** and **Paul Cho**, clarinets; **Seth Baer** and **Shelley Monroe Huang**, bassoons; **Eric Reed** and **Alma Liebrecht**, horns

ALL PHOTOS, ANDREA KANE, EXCEPT BOTTOM PHOTO, AMY RAMSEY

January 30
Dr. S.T. Lee Lecture ✦ *(Ancient) History on Screen* ✦ **Oliver Stone**, Director; **Angelos Chaniotis**, Professor, School of Historical Studies; **Nathanael Andrade**, Assistant Professor, University of Oregon; **Yannis Hamilakis**, Professor, University of Southampton; **Gary Leva**, Director, Film Historian

February 1–2
Edward T. Cone Concert Series ✦ *Eclectic/Electric* ✦ **Wiek Hijmans**, electric guitar; **Derek Bermel**, clarinet; **JACK Quartet**

Edward T. Cone Concert Series Talk ✦ **Wiek Hijmans**, **Kevin McFarland**, **Christopher Otto**, **John Pickford Richards**, **Ari Streisfeld**, and **Derek Bermel**, Artist-in-Residence

February 5
Term II Member Welcome Dinner

February 20
Writers Conversation ✦ *The Multi-Logics of West African Improvisations: And Some Others* ✦ **Sheron Wray**, Choreographer, Dancer, Researcher

February 22
Friends Culture and Cuisine ✦ *Steal the Menu: Forty Years in Food* ✦ **Raymond Sokolov**, Food Critic

March 2
Midwinter Party for Faculty, Members, and Staff

March 5
Art Lecture ✦ *A Multitude of Images* ✦ **David Joselit**, Carnegie Professor, Yale University

March 6
Public Lecture ✦ *When Truth Gets in the Way: Addressing Multiple Realities in Intrastate Conflicts* ✦ **Michael van Walt van Praag**, Visiting Professor, School of Historical Studies

March 8–9
Edward T. Cone Concert Series ✦ *Songs from* Golden Motors*: A Staged Reading* ✦ **Derek Bermel**, music; **Wendy S. Walters**, lyrics and book; **Johanna McKeon**, direction; **Lawrence Clayton**, **Chuck Cooper**, **Aisha de Haas**, **Okieriete Onaodowan**, **Dan'yelle Williamson**, acting; **John DiPinto**, piano and music direction

March 8
Edward T. Cone Concert Series Talk ✦ **Johanna McKeon**, **Wendy S. Walters**, and **Derek Bermel**, Artist-in-Residence

March 9
Edward T. Cone Concert Series Talk ✦ **John DiPinto**, **Johanna McKeon**, **Steve Smith**, **Wendy S. Walters**, and **Derek Bermel**, Artist-in-Residence

March 13
Friends Forum ✦ *Your Brain at Work: Facts, Theory, and Just So Stories* ✦ **John J. Hopfield**, Martin A. and Helen Chooljian Visiting Professor, School of Natural Sciences

March 20
Einstein Legacy Society Talk ✦ *America's Retirement Crisis* ✦ **Roger W. Ferguson, Jr.**, President and Chief Executive Officer, TIAA-CREF; Trustee, Institute for Advanced Study

March 24
Memorial for Albert O. Hirschman, Professor Emeritus in the School of Social Science

March 27
Writers Conversation ✦ *How to Love Wine* ✦ **Eric Asimov**, Wine Critic, *The New York Times*

April 3
Public Lecture ✦ *The Arduous Path of Refugees in the Changing Landscape of Asylum* ✦ **Didier Fassin**, James D. Wolfensohn Professor, School of Social Science

April 5
Friends Fireside Chat ✦ *Today's Landscape of Pharmaceutical Research in Cancer* ✦ **Elliott Sigal**, Chief Scientific Officer and President of Research and Development for Bristol-Myers Squibb

April 9
Art Lecture ✦ *The Ubiquitous Exhibition: Magazines, Museums, and the Reproducible Exhibition after World War II* ✦ **Olivier Lugon**, Professor, Université de Lausanne

April 21
Princeton Symphony Orchestra Concert ✦ *Cello Recital* ✦ **Alistair MacRae**, cello; **Jeewon Park**, piano

April 24
Public Lecture ✦ *A Hollywood Celebrity, the "Bad Boy" of Music, and the History of Modern Wireless Communications* ✦ **Mark Goresky**, Long-term Member, School of Mathematics

April 26
Friends Fireside Chat ✦ *Blogging, Now and Then (250 Years Ago)* ✦ **Robert Darnton**, Carl H. Pforzheimer University Professor and Director of the Harvard University Library

May 1
Friends Forum ✦ *Changing Politics: New Issue Acceptance and the American Way* ✦ **Deva Woodly**, Friends of the Institute Member, School of Social Science

May 3
Public Lecture ✦ *The Latest News from the Cosmos* ✦ **Matias Zaldarriaga**, Professor, School of Natural Sciences

May 8
Institute Community Concert ✦ **Derek Bermel**, Artist-in-Residence, **Anthony Davis**, **Christina von Döbeln**, **Léo Dubois**, **Noriko Manabe**, **Taylor Noble**, **Zoe Sarnak**, and **Nigel Smith**

May 10
AMIAS Lecture ✦ *Gone with the Wind: Black Holes and their Gusty Influence on the Birth of Galaxies* ✦ **Nadia Zakamska**, Assistant Professor, Johns Hopkins University; former Member, School of Natural Sciences

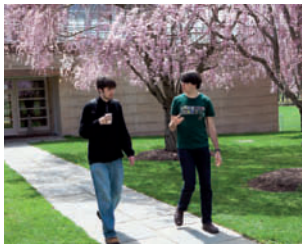
May 15
Public Lecture ✦ *Robert Oppenheimer: A Life Inside the Center* ✦ **Ray Monk**, Professor, University of Southampton

May 29
Institute Talk ✦ *Identities and Migrations in the European Steppe: Comparative Perspectives* ✦ **Walter Pohl**, Professor, University of Vienna

May 30
Friends Annual Meeting and Barbecue

May 31
Staff Picnic





After Hours Conversations

The After Hours Conversations program, launched in February 2008 to encourage inter-School conversations in an informal and relaxed environment, continued in 2012–13. Talks were held in Harry's Bar every Monday and Thursday in October and November and again in February and March. After a ten-minute presentation of a theme or problem of broad significance, there were twenty minutes of lively group discussion, often followed by continuing conversation as people lingered over drinks. The program was organized by a group of four IAS Faculty members, Didier Fassin of the School of Social Science, Patrick Geary of the School of Historical Studies, Helmut Hofer of the School of Mathematics, and Piet Hut of the Program in Interdisciplinary Studies. The program was chaired by Piet Hut, with all four Faculty members taking turns moderating the discussions. Attendance varied from twenty to seventy. There were presentations by Members, Visitors, and Faculty, both active and emeriti, from all four Schools of the Institute and from the Program in Interdisciplinary Studies, as well as by Director's Visitors and Staff. Topics ranged from the use of genetics in historical research to planets around other stars, treatments of brain-injured children, scientific fraud, foundations of mathematics, urban violence, and marriage markets. A webpage (www.ids.ias.edu/after-hours-conversations) provides information on dates, speakers, and topics. The program will continue in 2013–14.

ANDREA KANE

Juan Maldacena, Professor in the School of Natural Sciences, spoke at an After Hours Conversation on what happens when you fall into a black hole.

BENTLEY DREZNER

Artist-in-Residence Derek Bermel (center, playing clarinet) performed with the JACK Quartet and Wiek Hijmans, the Dutch electric guitarist, in the third concert of the season, which featured a new composition by Bermel, *A Short History of the Universe (as related by Nima Arkani-Hamed)*, inspired by the physics lectures of Arkani-Hamed, Professor in the School of Natural Sciences.

Special Programs

Program in Interdisciplinary Studies

Professor **Piet Hut**'s research in astrophysics addressed the need for more universal and transparent data formats. Every area of science now threatens to be overwhelmed by an increasing flood of data, given ever higher computer speeds and the need for larger databases keeping up with those speeds. In order to regulate the necessary data flows better, in the case of N-body simulations, Hut, together with colleagues Will Farr and others, proposed a new data format called PSDF, for Particle Stream Data Format. After publishing their format, and making the software freely available, they have started to use it in their own simulations.

In other areas of astrophysics, Hut continued his research with Ataru Tanikawa and Jun Makino on the formation of double stars in dense stellar systems. With Douglas Heggie joining them, they greatly improved their search and analysis algorithms, providing the first in-depth "microscopic" analysis of the complete history of the formation of the first hard binary in core collapse of a dense star cluster. Among Hut's other astrophysics activities were co-organizing the conference MODEST-12 in Kobe, Japan, on multiscale multiphysics simulations of dense stellar systems and joining the Organizing Committee of the International Astronomical Union Commission 7: Celestial Mechanics and Dynamical Astronomy.

In addition, Hut and George Djorgovski concluded their National Science Foundation–funded five-year-running experiment of establishing astrophysical research in three-dimensional online virtual worlds. They, with colleagues from astrophysics and computer science, published their final results in the paper "The Meta Institute for Computational Astrophysics: Astrophysics in Virtual Worlds."

As Head of the Program in Interdisciplinary Studies at IAS, Hut interacted with a range of visitors in his program, covering areas from literature, philosophy, media, sociology, and political science to biology, chemistry, bioinformatics, mathematics, computer science, and astrophysics.

Hut joined a major new interdisciplinary initiative in Japan at the Tokyo Institute of Technology, a ten-year running project for which he was asked to be a foreign principle investigator and councilor. Launched at the end of 2012, the Earth-Life Science Institute (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. Hut was invited to give the opening speech on "big questions" at the first international symposium at ELSI in March 2013. He also was co-organizer of a workshop on the origins of life in June 2013. In order to orient himself further in this field, he attended origins of life conferences at Princeton University, CERN in Geneva, and the Japan Geoscience Union in Tokyo, as well as the workshop "Engines of Life: Thermodynamic Pathways to Metabolism," at Arizona State University. In addition, he visited the University of California, Davis, to discuss networks and complexity theory, and he met various astrobiologists in the Bay Area.

During the year, Hut continued to lead a series of After Hours Conversations, together with colleagues Nicola Di Cosmo from the School of Historical Studies, Didier Fassin from the School of Social Science, and Helmut Hofer from the School of Mathematics. These conversations were held at IAS in Harry's Bar two times a week for a period of two months during each semester, and they were widely seen as an effective way to encourage inter-School communication at IAS. In the second semester, Hut started a new series of informal lunch conversations, IPA@IAS, short for Interdisciplinary Perspectives on Abiogenesis.

Other interdisciplinary activities included the B612 foundation of which Hut is a co-founder. In October 2012, their project Sentinel was official declared technically sound and on track for a 2017 launch, according to an independent review panel. This will be the first privately sponsored space mission aimed at making a more complete inventory of asteroids that may threaten impacts on Earth. Hut also joined the Advisory Board of the Helix Center for Interdisciplinary Investigation, a division of the New York Psychoanalytic Society. He became a Member of the International Society for the Study of the Origin of Life and Astrobiology Society and a Member of the International Society for Artificial Life.

Artist-in-Residence Program

The Artist-in-Residence program creates a musical presence at the Institute. As the Institute's Artist-in-Residence, the composer and clarinetist Derek Bermel organized the Edward T. Cone Concert Series in 2012–13, as well as a series of Writers Conversations and a concert featuring musicians from the Institute community.

The Edward T. Cone Concert Series, which is open to the public as well as the Institute community, featured concerts and related talks exploring a spectrum of nineteenth-, twentieth-, and twenty-first-century art music. In *Across the Continent*, Bermel and the pianist Christopher Taylor performed works hailing from countries across Europe, including Witold Lutosławski's *Dance Preludes* and Johannes Brahms's first Clarinet Sonata. In *shifted during flight*, the sextet eighth blackbird performed a collection of inventive compositions, including work by Bermel, György Ligeti, and Andy Akiho. The JACK Quartet appeared with Bermel and Wiek Hijmans, the Dutch electric guitarist, in the third concert of the season, which featured a new composition by Bermel, *A Short History of the Universe (as related by Nima Arkani-Hamed)*, inspired by the physics lectures of Arkani-Hamed, Professor in the School of Natural Sciences. The final concerts presented a staged reading of *Golden Motors*, a musical centering on a family's struggle to improve their lives in the shadow of a fictional Detroit auto plant during the early 1980s, sung by the actors Aisha de Haas, Lawrence Clayton, Chuck Cooper, Dan'yelle Williamson, and Okieriete Onaodowan. The collaboration includes book and lyrics by the poet Wendy S. Walters and music by Bermel that draws on gospel, art song, Motown, country, and Broadway.

In addition to the concert series, Bermel continued to organize a series of Writers Conversations featuring discussions with writers and other artists about the creative process. In the fall, the filmmaker and artist Kevin Jerome Everson spoke about his process of combining scripted, documentary, and formal elements in film. In the spring, choreographer, dancer, and researcher Sheron Wray spoke about and demonstrated a paradigm of performance combining body, voice, technology, and audience participation. In the final conversation, Eric Asimov, chief wine critic of *The New York Times*, discussed his book *How to Love Wine: A Memoir and Manifesto*.

For the second year, Bermel organized a concert of musicians from the Institute community, including Anthony Davis, the spouse of Deva Woodly, Member in the School of Social Science; Christina von Döbeln, the spouse of School of Mathematics Member Anders Södergren; Léo Dubois, the son of Vincent Dubois, Member in the School of Social Science; Zoe Sarnak (who composed the song that she performed with Taylor Noble), the daughter of Peter Sarnak, Professor in the School of Mathematics; and Nigel Smith, Member in the School of Historical Studies, who performed with Noriko Manabe.

During the 2012–13 academic year, Bermel also served as Composer-in-Residence at Mannes College The New School for Music; hosted a panel at the prestigious Output electric guitar festival in Amsterdam; performed his clarinet concerto at Lincoln Center's Alice Tully Hall; and created an intensive all-scholarship annual workshop and mentoring program for young composers, CULTIVATE, based at Copland House. With Helmut Hofer, Professor in the School of Mathematics, Bermel wrote an article in the Summer 2012 *Institute Letter* about their collaboration on *Orbit Design*, a composition inspired by Hofer's work on symplectic dynamics. Bermel's four-year term as Artist-in-Residence concluded on June 30, 2013. The composer Sebastian Currier was selected to be the Institute's next Artist-in-Residence.

Director's Visitors

Director's Visitors, scholars who work in a variety of fields, including areas not represented in the Schools, contribute much to the vitality of the Institute. They are invited to the Institute for varying periods of time, depending on the nature of their work.

Graham Farmelo

During his visit in summer 2012, Farmelo completed the penultimate draft of his book "Churchill's Bomb," which will describe Churchill's development as a nuclear visionary in the 1920s and 30s, his role in developing the bomb, and his relationships with his nuclear scientists and with the presidents who oversaw America's first nuclear programs. During his stay, Farmelo consulted members of the Faculty and made extensive use of the Institute's peerless library facilities and the Shelby White and Leon Levy Archives Center, together with several archives in Washington, D.C.

Institute for Advanced Study/Park City Mathematics Institute (PCMI)

TODD ROYAL HICKEN

Paul Allen, Lewis & Clark College, lecturing in the Undergraduate Summer School

The IAS/Park City Mathematics Institute (PCMI) is a program of professional development for the mathematics community, including research mathematicians, graduate students, undergraduate students, mathematics education researchers, undergraduate faculty, and school mathematics teachers. Established in 1991 through a grant from the National Science Foundation, PCMI has been an outreach program of the Institute for Advanced Study since 1994.

The annual Summer Session is the flagship activity of PCMI. Held in Park City, Utah, this three-week, residential institute combines high-quality lectures and seminars with activities and events designed to foster all-institute interaction. The unique interaction at PCMI creates strong bonds throughout the mathematical community and increases awareness of the roles and the contributions of all professionals in mathematics-based occupations.

In addition to the annual Summer Session, PCMI offers year-round professional development outreach activities to summer school mathematics teachers around the nation through the c-TaP Project and through PCMI's Professional Development and Outreach Groups.

Another method of outreach is through the publications offered by PCMI. The Math Forum at Drexel University publishes online the products created by PCMI's Summer School Teachers Program and the proceedings and briefs authored by PCMI's International Seminar on Mathematics Education. The Graduate Summer School lectures are collected in their own volumes, the *Park City Mathematics Series*, published by the American Mathematical Society (AMS) and targeted at graduate students and research mathematicians. Also published by the AMS is a series of lectures from PCMI's Undergraduate Summer School.

Summer Session

The twenty-third annual Summer Session was held June 30–July 20, 2013, in Park City, Utah, and attracted some 350 participants combined in all programs.

The following programs comprised the Summer Session (except as noted, all programs met for the entire three weeks):

- Graduate Summer School
- High School Student Mathematics Camp (one week)
- Research Program in Mathematics
- School Teachers Program
- Undergraduate Faculty Program
- Undergraduate Summer School
- Workshop for Mentors of Minority Undergraduate Research in Mathematics (one week)

The mathematical research topic informs the courses and seminars for the Graduate Summer School, the Research Program, the Undergraduate Summer School, and the Undergraduate Faculty Program; in 2013, the topic was

"Geometric Analysis." The topic "Making Mathematical Connections" provided the focus for the three-week School Teachers Program and the one-week program for high school students.

Each program met daily for a series of courses and seminars. The programs also met together for Cross-Program Activities three or four days each week.

Graduate Summer School and Research Program

The Graduate Summer School and the Research Program in Mathematics were organized by Professors Hubert Bray, Duke University; Greg Galloway, University of Miami; Rafe Mazzeo, Stanford University; and Natasa Sesum, Rutgers, The State University of New Jersey. This year's theme, "Geometric Analysis," is a very broad area of mathematics whose objective is to study geometrically motivated problems using diverse tools from analysis, partial differential equations, physics, topology, and geometry. The Graduate Summer School lecture series, as well as the Research Program's lectures, reflected this diversity.

Graduate Summer School

The Graduate Summer School is designed to provide graduate students with a comprehensive and diverse learning experience that few, if any, could obtain within a single university. Attendance at all lectures was very high and included participants from the Graduate Summer School, the Research Program, the Undergraduate Faculty Program, the Undergraduate Summer School, and even the Summer School Teachers Program.

The 2013 Graduate Summer School had nine lecture series (with a total of thirty-six lectures), each on a particular aspect of geometric analysis. Each lecture series consisted of four or five lectures as well as three supplementary sessions where students worked on prepared problems guided by the lecturers' teaching assistants. The lectures were well-balanced between introductory and advanced research material.

Graduate Summer School Lecture Series 2013

Michael Echmair, Eidgenössische Technische Hochschule Zürich: "On the Isoperimetric Structure of Asymptotically Flat Manifolds"

Fernando Marques, Instituto Nacional de Matemática Pura e Aplicada, Rio de Janeiro: "Min-max Theory and the Willmore Conjecture"

Tristian Riviere, Eidgenössische Technische Hochschule Zürich: "Weak Immersions of Surfaces with Finite Total Curvature"

Igor Rodnianski, Massachusetts Institute of Technology: "Evolution Problem in General Relativity"

Peter Topping, Warwick University: "Applications of Hamilton's Compactness Theorem for Ricci Flow"

Jeff Viaclovsky, University of Wisconsin–Madison: "Riemannian Curvature Functionals"

Ben Weinkove, University of California, San Diego: "The Kahler-Ricci Flow on Compact Kahler Manifolds"

Brian White, Stanford University: "Minimal Submanifolds"

Steve Zelditch, Johns Hopkins University: "Global Harmonic Analysis"

TODD ROYAL HICKEN

Participants of the International Seminar on Mathematics Education

The Research Program in Mathematics

A broad spectrum of highly active researchers in "Geometric Analysis" were recruited for the Research Program. A significant number of researchers stayed for the entire three weeks of the Summer Session.

The main formal activity of the Research Program consisted of nine hours of research talks each week. The speakers took into account the diversity of the audience and carefully explained the background and motivation for their work as well as their recent results. Informal activity was also

extensive; small groups gathered for conversations wherever they could find space. Many of these conversations have already developed into new collaborations.


TODD ROYAL HICKEN

Working on mathematics in the Summer School Teachers Program

Clay Senior Scholars-in-Residence

Through the generous support of the Clay Mathematics Institute, PCMI is able to nominate two Senior Scholars-in-Residence for each Summer Session. The Scholars are nominated from among the international leadership in the research topic, and and they are required to be in residence at PCMI for the entire three weeks as part of the Research Program and to give a public all-institute lecture while at PCMI. The 2013 Clay Scholars at PCMI were Gerhard Huisken, Eberhard Karls Universität Tübingen, and Richard Schoen, Stanford University. Both Scholars were active participants of the Research Program and Graduate Summer School, and both took the time to hold informal discussion sessions with the school mathematics teachers and the undergraduate students at PCMI.

Summer School Teachers Program

The Summer School Teachers Program (SSTP) of 2013 attracted sixty-four teachers from all levels. The participants followed an intense daily schedule that included learning mathematics, reflecting on the practice of teaching mathematics in today's classrooms, and working together in groups to create products to be shared with their colleagues.

Participants took part daily in a two-hour mathematics problem-solving course; this year's course was entitled "Probability, Randomization, and Polynomials."

The materials for the mathematics problem-solving courses were created by a team led by Al Cuoco and Bowen Kerins from the Educational Development Center (EDC); instructors for the course were Darryl Yong from Harvey Mudd College and Kerins, a mathematics educator from EDC and a former math teacher.

In the daily "Reflecting on Practice" session, participants considered research related to teaching and learning mathematics with a particular focus on questioning and how it impacts instruction. The discussion was grounded in the research literature as participants worked collaboratively to better understand why questions are an important component of instruction and how they can use questioning in their own classrooms to promote student understanding. A staff of six teacher-leaders designed and led the sessions under the guidance and supervision of the SSTP leadership team. Videos of classrooms from the United States and other countries, transcripts, research findings, articles, assessment results, and student work were used to prompt an analysis of effective questioning and how it can be enacted in classrooms.

Each afternoon the participants took part in one of several working groups established by the c-TaP Project (see below). Within these groups, participants discussed and wrote professional development modules for teachers to be used in the c-TaP workshops at all levels of school mathematics: elementary, middle school, and high school. In addition, two of the SSTP's traditional working groups were maintained from prior years: the Lesson Study group and the group that takes part in the mathematics course of the Undergraduate Faculty Program. These last two groups also met daily in the afternoons to focus on preparing classroom activities in keeping with their chosen mathematical themes.

The c-TaP Project

Since 2011, the Summer School Teachers Program of PCMI has been engaged in a concerted effort to attain a position of national reputation and influence in the professional development of school mathematics teachers. This initiative began with an extended consultation in the summer of 2011 with fourteen of the major national mathematics teaching constituencies, groups spanning a spectrum that included the National Council of Teachers of Mathematics, the American Federation of Teachers, and the U.S. Department of Education.

The premise on which all of these groups agreed was the increased professionalization of teachers of mathematics, based on high-quality mathematical and pedagogical norms, together with the additional premise that those mathematical and pedagogical norms be generated in partnership with teachers themselves, supported by mathematicians, mathematics educators, and other governmental and private entities. The advent of the Common Core State Standards for Mathematics (CCSSM) and their adoption by forty-five of the fifty states provides a historic opportunity to raise the status of mathematics teaching and mathematics teachers, grounded in quality of content and presentation. As a result of these consultations, ten of the above-mentioned fourteen constituencies formed an ad hoc committee called the Committee on Teachers as Professionals, or c-TaP for short, dedicated to supporting teacher-led design and delivery of (teacher-to-teacher) professional development centered around authentic implementation of the CCSSM.

With initial funding from Math for America, c-TaP utilizes PCMI's Summer School Teachers Program and the Institute for Mathematics and Education as its base, giving mathematics teacher-leaders the opportunity to develop and adapt CCSSM-implementation materials for their colleagues. (The Institute for Mathematics and Education at the University of Arizona is headed by Bill McCallum, chair of the CCSSM writing group.) Teams of teacher-leaders then take these materials on the road, offering professional development workshops for their colleagues around the United States. In the last eighteen months, over thirty such c-TaP teacher-to-teacher workshops have been given, entirely financed by the local venue requesting the particular workshop.

More recently, wider groups of teachers, comprising not only the entire SSTP teacher cohort but also networks of teachers who were reached through the c-TaP workshops, are gradually beginning to comprise a professional community of teachers of mathematics.

Other Connected Programs

A high school student Math Camp was a pilot feature at PCMI in 2012 and was held again in 2013. Organized by Troy Jones, a teacher from Westlake High School in Alpine, Utah, with funding from IM Flash Technologies, the program enabled sixteen high school students to attend PCMI during the second week. The students, chaperoned by a subset of parents, worked in their own classroom on the same mathematical problem sets as the SSTP participants in the morning and had a series of afternoon speakers from nearby universities, industries, or from other PCMI programs. They also attended and took part in the cross-program activities (e.g., Clay Mathematics Institute lectures, pizza and problem-solving session) and attended the SSTP sessions held in late afternoon or evening (e.g., origami building). In addition to their own class work and homework, the students functioned as the laboratory for the first teaching done by the SSTP's Lesson Study working group. They also managed to complete two weeks of the mathematics course during their morning sessions and were actually able to join the SSTP participants in the mathematics course on their last day at PCMI.

TODD ROYALHICKEN

Rafe Mazzeo of Stanford University (center), one of the organizers of the PCMI Graduate Summer School and the Research Program, talks with two researchers in the program.

Distance Learning

In addition to the SSTP taking place in Park City, eleven teachers from Las Cruces, New Mexico, funded through a National Science Foundation grant, took part each day in real time via electronic "e-tables," i.e., distance learning with real-time screen images and interaction between the two sites. The New Mexico e-tables were organized by Susana Salamanca, a mathematician at New Mexico State University, and facilitated by Rina Martinez, a past SSTP participant, with Soledad Gonzales and Robyn Perkins, all three middle school teachers.

TODD ROYAL HICKEN

Participants of the Graduate Summer School working together during a problem-solving session

Undergraduate Faculty Program

For faculty members whose main focus is teaching undergraduate students, the Undergraduate Faculty Program (UFP) at PCMI offers the opportunity to renew excitement about mathematics, talk with peers about new teaching approaches, address some challenging research questions, and interact with the broader mathematical community. The UFP is unique in that it bridges the educational and research objectives of PCMI. There were fourteen participants. Their backgrounds in geometric analysis (this year's research theme for PCMI) varied tremendously.

This year's UFP instructor was Professor Justin Corvino of Lafayette College. The group met three times a day, attending lectures on the foundations of differential geometry and the links between differential geometry and relativity theory. Each afternoon, the group met to discuss teaching and research projects. During the last week, the participants themselves prepared and gave lectures not just about mathematics but also about pedagogy in the undergraduate classroom.

Undergraduate Summer School

Some thirty-five undergraduate students took part in PCMI's 2013 Undergraduate Summer School. PCMI offers two distinct courses for undergraduates, one introductory and one advanced, with students self-selecting into either or both.

The introductory course, by Iva Stavrov of Lewis & Clark College, was titled "Curvature of Space and Time." Motivated by examples from general relativity, she developed the topics from differential geometry necessary to define, compute, understand (visualize), and apply the curvature tensor. Paul Allen, also of Lewis & Clark College, offered the advanced course, "Geometric Differential Equations." Also motivated by problems in relativity and the interplay between analysis and geometry, he took a more bottom-up approach and developed the notions from the calculus of variations and functional analysis needed to build a variational setting for partial differential equations (in particular, waves) in which the equations could be derived and shown to have solutions with sufficient regularity.

TODD ROYAL HICKEN

SSTP participants at the PCMI Summer Session

Stavrov and Allen, though focused on distinct regions of the field, worked carefully to draw connections to one another's perspectives and lectures. They were also regular participants in the PCMI Graduate Summer School and so were able to support many of the topics addressed in the graduate lectures. This was especially important for the one-third of their class comprised of post-baccalaureate students and the participants from the Undergraduate Faculty Program.

Workshop for Mentors of Undergraduate Mathematics Research by Minority Students (WfM)

In its second year of funding from the National Science Foundation, the Workshop for Mentors of Undergraduate Mathematics Research by Minority Students (WfM) was held at PCMI July 8–13, 2013. Organized and conducted by Steven Cox, Rice University, and Dennis Davenport, Howard University, the workshop attracted some twenty-three applicants from a variety of institutions, some of which specifically serve minorities. Ten participants were selected to take part in the workshop, whose focus was to enable more mentors to successfully engage their minority undergraduate students in mathematical research. The stated goals of the workshop were:

(1) to construct or select exciting undergraduate-tractable research problems,
(2) to transform their mentees into confident speakers and writers of mathematics,
(3) to acquire group-building skills and so create communities of scholars,
(4) to design and/or augment curricula for academic and/or summer research, and
(5) to construct competitive proposals to fund and sustain the above activities.

The WfM program met for three to four hours each day and was joined by the Undergraduate Faculty Program on three occasions for a joint session. The content sessions served to inform the younger participants and to anchor the daily discussion periods.

Cross-Program Activities

In order to bring together the entire PCMI community during the three weeks of the annual Summer Session, many cross-program activities were held. Some were organized informally by the participants, and some were organized more formally by PCMI.

The Opening Socials
Clay Mathematics Institute Public Lectures: Gerhard Huisken, Eberhard Karls Universität Tübingen, and Richard Schoen, Stanford University
The PCMI Opening Dinner
The Annual Park City Fourth of July Parade Entry by PCMI
PCMI World Cup Soccer Match
Discussion Forum: Conversations between Undergraduate Faculty and Summer School Teachers
Origami Construction Sessions
Pizza and Problem-Solving Session, presented by Francis Su, Harvey Mudd College
Mathematical Modeling with George Hart
Ice Cream Social, hosted by the participants of the SSTP
The Director's Hike
The PCMI Closing Dinner

Publications

PCMI publishes lectures and proceedings from each Summer Session as follows:

Published by the American Mathematical Society, the Park City Mathematics Series comprises nearly all of the lectures ever given in PCMI's Graduate Summer School, from 1991 to 2011 thus far. The series now comprises twenty volumes, all of which are currently in print and available for sale.

Also published are seven volumes in the Park City Mathematics Institute Subseries, a subsection of the AMS Student Mathematics Series. These volumes are aimed at undergraduate students and each is written by a lecturer from the Undergraduate Summer School of PCMI's Summer Session.

The Summer School Teachers Program will be publishing its mathematical materials with the American Mathematical Society in a new, stand-alone AMS series targeted for the professional development of in-service teachers, pre-service teachers, and mathematics educators.

The proceedings and briefs of the International Seminar on Mathematics Education are published on the PCMI website.

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IAS/Park City Mathematics Institute Governance and Management

Science Initiative Group (SIG)

The Science Initiative Group (SIG) has fostered science in developing countries since it became an IAS outreach program in 1999. For the past six years, SIG has focused on the Regional Initiative in Science and Education (RISE). With funding from Carnegie Corporation of New York, RISE supports five university-based research and training networks in science and engineering in sub-Saharan Africa. While SIG plays an advisory and developmental role, the African networks have substantial autonomy with respect to academic content and policy, budget allocation, and internal administration.

Since the program began, RISE students have earned seventeen Ph.D.s and twenty-eight master's degrees, and three have completed postdocs. Forty-four women and ninety-one men from fifteen African nations have benefited directly from participation in RISE.

A distinctive feature of the RISE experience is how closely the students' careers and lives are intertwined with political and social issues outside the laboratory. Many have adapted their work to the challenges of modern Africa, ranging from the distortions of war to the demands of public policy. The following stories are presented in full at http://sig.ias.edu/rise.

The Upsets of War

The scientific journey of **Alain Mufala**, a native of the Democratic Republic of Congo, shows how the roadblocks, delays, and dangers of war can jeopardize the scientific careers of even the most talented and persistent African scientists. Since earning a B.S. in chemical engineering at the University of Lubumbashi in 2000, he struggled for more than a decade before chancing upon an opening in the RISE program in Namibia. He is now pursuing his Ph.D. in chemical engineering, working on a new ion-exchange membrane for hydrogen fuel cells, but he continues to live as a scientist without a country.

Venancio Taimo was born in Mozambique in 1976, between the decade-long war of independence and fifteen years of civil war. When peace came, he enrolled at Eduardo Mondlane University and vowed to help rebuild his country, choosing the goal of safe drinking water. But he found few resources for his studies. Water movements were unknown, and borehole data had never been analyzed. He found RISE, and its network structure allowed him to send samples to South Africa for analysis, to consult with RISE faculty, and to use advanced software.

Godwil Madamombe, a native of Zimbabwe, began his career as a plant pathologist. After completing his master's degree, he was offered a job with the Tea Research Foundation of Central Africa (TRFCA). He learned that the industry was plagued by a shortage of labor. Both Zimbabwe and Malawi had long benefited from cheap refugee labor from Mozambique during the civil war, but after the war these laborers returned home, and tea

growers were forced to mechanize. The machines gave lower yields and Madamombe was asked to discover why. The easy answers of non-selective picking and random damage gave way to complex horticultural questions. Through the TRFCA he joined RISE and gained access to advanced research facilities and expert researchers who helped him with the complex biochemistry and instrumentation he needed.

Politics and Policy

Laboratory research may have enormous social value—if society chooses to use it. **Nelson Odume**, a Nigerian who enrolled at Rhodes University in 2009 through RISE, studies the use of insects and other organisms as indicators of water quality. He learned that even slight changes in the mouthparts of certain insects were caused by heavy metal pollutants in the nearby Swartskop River. He has since developed effective water-quality indexes and, with his supervisor, proposed their use to strengthen new laws regulating water quality in South Africa. Thus his laboratory work has led to results of great potential importance to policy.

Similarly **Paul Mensah**, born in Ghana, had long dreamed of using his biological training to protect the environment. When searching for a worthy research project at Rhodes University, he learned that no one had done local studies of the herbicide Roundup, which is sprayed liberally throughout the country. Working closely with the local Department of Water Affairs, he tested Roundup against *Caridina nilotica*, a common freshwater shrimp, and eight other organisms, and suggested safe usage amounts that would minimize impacts on non-target freshwater organisms. When one of Mensah's supervisors moved to a company that provides water services to municipalities, he gained an additional connection to the larger world of public policy.

For **Gaolathe Tsheboeng**, a native of Botswana, botanical studies of plants in the Okavango Delta have importance beyond academia. The ecological richness of the Delta, he has found, depends on regular pulses of flood water from Angola. However, the countries bordering the Okavango—Namibia, Angola, Zambia, and Zimbabwe—continually jockey for water rights, and a constant worry is the danger of large dams or diversions that would jeopardize the rich Delta ecosystem. Hence Tsheboeng and his colleagues must educate the public about the importance of the flooding.

Raphael Tshimanga, too, has moved from the laboratory to the world of policy. Having grown up in the Democratic Republic of Congo, he wanted to understand the hydrology of the mighty Congo River. He earned a Ph.D. through RISE and has returned home to the University of Kinshasa, where he is both a lecturer and the "man in the hot seat" for difficult water-resource questions. With development, his country will need more water for growth, and neighboring countries clamor for a share as well. "The future of the Congo basin is unknown," said Tshimanga. "People don't want to wait for the science, they just want to go ahead with the planning. But what is planning without science?"

Further information about SIG and RISE is available at http://sig.ias.edu and twitter.com/SIGatIAS.

Acknowledgments

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 serves as the basis for the $200 million Campaign for the Institute, intended to strengthen its position for future generations of scholars and scientists.

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(through June 30, 2013)

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Institute for Advanced Study—
Louis Bamberger and Mrs. Felix Fuld Foundation

Financial Statements
June 30, 2013 and 2012

(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, 2013 and 2012, 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, 2013 and 2012, 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

November 25, 2013

STATEMENTS OF FINANCIAL POSITION
JUNE 30, 2013 AND 2012

Assets		2013	2012
Cash and cash equivalents	$	5,457,600	6,201,135
Accounts receivable and other assets		1,029,779	1,871,735
Grants receivable		3,138,227	4,325,582
Contributions receivable—net		33,261,877	50,480,353
Unamortized debt issuance costs—net		625,490	467,346
Funds held by bond trustee		2,281,080	2,407,508
Beneficial interest in remainder trust		2,721,332	2,834,108
Land, buildings and improvements, equipment, and rare book collection—net		74,496,930	69,544,447
Investments		671,372,318	607,790,303
Total assets	$	794,384,633	745,922,517
Liabilities and Net Assets			
Liabilities:			
Accounts payable and accrued expenses	$	7,875,196	6,291,175
Deferred revenue		5,316,308	7,355,774
Liabilities under split-interest agreements		2,245,464	2,224,186
Postretirement benefit obligation		13,175,092	15,061,242
Asset retirement obligation		1,005,070	993,443
Bond swap liability		4,475,949	6,498,621
Note payable		289,954	358,908
Long-term debt, net of discount		66,050,034	52,741,795
Total liabilities		100,433,067	91,525,144
Net assets:			
Unrestricted		364,283,394	346,522,897
Temporarily restricted		147,257,386	134,811,093
Permanently restricted		182,410,786	173,063,383
Total net assets		693,951,566	654,397,373
Total liabilities and net assets	$	794,384,633	745,922,517

See accompanying notes to financial statements.

STATEMENT OF ACTIVITIES
YEAR ENDED JUNE 30, 2013

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Operating revenues, gains, and other support:				
Private contributions and grants	$ —	8,917,535	—	8,917,535
Government grants	—	7,266,639	—	7,266,639
Endowment spending policy	18,589,144	16,090,456	—	34,679,600
Auxiliary activity	5,894,135	—	—	5,894,135
Net assets released from restrictions—satisfaction of program restrictions	32,274,630	(32,274,630)	—	—
Total operating revenues, gains, and other support	56,757,909	—	—	56,757,909
Expenses:				
School of Mathematics	10,912,238	—	—	10,912,238
School of Natural Sciences	11,643,841	—	—	11,643,841
School of Historical Studies	7,582,420	—	—	7,582,420
School of Social Science	4,330,501	—	—	4,330,501
Libraries and other academic	8,185,287	—	—	8,185,287
Administration and general	9,510,608	—	—	9,510,608
Auxiliary activity	7,073,128	—	—	7,073,128
Total expenses	59,238,023	—	—	59,238,023
Change in net assets from operations, including depreciation	(2,480,114)	—	—	(2,480,114)
Other revenues, gains, and other support:				
Private contributions and grants	733,147	396,250	9,347,403	10,476,800
Endowment change after applying spending policy	17,240,968	12,050,043	—	29,291,011
Change in fair value of bond swap liability	2,022,672	—	—	2,022,672
Gain on sale of plant assets	243,824	—	—	243,824
Change in net assets	17,760,497	12,446,293	9,347,403	39,554,193
Net assets—beginning of year	346,522,897	134,811,093	173,063,383	654,397,373
Net assets—end of year	$ 364,283,394	147,257,386	182,410,786	693,951,566

See accompanying notes to financial statements.

STATEMENT OF ACTIVITIES
YEAR ENDED JUNE 30, 2012

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Operating revenues, gains, and other support:				
Private contributions and grants	$ —	18,764,858	—	18,764,858
Government grants	—	8,366,951	—	8,366,951
Endowment spending policy	12,952,782	10,710,118	—	23,662,900
Auxiliary activity	5,059,512	—	—	5,059,512
Net assets released from restrictions—satisfaction of program restrictions	37,841,927	(37,841,927)	—	—
Total operating revenues, gains, and other support	55,854,221	—	—	55,854,221
Expenses:				
School of Mathematics	10,576,045	—	—	10,576,045
School of Natural Sciences	11,095,543	—	—	11,095,543
School of Historical Studies	6,790,033	—	—	6,790,033
School of Social Science	4,096,095	—	—	4,096,095
Libraries and other academic	8,528,094	—	—	8,528,094
Administration and general	12,164,093	—	—	12,164,093
Auxiliary activity	5,844,090	—	—	5,844,090
Total expenses	59,093,993	—	—	59,093,993
Change in net assets from operations, including depreciation	(3,239,772)	—	—	(3,239,772)
Other revenues, gains, and other support:				
Private contributions and grants	652,182	79,089	74,979,752	75,711,023
Endowment change after applying spending policy	(6,739,386)	(6,384,460)	—	(13,123,846)
Change in fair value of bond swap liability	(2,558,439)	—	—	(2,558,439)
Loss on sale of plant assets	(36,157)	—	—	(36,157)
Change in net assets	(11,921,572)	(6,305,371)	74,979,752	56,752,809
Net assets—beginning of year	358,444,469	141,116,464	98,083,631	597,644,564
Net assets—end of year	$ 346,522,897	134,811,093	173,063,383	654,397,373

See accompanying notes to financial statements.

STATEMENTS OF CASH FLOWS
YEARS ENDED JUNE 30, 2013 AND 2012

	2013	2012
Cash flows from operating activities:		
Change in net assets	$ 39,554,193	56,752,809
Adjustments to reconcile change in net assets to net cash used in operating activities:		
Depreciation	4,813,656	4,198,798
Contributions restricted for endowment and plant	(25,585,914)	(25,737,701)
Net realized and unrealized gains	(66,212,269)	(11,989,659)
Change in fair value of bond swap liability	(2,022,672)	2,558,439
(Gain) loss on sale of plant assets	(243,824)	36,157
Amortization of debt issuance costs	48,806	51,587
Amortization of bond discount	20,550	22,150
Changes in assets/liabilities:		
Accounts receivable, grants receivable, and other assets	2,029,311	(18,987)
Contributions receivable	17,218,476	(49,332,313)
Beneficial interest in remainder trust	112,776	371,897
Accounts payable and accrued expenses	1,584,021	(698,549)
Deferred revenue	(2,039,466)	(1,206,215)
Postretirement benefit obligation	(1,886,150)	607,130
Asset retirement obligation	11,627	27,994
Net cash used in operating activities	(32,596,879)	(24,356,463)
Cash flows from investing activities:		
Proceeds from sale of plant assets	1,396,406	3,074,738
Purchase of plant assets	(10,918,721)	(17,053,168)
Proceeds from sale of investments	289,709,193	208,116,315
Purchase of investments	(287,078,939)	(196,255,448)
Net cash used in investing activities	(6,892,061)	(2,117,563)
Cash flows from financing activities:		
Contributions restricted for endowment and plant	25,585,914	25,737,701
Increase (decrease) in liabilities under split-interest agreements	21,278	(286,615)
Debt issuance costs on 2012 Taxable Bonds	(206,950)	—
Discount on 2012 Taxable Bonds	(92,311)	—
Proceeds from issuance of 2012 Taxable Bonds	17,320,000	—
Advance refunding of 2001 Series A Bonds	(1,940,000)	—
Principal payments on long-term debt	(2,000,000)	(2,055,000)
Principal payments on note payable	(68,954)	(67,595)
Decrease in funds held by bond trustee	126,428	2,733,758
Net cash provided by financing activities	38,745,405	26,062,249
Net decrease in cash and cash equivalents	(743,535)	(411,777)
Cash and cash equivalents—beginning of year	6,201,135	6,612,912
Cash and cash equivalents—end of year	$ 5,457,600	6,201,135
Supplemental data:		
Interest paid	$ 1,884,445	1,581,020

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 0.15% to 1.41%. 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 reclassified 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, 2013 and 2012, 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 (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, 2013 and 2012 were net of accumulated amortization of $911,213 and $862,407, 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 $1,582,457 and $1,562,269 for the years ended June 30, 2013 and 2012, 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, 2013 and 2012 were as follows:

		2013	2012
Unconditional promises to give:			
Less than one year	$	11,370,002	20,426,475
One to five years		23,597,845	31,034,037
		34,967,847	51,460,512
Discount on promises to give		(1,705,970)	(980,159)
Total	$	33,261,877	50,480,353

At June 30, 2013, 98% of gross contributions receivable and 31% of contributions revenue are from four and two donors respectively. At June 30, 2012, 99% of gross contributions receivable and 77% 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 March 31, 2016. As of June 30, 2013 and 2012, the Institute has recorded revenue totaling approximately $49 million and $43 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, 2013 and 2012, as well as related strategy, liquidity, and funding commitments:

	June 30, 2013			
	Level 1	Level 2	Level 3	Total
Investments:				
Long-term investment strategies:				
Hedge funds—onshore:				
Emerging markets	$ —	—	1,524,829	1,524,829
Equities—long bias	—	11,985,284	—	11,985,284
Multiple strategies	—	—	58,204,806	58,204,806
Total	—	11,985,284	59,729,635	71,714,919
Hedge funds—offshore:				
Commercial mortgage backed	—	—	9,730,472	9,730,472
Distressed/high-yield	—	—	11,541,391	11,541,391
Emerging markets	—	—	8,477,358	8,477,358
Equities—long bias	—	15,948,000	—	15,948,000
Equities—long/short	—	26,682,915	32,056,785	58,739,700
Event driven strategies	—	10,073,922	—	10,073,922
Fixed income arbitrage	—	—	27,630,277	27,630,277
Global asset allocation	—	25,458,338	—	25,458,338
Multiple strategies	—	63,087,904	143,921,877	207,009,781
Quantitative/CTA	—	5,655,609	—	5,655,609
Quantitative equity long short	—	10,430,293	—	10,430,293
Fixed income—relative value	—	—	11,186,073	11,186,073
Bio tech/health care	—	—	11,253,449	11,253,449
Total	—	157,336,981	255,797,682	413,134,663
Limited partnerships (1)	—	—	117,080,539	117,080,539
Cash and cash equivalents	56,560,492	—	—	56,560,492
Other investments:				
Assets held under split-interest agreements:				
Cash and cash equivalents	17,240	—	—	17,240
Fixed income securities	—	—	4,077,332	4,077,332
Mortgages from faculty and staff	—	—	8,787,133	8,787,133
Total investments	$ 56,577,732	169,322,265	445,472,321	671,372,318
Other assets:				
Beneficial interest in remainder trust	$ —	—	2,721,332	2,721,332
Funds held by bond trustee:				
U.S. government obligations	2,281,080	—	—	2,281,080
Total other assets	$ 2,281,080	—	2,721,332	5,002,412

	June 30, 2012			
	Level 1	Level 2	Level 3	Total
Investments:				
Long-term investment strategies:				
Hedge funds—onshore:				
Emerging markets	$ —	4,213,509	1,541,397	5,754,906
Equities—long bias	—	9,597,508	—	9,597,508
Multiple strategies	—	—	51,440,383	51,440,383
Total	—	13,811,017	52,981,780	66,792,797
Hedge funds—offshore:				
Commercial mortgage backed	—	—	12,622,481	12,622,481
Distressed/high-yield	—	—	18,111,452	18,111,452
Emerging markets	—	—	9,021,029	9,021,029
Equities—long bias	—	12,141,063	—	12,141,063
Equities—long/short	—	36,288,006	27,636,088	63,924,094
Event driven strategies	—	9,182,183	—	9,182,183
Fixed income arbitrage	—	—	27,706,190	27,706,190
Global asset allocation	—	24,582,389	—	24,582,389
Multiple strategies	—	59,654,691	149,938,329	209,593,020
Bio tech/health care	—	12,290,624	—	12,290,624
Total	—	154,138,956	245,035,569	399,174,525
Limited partnerships (1)	—	—	106,164,790	106,164,790
Cash and cash equivalents	24,964,487	—	—	24,964,487
Other investments:				
Assets held under split-interest agreements:				
Cash and cash equivalents	138,276	—	—	138,276
Fixed income securities	—	—	3,798,033	3,798,033
Mortgages from faculty and staff	—	—	6,757,395	6,757,395
Total investments	$ 25,102,763	167,949,973	414,737,567	607,790,303
Other assets:				
Beneficial interest in remainder trust	$ —	—	2,834,108	2,834,108
Funds held by bond trustee:				
U.S. government obligations	2,407,508	—	—	2,407,508
Total other assets	$ 2,407,508	—	2,834,108	5,241,616

The following tables present the Institute's activities for the years ended June 30, 2013 and 2012 for investments classified in Level 3:

2013

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, 2012	$ 298,017,349	106,164,790	3,798,033	6,757,395	2,834,108	417,571,675
Acquisitions	27,000,000	22,940,621	25,000	2,832,400	—	52,798,021
Dispositions	(38,172,394)	(29,906,189)	(141,897)	(802,662)	—	(69,023,142)
Transfers in/out of Level 3	(1,112,006)	—	—	—	—	(1,112,006)
Net realized and unrealized gains	29,794,368	17,881,317	396,196	—	(112,776)	47,959,105
Fair value at June 30, 2013	$ 315,527,317	117,080,539	4,077,332	8,787,133	2,721,332	448,193,653

2012

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, 2011	$ 313,904,120	89,493,643	4,138,260	9,095,117	3,206,005	419,837,145
Acquisitions	42,000,000	22,678,000	36,921	1,086,330	—	65,801,251
Dispositions	(25,671,333)	(17,826,312)	(273,614)	(3,424,052)	—	(47,195,311)
Transfers in/out of Level 3	(40,149,527)	—	—	—	—	(40,149,527)
Net realized and unrealized gains	7,934,089	11,819,459	(103,534)	—	(371,897)	19,278,117
Fair value at June 30, 2012	$ 298,017,349	106,164,790	3,798,033	6,757,395	2,834,108	417,571,675

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, 2013 or 2012. During fiscal years 2013 and 2012, approximately $16 million and $40 million, respectively, was transferred from Level 3 to Level 2 due to the expiration of lock-up restrictions. During fiscal year 2013, approximately $15 million was transferred from Level 2 to Level 3 primarily related to imposition of new redemption features.

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, 2013, the Institute is obligated under certain limited partnership agreements to advance additional funding in the amount of $64,858,661, which is anticipated to be called over the next 10 years.

Investment liquidity as of June 30, 2013 is aggregated below based on redemption or sale period:

	Investment fair values
Investment redemption or sale period:	
Daily	$ 56,577,731
Monthly	43,235,347
Quarterly	99,383,856
Semi-annually	26,703,063
Annually	48,194,445
Subject to rolling lock ups or other restrictions	251,481,225
Illiquid	145,796,651
Total as of June 30, 2013	$ 671,372,318

(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, 2013, the Institute had hedge fund investments of approximately $484,849,500, of which approximately $108,259,456 was restricted from redemption for lock-up periods. At June 30, 2012, the Institute had hedge fund investments of approximately $465,967,300, of which approximately $107,770,953 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:	
2014	$ 46,757,676
2015	35,919,662
2017 and thereafter	25,582,118
Total	$ 108,259,456

(e) Redemption Restrictions—Limited Partnerships

At June 30, 2013 and 2012, the Institute had limited partnership investments of approximately $117,080,500 and $106,164,800, 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:	
2013	$ 1,567,923
2014	8,318,475
2017	7,436,543
2018	24,880,458
2019	12,888,656
2020	31,771,710
2021 and thereafter	30,216,774
Total	$ 117,080,539

(f) Contingencies

The Institute has an investment in the Ariel Fund Limited (the Fund), which on June 30, 2013 and 2012 had a fair value of approximately $8,659,500 and $12,630,100, 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 2013 and 2012, the Institute received distributions of $5,065,963 and $2,894,863, 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 6.7% and 5.0% for 2013 and 2012, respectively.

The following tables summarize the investment return and its classification in the statements of activities for the years ended June 30, 2013 and 2012:

	2013		
	Unrestricted	Temporarily restricted	Total
Dividends and interest, net of investment expenses	$ (1,102,987)	(1,138,671)	(2,241,658)
Net realized and unrealized gains	36,933,099	29,279,170	66,212,269
Total investment return	35,830,112	28,140,499	63,970,611
Endowment spending policy for use in operations	18,589,144	16,090,456	34,679,600
Endowment change after applying spending policy	$ 17,240,968	12,050,043	29,291,011

	2012		
	Unrestricted	Temporarily restricted	Total
Dividends and interest, net of investment expenses	$ (853,407)	(597,198)	(1,450,605)
Net realized and unrealized gains	7,066,803	4,922,856	11,989,659
Total investment return	6,213,396	4,325,658	10,539,054
Endowment spending policy for use in operations	12,952,782	10,710,118	23,662,900
Endowment change after applying spending policy	$ (6,739,386)	(6,384,460)	(13,123,846)

Total investment management and advisory fees were $2,355,295 and $1,767,082 for the years ended June 30, 2013 and 2012, 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 $2,048,000 and $1,639,000, at June 30, 2013 and 2012, 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, 2013 and 2012:

	2013			
	Unrestricted	Temporarily restricted	Permanently restricted	Total
Donor restricted	$ (2,047,596)	146,712,480	182,410,786	327,075,670
Board designated	355,474,109	—	—	355,474,109
	$ 353,426,513	146,712,480	182,410,786	682,549,779

	2012			
	Unrestricted	Temporarily restricted	Permanently restricted	Total
Donor restricted	$ (1,638,917)	134,281,483	173,063,383	305,705,949
Board designated	330,569,926	—	—	330,569,926
	$ 328,931,009	134,281,483	173,063,383	636,275,875

Changes in endowment net assets for the fiscal years ended June 30, 2013 and 2012 were as follows:

	Unrestricted	Temporarily restricted	Permanently restricted	Total
Net assets, June 30, 2011	$ 348,386,615	140,107,904	98,083,631	586,578,150
Dividends and interest income, net	(853,407)	(629,550)	—	(1,482,957)
Realized and unrealized gains	7,066,803	5,434,158	—	12,500,961
Contributions	495,134	79,089	74,979,752	75,553,975
Appropriation for expenditure—operations	(12,952,782)	(10,710,118)	—	(23,662,900)
Appropriation for expenditure—capital and other	(13,211,354)	—	—	(13,211,354)
Net assets, June 30, 2012	328,931,009	134,281,483	173,063,383	636,275,875
Dividends and interest income, net	(1,102,987)	(895,195)	—	(1,998,182)
Realized and unrealized gains	36,933,099	29,020,398	—	65,953,497
Contributions	792,859	396,250	9,347,403	10,536,512
Appropriation for expenditure—operations	(18,589,144)	(16,090,456)	—	(34,679,600)
Amounts added back to the board-designated endowment	6,461,677	—	—	6,461,677
Net assets, June 30, 2013	$ 353,426,513	146,712,480	182,410,786	682,549,779

(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, 2013 and 2012 follows:

	2013	2012
Land	$ 377,470	377,470
Land improvements	2,114,955	1,979,081
Buildings and improvements	111,142,832	105,052,933
Equipment	31,123,609	28,332,117
Construction in progress	—	205,928
Rare book collection	203,508	203,508
Joint ownership property	4,492,555	3,937,361
	149,454,929	140,088,398
Accumulated depreciation	(74,957,999)	(70,543,951)
Net book value	$ 74,496,930	69,544,447

(7) Long-Term Debt

A summary of long-term debt at June 30, 2013 and 2012 follows:

	2013	2012
2001 Series A—NJEFA	$ —	1,940,000
2006 Series B—NJEFA	26,500,000	27,500,000
2006 Series C—NJEFA	17,500,000	18,000,000
2008 Series C—NJEFA	4,975,000	5,475,000
2012 Taxable	17,320,000	—
Less unamortized bond discount	(244,966)	(173,205)
Total long-term debt	$ 66,050,034	52,741,795

Interest expense on long-term debt for the years ended June 30, 2013 and 2012 was $1,600,692 and $1,307,016, respectively.

(a) 2001 Series A

In May 2001, the Institute received proceeds of the Authority offering of $11,000,000 Revenue Bonds, 2001 Series A of the Institute for Advanced Study Issue. Proceeds were used for the construction of Bloomberg Hall and additional capital projects. These bonds were partially refunded through the 2006 Series B Revenue bonds detailed below. During the year ending June 30, 2013, the remaining outstanding bonds from this issue were refunded through the 2012 Taxable bonds detailed below.

(b) 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.

(c) 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.

(d) 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.

(e) 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.

(f) Interest Rates

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 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 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.

(g) 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, 2013 and 2012, the fair value of the interest rate swap was ($4,475,949) and ($6,498,621), respectively. The unrealized gain (loss) recognized during the year ended June 30, 2013 and 2012 in the amount of $2,022,672 and ($2,558,439), 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, 2013 and 2012, there was no requirement to post collateral imposed by the swap counterparty.

The bonds are repayable as follows at June 30, 2013:

	Amount
Year ending June 30:	
2014	$ 2,415,000
2015	2,440,000
2016	2,575,000
2017	2,605,000
2018	2,845,000
2019 through 2036	53,415,000
Total	$ 66,295,000

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.

(h) Line of Credit

As of June 30, 2013 and 2012, the Institute had unsecured loan agreements representing a line of credit. As of June 30, 2012 the agreement provided for borrowings up to $20,000,000 and was available through April 2013. Interest payments were due on demand and interest accrued at the LIBOR rate plus 100 basis points, which was 2.07% as of June 30, 2012. As of June 30, 2013, 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 1.58% as of June 30, 2013. There were no borrowings in fiscal year 2013 or 2012 against the lines of credit. No interest expense was incurred for the years ended June 30, 2013 and 2012.

(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, 2013 and 2012 totaled approximately $2,285,200 and $2,070,700, 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, 2013 and 2012. There are no plan assets at June 30, 2013 and 2012.

		2013	2012
Postretirement benefit obligation:			
Retirees	$	4,769,377	6,036,019
Fully eligible active plan participants		1,713,694	1,359,880
Other active plan participants		6,692,021	7,665,343
Postretirement benefit obligation	$	13,175,092	15,061,242
Change in benefit obligation:			
Benefit obligation at beginning of year	$	15,061,242	14,454,112
Service cost		710,624	626,003
Interest cost		604,718	795,112
Benefits paid		(376,897)	(424,617)
Actuarial gain		(2,824,595)	(389,368)
Benefit obligation at end of year	$	13,175,092	15,061,242
Components of net periodic benefit cost:			
Service cost	$	710,624	626,003
Interest cost		604,718	795,112
Amortization of net gain		(2,824,595)	(389,368)
Net periodic postretirement benefit (credit) cost	$	(1,509,253)	1,031,747

	2013	2012
Benefit obligation weighted average assumptions at June 30, 2013 and 2012:		
Discount rate	4.81%	4.08%
Periodic benefit cost weighted average assumptions for the years ended June 30, 2013 and 2012:		
Discount rate	4.08%	5.61%

The healthcare trend rate is assumed to be 9% in fiscal 2014, trending down to an ultimate rate of 5% in 2021 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:

		2013		2012	
		Increase	Decrease	Increase	Decrease
Effect on total service and interest cost	$	370,416	(251,224)	318,370	(246,025)
Effect on the postretirement benefit obligation		3,042,465	(2,098,726)	3,157,958	(2,218,573)

Projected payments for each of the next five fiscal years and thereafter through 2023 are as follows:

		Amount
Year ending June 30:		
2014	$	394,000
2015		397,000
2016		400,000
2017		401,000
2018		398,000
2019 through 2023		1,805,000

The Institute funds claims as they are incurred. The Institute does not expect to contribute any amounts in fiscal 2013, 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, 2013 and 2012:

		2013	2012
Temporarily restricted net assets are restricted to:			
School of Mathematics	$	30,982,319	29,549,172
School of Natural Sciences		12,388,448	9,632,215
School of Historical Studies		35,601,130	33,527,995
School of Social Science		55,029,995	52,150,178
Libraries and other academic		4,880,138	4,227,856
Administration and general		8,375,356	5,723,677
	$	147,257,386	134,811,093
Permanently restricted net assets are restricted to:			
Investments to be held in perpetuity, the income from which is expendable to support academic services	$	182,410,786	173,063,383

(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 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 $68,299,937 and $53,666,000 at June 30, 2013 and 2012, respectively.

(11) Subsequent Events

The Institute evaluated events subsequent to June 30, 2013 through November 25, 2013, the date on which the financial statements were issued, and determined there were no subsequent events required to be disclosed.

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