

Fac

Borel

16 December 1959

Dear Mr. McDaniel:

Thank you very much for your letter
of December 10th, and the good news it
contains.

Very sincerely,

Robert Oppenheimer

Mr. Joseph M. McDaniel, Jr.
Secretary
The Ford Foundation
477 Madison Avenue
New York 22, New York

THE FORD FOUNDATION
477 MADISON AVENUE
NEW YORK 22, N. Y.

JOSEPH M. McDANIEL, JR.
SECRETARY

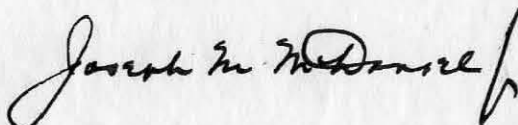
December 10, 1959

Dr. Robert Oppenheimer
The Institute for Advanced Study
Princeton, New Jersey

Dear Dr. Oppenheimer:

I am pleased to report informally that the Foundation has approved a Travel and Study award to Dr. Armand Borel in connection with his projected visit to India. The award will provide him with a supplemental allowance in lieu of salary, at the rate suggested in your letter of November 16, 1959, while he is on leave from the Institute for Advanced Study. He will receive official notification in due course from the Institute of International Education, which administers our Travel and Study program.

Sincerely yours,


Secretary

cc: Dr. Armand Borel

*copies sent to Judge Wyzanski
Mr. Leidesdorf*

16 November 1959

Dear Dr. Heald:

When I had the pleasure of calling on you on November 5th, I mentioned to you the problem of Dr. Armand Borel's visit to India. Borel is a young Swiss mathematician, who first came to the Institute as a member in 1952, and who was elected to a professorship at the Institute in 1957. He has been invited to come to the Tata Institute in Bombay by Dr. Chandrasekharan, who is, I believe, the head of research in mathematics at that Institute. Dr. Borel writes of this projected visit:

"During these last years, Dr. Chandrasekharan has made considerable efforts to increase contacts between the Tata Institute and foreign mathematical centers, either by inviting foreign mathematicians or by sending students abroad. It seems now that there is a substantial group of gifted young mathematicians at the Tata Institute, some interested in fields of research related to my own ones. Therefore I want very much to accept this invitation. I would presumably be giving a course of lectures or a seminar in algebraic topology, or Lie group theory or algebraic group theory, or maybe differential geometry. I would of course also like to travel in India, to visit the country and to get acquainted with the mathematics departments of some other universities, so as to have a chance to get first hand information about young mathematicians whom it might be worthwhile to consider for membership at the Institute. Also important of course is the possibility to have sustained personal contacts with some students at the Tata Institute."

Dr. Borel has had extensive negotiations with Chandrasekharan about the timing of the visit, so that it should be most effective in Bombay, and also permit Borel to visit some of the other centers in India. As a result of this correspondence, it is clear that the invitation to Borel will correspond with the Institute for Advanced Study's second term, in the winter and spring of 1961, and that Borel would have to be absent from Princeton throughout the whole of our semester. He has been offered compensation for his travel expenses, and 1500 rupees a month, which he has been told will be enough for his living expenses but no more.

- 2 -

Professor Borel's salary at the Institute is \$22,500 a year, or \$11,250 for the period during which he will be absent. He is married, and has children. He tells me that he will not feel able to make the journey if it involves so serious a financial loss. It is for these reasons that the Institute for Advanced Study is applying to the Ford Foundation for an officer's grant to Borel.

With good wishes,

Robert Oppenheimer

Dr. Henry Heald
Ford Foundation
477 Madison Avenue
New York, New York

16 November 1959

Dear Dr. Heald:

When I had the pleasure of calling on you on November 5th, I mentioned to you the problem of Dr. Armand Borel's visit to India. Borel is a young Swiss mathematician, who first came to the Institute as a member in 1952, and who was elected to a professorship at the Institute in 1957. He has been invited to come to the Tata Institute in Bombay by Dr. Chandrasekharan, who is, I believe, the head of research in mathematics at that Institute. Dr. Borel writes of this projected visit:

"During these last years, Dr. Chandrasekharan has made considerable efforts to increase contacts between the Tata Institute and foreign mathematical centers, either by inviting foreign mathematicians or by sending students abroad. It seems now that there is a substantial group of gifted young mathematicians at the Tata Institute, some interested in fields of research related to my own ones. Therefore I want very much to accept this invitation. I would presumably be giving a course of lectures or a seminar in algebraic topology, or Lie group theory or algebraic group theory, or maybe differential geometry. I would of course also like to travel in India, to visit the country and to get acquainted with the mathematics departments of some other universities, so as to have a chance to get first hand information about young mathematicians whom it might be worthwhile to consider for membership at the Institute. Also important of course is the possibility to have sustained personal contacts with some students at the Tata Institute."

Dr. Borel has had extensive negotiations with Chandrasekharan about the timing of the visit, so that it should be most effective in Bombay, and also permit Borel to visit some of the other centers in India. As a result of this correspondence, it is clear that the invitation to Borel will correspond with the Institute for Advanced Study's second term, in the winter and spring of 1961, and that Borel would have to be absent from Princeton throughout the whole of our semester. He has been offered compensation for his travel expenses, and 1500 rupees a month, which he has been told will be enough for his living expenses but no more.

C O P Y

- 2 -

Professor Borel's salary at the Institute is \$22,500 a year, or \$11,250 for the period during which he will be absent. He is married, and has children. He tells me that he will not feel able to make the journey if it involves so serious a financial loss. It is for these reasons that the Institute for Advanced Study is applying to the Ford Foundation for an officer's grant to Borel.

With good wishes,

Robert Oppenheimer

Dr. Henry Heald
Ford Foundation
477 Madison Avenue
New York, New York

16 November 1959

Dear Dr. Heald:

When I had the pleasure of calling on you on November 5th, I mentioned to you the problem of Dr. Armand Borel's visit to India. Borel is a young Swiss mathematician, who first came to the Institute as a member in 1952, and who was elected to a professorship at the Institute in 1957. He has been invited to come to the Tata Institute in Bombay by Dr. Chandrasekharan, who is, I believe, the head of research in mathematics at that Institute. Dr. Borel writes of this projected visit:

"During these last years, Dr. Chandrasekharan has made considerable efforts to increase contacts between the Tata Institute and foreign mathematical centers, either by inviting foreign mathematicians or by sending students abroad. It seems now that there is a substantial group of gifted young mathematicians at the Tata Institute, some interested in fields of research related to my own ones. Therefore I want very much to accept this invitation. I would presumably be giving a course of lectures or a seminar in algebraic topology, or Lie group theory or algebraic group theory, or maybe differential geometry. I would of course also like to travel in India, to visit the country and to get acquainted with the mathematics departments of some other universities, so as to have a chance to get first hand information about young mathematicians whom it might be worthwhile to consider for membership at the Institute. Also important of course is the possibility to have sustained personal contacts with some students at the Tata Institute."

Dr. Borel has had extensive negotiations with Chandrasekharan about the timing of the visit, so that it should be most effective in Bombay, and also permit Borel to visit some of the other centers in India. As a result of this correspondence, it is clear that the invitation to Borel will correspond with the Institute for Advanced Study's second term, in the winter and spring of 1961, and that Borel would have to be absent from Princeton throughout the whole of our semester. He has been offered compensation for his travel expenses, and 1500 rupees a month, which he has been told will be enough for his living expenses but no more.

- 2 -

Professor Borel's salary at the Institute is \$22,500 a year, or \$11,250 for the period during which he will be absent. He is married, and has children. He tells me that he will not feel able to make the journey if it involves so serious a financial loss. It is for these reasons that the Institute for Advanced Study is applying to the Ford Foundation for an officer's grant to Borel.

With good wishes,

Robert Oppenheimer

Dr. Henry Heald
Ford Foundation
477 Madison Avenue
New York, New York

To whom it may concern :

Dr. Chandrasekharan of the ~~Tata Institute in~~ Mathematics department of the Tata Institute in Bombay, India, has invited me to spend there the first ~~three~~ months of 1961. During these last years, Dr. Chandrasekharan has made considerable effort to foster interest for ~~research in~~ mathematical research in India, in particular by ~~increasing~~ establishing contacts with foreign mathematical centers, efforts to increase contacts between the Tata Institute and foreign mathematical centers, either by inviting foreign mathematicians or by sending students abroad. It seems now that there is a substantial group of gifted young mathematicians at the Tata Institute, some interested in fields of research related to my own ones. Therefore I ~~would like~~ want very much to accept this invitation. I would presumably be giving a course of lectures or a seminar in algebraic topology, or Lie group theory or algebraic group theory, or may be differential geometry. I would of course also like to travel in India, to visit the country and to get acquainted with the mathematics departments of ^{some} other universities, so as to have a chance to get first hand information about young mathematicians whom it might be worthwhile to consider for membership at the Institute. Also important, of course is the possibility of ^{to} having sustained personal contacts with some students at the Tata Institute. For all this, it seems that ~~such a visit should be at least of the in~~ order to fulfill its purpose, ^{such a visit} should be at least ~~for~~ of the duration contemplated here, and in fact, Dr. Chandrasekharan does not wish to extend invitations of this type for much shorter periods.

I am offered a salary of 1500 rupies a month, besides ~~in~~ ^{the former} a compensation for travel expenses. According to Dr. Chandrasekharan, ~~this~~ is adequate for living but no more. It is likely to be his best offer, and anyway, since this trip is meant ^{partly} ~~partly~~ to ~~increase~~ help increasing mathematical activity in India, there is hardly any point in bargaining for more. ~~Also,~~ ^{anyhow} it seems next to impossible to a Indian university to offer a ~~starx~~ salary which would cover my living expenses in India ^{as well as} ~~and the running~~ expenses in Princeton. I plan to make this trip with my

(even if I were to go by myself)
wife but, ~~whether~~ I go ~~alone or not~~, I do not think I ~~can~~ ^{could} possibly accept this
offer without ~~getting my regular salary~~ ~~ax leave~~ being granted a leave
with pay, or with the equivalent of my usual salary, for the Spring term 1961.

A. Borel

cc Mr. Morgan

20 April 1959

Dear Professor Borel:

The Trustees of the Institute, meeting on April 18th, have fixed your salary, and that of your colleagues, at \$22,500 a year, starting July 1, 1959.

I am glad to tell you the good news.

Very sincerely,

Robert Oppenheimer

Professor A. Borel
The Institute for Advanced Study

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

14 May 1957

Memorandum to File:

Today Dr. Borel came in to talk with me about his salary during his leave of absence to be at M.I.T. in the spring of 1958. Dr. Borel informed me that he would not leave the Institute until February 15th, 1958; and that he would receive from M.I.T. the sum of \$6,000.

I told Dr. Borel that the Institute would pay him not less than one-third of his salary for the second half of the year, 1957-1958; i.e. \$3,000; that if the Mathematics Faculty could find another \$1,000 we would pay him \$4,000, but no more than that. I also undertook not to discuss the matter with the Mathematicians until the autumn.

Robert Oppenheimer

NOTE: \$6,000 of Borel's salary is being transferred to Math. stipend funds to cover a grant to Dr. Nirenberg, who will be a member for the second term of 1957-1958.

September 26, 1957

School of Mathematics Faculty:

Dr. Oppenheimer has asked me to circulate this memorandum and to ask if you would be willing to allocate \$1,000 of the Stipend Budget to Nirenberg's grant, so that we can give Borel \$4,000 rather than \$3,000 for the spring semester".

Secretary, School of Mathematics

| | <u>Approve</u> | <u>Disapprove</u> |
|-----------------------|----------------|-------------------|
| Professors Beurling | — | — |
| Gödel | — | — |
| Montgomery | — | — |
| Morse | — | — |
| Selberg | — | — |
| Whitney | — | — |
| cc: ✓ Dr. Oppenheimer | | |

Please return to Miss Underwood.

Fac Borel

2 October 1957

Memorandum to Miss Underwood:

Dr. Oppenheimer has suggested the following
for inclusion in the Mathematics minutes:

"It was agreed to allocate \$1,000 of
the School stipend funds to Nirenberg,
to supplement the \$5,000 that will be
available because of Professor Borel's
absence at M. I. T."

Would you please make the appropriate change in the
Note on your copy of Dr. Nirenberg's letter of appoint-
ment.

Thank you,

Verna Hobson

2 October 1957

Dear Professor Borel:

Last May you and I discussed the arrangements for the spring term 1957-1958. You told me that you would have to leave in mid-February to accept an appointment at M. I. T. We shall be able to pay you \$4,000 for the six months from January 1st to June 30th, 1958.

Very sincerely,

Robert Oppenheimer

Professor A. Borel
Institute for Advanced Study

Copy to Mr. Morgan

THE INSTITUTE FOR ADVANCED STUDY

PRINCETON, NEW JERSEY

Re Borel's salary

Oct 57

I could see the reason for doing this if it was the question of bringing Borel's salary up to the normal amount, as it is however, I feel we should not use the stipend fund for this purpose, as we shall probably receive less from contracts with the Army Ordinance or the Air force in the future.

A. Seligson

THE INSTITUTE FOR ADVANCED STUDY

PRINCETON, NEW JERSEY

14 May 1957

Memorandum to File:

Today Dr. Borel came in to talk with me about his salary during his leave of absence to be at M.I.T. in the spring of 1958. Dr. Borel informed me that he would not leave the Institute until February 15th, 1958; and that he would receive from M.I.T. the sum of \$6,000.

I told Dr. Borel that the Institute would pay him not less than one-third of his salary for the second half of the year, 1957-1958; i.e. \$3,000; that if the Mathematics Faculty could find another \$1,000 we would pay him \$4,000, but no more than that. I also undertook not to discuss the matter with the Mathematicians until the autumn.

Robert Oppenheimer

NOTE: \$6,000 of Borel's salary is being transferred to Math. stipend funds to cover a grant to Dr. Nirenberg, who will be a member for the second term of 1957-1958.

September 26, 1957

School of Mathematics Faculty:

Dr. Oppenheimer has asked me to circulate this memorandum and to ask if you would be willing to allocate \$1,000 of the Stipend Budget to Nirenberg's grant, so that we can give Borel \$4,000 rather than \$3,000 for the spring semester.

C.Dh
Secretary, School of Mathematics

| | <u>Approve</u> | <u>Disapprove</u> |
|---------------------|-------------------------------------|-------------------------------------|
| Professors Beurling | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Gödel | <input type="checkbox"/> | <input type="checkbox"/> |
| Montgomery | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Morse | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| ✓ Selberg | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Whitney | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| cc: Dr. Oppenheimer | | |

Please return to Miss Underwood.

A.S.

Borel

3 June 1957

Dear Professor Borel:

The Trustees of the Institute for Advanced Study have been considering the adequacy of retirement and pension arrangements, both for the Faculty and for others who are in the employ of the Institute. Their deliberations have led to some changes in policy, all of which should be favorable for the employee, and some of which affect you.

1. The mandatory age for retirement for members of the Faculty has been advanced to the June 30th following their 70th birthday.

2. The Institute will allocate the maximum that it may, which is fifty per cent of the total annual contribution that you and the Institute make toward your retirement, to College Retirement Equities Fund. This fund has been established in order that beneficiaries may be provided with a hedge against inflation, through investment in equities whose value and whose income have increased with the years in the past, and are expected to increase in the future. The Trustees are aware of the fact that benefits from C.R.E.F. vary as provided in C.R.E.F. contracts, and are not guaranteed as those accruing under T.I.A.A.; but they believe that, under the C.R.E.F.-T.I.A.A. arrangement, your total pension is far more likely to exceed that provided by T.I.A.A. alone than to fall below this sum.

Within the next months you will receive a new contract from T.I.A.A. describing the provisions under which your retirement benefits will be paid. Should you have any questions about that contract or this letter, or the matters touched upon in it, please do not hesitate to let me know.

Very sincerely,

Robert Oppenheimer

Professor A. Borel
Institute for Advanced Study

Fac Borel

25 September 1957

Caroline:

Dr. Oppenheimer would like to have a copy of the attached circulated to your School, with the query:

"Would you be willing to allocate \$1,000 of the Stipend Budget to Nirenberg's grant, so that we can give Borel \$4,000 rather than \$3,000 for the spring semester?"

Verna

14 May 1957

Memorandum to File:

Today Dr. Borel came in to talk with me about his salary during his leave of absence to be at M.I.T. in the spring of 1958. Dr. Borel informed me that he would not leave the Institute until February 15th, 1958; and that he would receive from M.I.T. the sum of \$6,000.

I told Dr. Borel that the Institute would pay him not less than one third of his salary for the second half of the year, 1957-1958, i.e. \$3,000; that if the Mathematics Faculty could find another \$1,000 we would pay him \$4,000, but no more than that. I also undertook not to discuss the matter with the Mathematicians until the autumn.

Robert Oppenheimer

NOTE: \$6,000 of Borel's salary is being transferred to Math. Stipend funds to cover a grant to Dr. Nirenberg, who will be a member for the second term of 1957-1958.

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

14 May 1957

Memorandum to File:

Today Dr. Borel came in to talk with me about his salary during his leave of absence to be at M.I.T. in the spring of 1958. Dr. Borel informed me that he would not leave the Institute until February 15th, 1958; and that he would receive from M.I.T. the sum of \$6,000.

I told Dr. Borel that the Institute would pay him not less than one third of his salary for the second half of the year, 1957-1958, i.e. \$3,000; that if the Mathematics Faculty could find another \$1,000 we would pay him \$4,000, but no more than that. I also undertook not to discuss the matter with the Mathematicians until the autumn.

R.D.

Robert Oppenheimer

NOTE: \$6,000 of Borel's salary is being transferred to Math. Stipend funds to cover a grant to Dr. Nirenberg, who will be a member for the second term of 1957-1958.

Fae Borel

FOR RELEASE 9 P.M., THURSDAY, MAY 30, 1957.

The Institute for Advanced Study announces the appointment of four new members to its Faculty: Dr. Armand Borel, Professor of Mathematics at the Federal Institute of Technology of Zürich; Dr. Bengt Strömgren, Director of the Yerkes, McDonald and Royal Copenhagen Observatories, and Sewell Avery Distinguished Service Professor at the University of Chicago; and Dr. André Weil, Professor of Mathematics at the University of Chicago, have been named Professors in the School of Mathematics. Dr. Millard Meiss, Professor of Fine Arts in the William Hayes Fogg Art Museum at Harvard University, has been named Professor in the School of Historical Studies.

The Institute for Advanced Study
Princeton, New Jersey

Borel

ARMAND BOREL

The School of Mathematics nominates Armand Borel for a professorship. As a young man who has already achieved great distinction in the field of mathematics there is every indication that he has a great career before him.

Borel and his wife are Swiss (French) and at present he has a professorship at the Technical University of Zurich (ETH) where Professor Weyl was a professor for many years at the beginning of his career. He obtained his Ph.D. at Zurich under Hopf and then studied for two years in Paris where he was influenced by H. Cartan and Leray. It was at this time that he met Serre. The two have had a number of common interests and have written several important joint papers. After his stay in Paris he taught for a year in Lausanne, where his chief colleague was de Rham, and then came to the Institute for two years. While in Princeton he wrote a great deal and was very active in conducting seminars both here and at the University. His lectures were influential both places, especially the ones at the University on his own contributions to homogeneous spaces and the ones here on symmetric spaces which he presented in a very clear way and with many improvements of his own.

In the summer between his two years here he was invited for six weeks to the Summer Institute on Lie Groups conducted in Maine by the American Mathematical Society. At this meeting he was one of the chief speakers and while there he began collaborations with Chevalley and Mostow. In the same summer he was invited to lecture in Mexico City and according to report his lectures there were well received. Both he and his wife have more of an interest in art and archeology than the average layman and they found Mexico of interest for this reason as well as others.

While at the Institute he gave invited hour addresses at a number of places, possibly the most important of these was one at a meeting of the American Mathematical Society in New York. He was offered temporary or permanent positions at several leading universities, including California, Chicago, Illinois, Princeton, and Yale. He took a position at Chicago for the year after he left here (1954-1955). Throughout his stay in the United States he was aware that Hopf, Eckmann, and the other mathematicians at Zurich were anxious to have him return there. He was conscious of the advantages of both Europe and America but when he was formally offered a newly created professorship at Zurich he accepted and returned to Switzerland in August 1955. Massachusetts Institute of Technology plans to offer him a visiting position next year ~~_____~~

His main mathematical interests are in topology, continuous groups, and differential geometry, although his most recent work has been in algebraic groups using the methods of algebraic geometry. At Zurich he received a thorough training under Hopf in the first three topics, as all of Hopf's students do. Hopf has had many students, including Eckmann and Samelson, who have become fine mathematicians, but it is agreed that Borel is unquestionably the outstanding one of these and that he ranks among a very few of the best young mathematicians in the world. Serre, for example, has given it as his considered opinion that no young man is a stronger candidate for a position here. His knowledge is unusually wide and thorough and his many papers are uniformly on a very high and powerful level. He communicates freely and easily with others and his judgment is balanced and thorough. He is a very clear lecturer and as a colleague is friendly and has diverse interests.

- 2 -

Since 1948 Mathematics has lost five permanent people by death or retirement (Alexander, Mayer, Siegel, Veblen, Weyl) and during this period has gained only four permanent people (Beurling, Montgomery, Selberg, Whitney). In addition von Neumann is on leave so that the number of mathematicians here on permanent appointment, which has always been rather small, has been reduced. On the other hand the field of mathematics has grown tremendously so that a modest expansion, rather than the opposite, is necessary.

It is against this background that this nomination is made. Although age has not been a determining factor, it has played a small part and the fact that Borel is 32 would have the advantage of giving a variety in ages and thereby contributing to the continuity and stability of the department. His interest is somewhat more algebraic than is the case for most of us and this would be advantageous, although a man's field, like his age, would not by itself be a decisive factor.

A great deal of his work has been in the topological properties of Lie groups and their homogeneous spaces, a subject in which early contributions were made by Weyl and especially by E. Cartan. The work was carried on by Pontrjagin and Hopf and later by H. Cartan, Chevalley, A. Weil and others. In the last few years the major contributions have been made by Borel. For compact Lie groups and their homogeneous spaces, great progress has been made, though many important questions remain. For the case of compact homogeneous spaces of non-compact groups rather little progress has been made and this topic remains largely unexplored. Borel has some contributions in this direction and it is one of several topics, which, with his background, he might be led to pursue.

Before stating a few of Borel's results we mention and describe certain of the tools and concepts of frequent occurrence in this work. Some of these are spectral sequences, Whitney characteristic classes, principal bundles, universal bundles, transgressions and classifying spaces. Given a compact Lie group G and a closed subgroup H it is possible to form the homogeneous space G/H on which G acts transitively. Spectral sequences were devised by Leray to study the relations among the homology properties of a fiber space, the fiber, and the base space. One important case is that where G is the fiber space, H is the fiber, and G/H the base space. The use of spectral sequences by Borel was by no means routine, and in fact it has been work by him and Serre which has helped to establish the importance of spectral sequences. The transgression is a relation between certain cycles in G and in G/H . A space E is a principal bundle with structural group G if G is a transformation group acting on E in such a way that no element of G except the identity leaves any point fixed. The space E or E_G is called n -universal if its homology groups are trivial up to dimension n . Such spaces exist for any n including n infinite. The base space (the space of orbits) of such a universal bundle E_G is called a classifying space B_G .

We shall now mention a few of Borel's results more or less at random. In one of his first papers, written with de Siebenthal, all closed subgroups of a compact Lie group of equal rank with the group are determined. In another he determined all compact Lie groups which can be transitive on a sphere or a torus. There had been work on this problem before but he introduced entirely new methods which simplified and completed the analysis of this situation. If G is a connected Lie group (in general not compact) and H a closed connected subgroup then G/H has at most two "ends". In case it has two ends it is the topological product of a compact subspace and a line. If H is not connected G/H may have many ends. Together with Serre he proved that Euclidean space cannot be fibered with a compact fiber. He also proved

- 3 -

that if Euclidean space is fibered by a non-compact fiber, then both the fiber and the base have the homology properties of a Euclidean space, and that it is impossible to fiber a sphere with a fiber which is a product of spheres.

In a joint paper with Serre a study was made of the Steenrod reduced powers for the classical groups and their classifying spaces. As an application it was proved that no sphere, except S^2 and possibly S^0 , can be given a complex analytic structure. In another joint paper with Serre it was shown that some of the five exceptional groups have torsion. This was done by defining and studying the p-rank of compact Lie groups.

In a long paper in the Annals of Mathematics a few years ago, Borel gave an extension of Hopf's theorem on homology of groups on H-spaces to many kinds of coefficients. Roughly speaking the result is that the homology of a group space is like the homology of a topological product of odd dimensional spheres. It is in this paper that he obtains results on the homology of classifying spaces, and connects it with the homology of G through the use of transgression and the universally transgressive elements of G . In the same paper are many new results on the homology of compact Lie groups and their homogeneous spaces. Combined with later papers his results in these directions are very thorough and complete. The simultaneous study of groups, homogeneous spaces, and universal bundles has shed new light on all these subjects. The development of this approach has been one of his best achievements. The results have been many and varied.

He has written two short notes with Lichnerowicz on differential geometry, and recently has collaborated with Hirzebruch to obtain results on the Whitney classes of homogeneous spaces. A great deal of his most recent work has been on algebraic groups. Using the methods of algebraic geometry he has written a paper to appear in the Annals in which he extends and simplifies the results of Chevalley's two recent books on algebraic groups.

A paper of his in the Proceedings of the National Academy studies homogeneous spaces with an invariant complex Kähler structure. In the compact case all such manifolds are algebraic and admit a complex analytic cellular decomposition. In the non-compact case they are complex analytically fibered with compact fibers. As an application he gives a partial solution to one of E. Cartan's problems by showing that a bounded complex domain with a transitive semi-simple group is symmetric. Some of his work with Mostow has been on Lie algebras and fixed points of automorphisms.

Some of Borel's expository lectures have been published in mimeographed form and have been widely read. The ones given in Zurich in 1951 (95 pages) are a very clear and readable introduction to fiber spaces and the methods of Leray with application and improvements by Borel.

13 June 1957

Memorandum to Mr. Morgan:

This will authorize you to make available to Professor Armand Borel, from his 1957-58 Faculty Travel Fund, the amount of \$600, to cover the expenses of his forthcoming round trip from New York to Zurich.

Robert Oppenheimer

NOTE: Professor Borel would like this sent to his checking account at the First National Bank, Princeton.

cc: Miss Underwood

13 June 1957

Memorandum to Mr. Morgan:

As voted by the Faculty in the School of Mathematics on 22 May 1957, and as approved by the Treasurer, please charge the School of Mathematics stipend fund and make available to Professor Armand Borel the amount of \$1,500 to help defray the expenses incurred in moving his household to this country.

Robert Oppenheimer

NOTE: Professor Borel would like this sent to his checking account at the First National Bank, Princeton.

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

SCHOOL OF MATHEMATICS

June 12, '57

Dear Prof. Oppenheimer,

As you know, I have been offered a contribution up to 1500 from the Institute for my moving expenses. It will be undoubtedly amount to more than that and, for a great part, has to be paid in advance. Therefore I would be grateful to you if you could have this sent to me now. For the same reason, I would appreciate it very much if I could get very soon 600 for the air-round trip ticket New-York-Zurich, to be drawn on my travel money for the coming academic year. Both sums should be sent to my check account, at the First National Bank, Princeton.

Many thanks in advance for your care in that matter.

Sincerely yours

A. Borel

(A. Borel)

Wish. Stipend Budget

2 letters

Fac Borel

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

SCHOOL OF MATHEMATICS

April 2, 1957

Dr. Robert Oppenheimer
Institute for Advanced Study

Dear Robert:

With Borel here there is a question of proper office space for him. May we assume that the von Neumann office can be made available to a mathematician when it is cleared of the belongings of Johnny? It would be our intention to offer it to the present Professors of Mathematics in the order of seniority. It is my belief that all are satisfied, so it would come to Borel.

Sincerely yours,

Marston Morse
Marston Morse

MMcdu

RO telephoned Prof. Morse 4/3 and said that he had promised Mrs. von Neumann the use of this office until the autumn term, but had made no other commitments with regard to its use; that it seemed appropriate for Borel to have it.

cc: Beurling
Gödel
Morse
Oppenheimer ✓
Selberg
Whitney
Mrs. Barnett

Borel

Berne, 3.16.57

Dear Montgomery,

As you may have noticed, I was in a hurry when I wrote about Weil and I did not thank you for your comments on the transformation groups questions and for the copy of Whitehead's manuscript. I also wanted to have the visa before writing you again. This is now done. Moreover, according to what they say, there will be no difficulties for my wife to get it at the appropriate moment. Thus, this is apparently all right.

I had military service this week and so could not think much about anything else. It seems to me that my proof of the theorem about the 2 classes of orbits (including fixed points) is correct; but it depends on generalizations of some lemmas in my thesis which I have not yet written out in details, but for which I think my older proofs are all right. From the cohomological point of view there seems to be 3 cases:

- a) Same cohomology as if we had $E^n = E^k \times E^{n-k}$ with the group acting trivially on the first factor and having an $n-k-1$ dim. orbit on the second one.
- b) Same decomposition of E^n but the second factor is a principal fibering (Hopf fibering) with group $SO(2)$ or $Sp(1)$.
- c) Same decomposition, $n-k$ is divisible by 4 and the group is a symplectic group.

(c) is very puzzling and, if it exists, might not be linear. May be this is connected with the maps of Hopf inv. 1, and will exist at most if n is a power of 2 + a fixed constant. Whether one of these cases is always linear I do not know. I would have hoped that Poncet's argument would work for case (a) but, having no news from him, I think that he could not make it go through. Of course, we are interested about any news in this area, but anyhow I shall be in a fortnight at the Institute and get the most up to date information.

Sincerely yours

/s/ A. Borel

ECOLE POLYTECHNIQUE FEDERALE
Mathematiques Superieures

Prof. Dr. Armand Borel

cc: Beurling
Gödel
Morse
Oppenheimer ✓
Selberg
Whitney
Mrs. Barnett

Zurich, le 2/10/57

Dear Montgomery,

Many thanks for your letter. We have now an appointment at the American Consulate General on March 8th. This is the last step and the visa is usually granted about one week after that, provided that the medical examination (which takes place on the same day) is satisfactory. I intend to leave Zurich by plane on March 31 and thus it should be all right. However, there will still be some difficulties to be ironed out, since (a) the visa is valid for 4 months after issuance (b) I intend to come back with Gaby and the children end of August, (c) if we ask Gaby's visa to be given later, that means that she would lose the benefit of the preference class and these people seem to think that under normal conditions, it takes presently more than 1 year to get an immigrant visa! Anyway, we shall see. Of course, if there is no other way out, we might come during July, but this would be exceedingly unpleasant for lots of reasons.

Someone here, named Poncet, tries to work on transformation groups. Recently he proved by a simple argument that if the compact connected Lie group G acts on \mathbb{R}^n and if there is a $n-1$ dim. orbit, then (as you conjecture in your book) it is equivalent to a linear group. Is this known to you? This led me to try to see what can be said when G acts on \mathbb{R}^n in such a way that besides the fixed points, there is only one class of orbits. It seems to me that I can prove (at least when the set of fixed points is a submanifold) that the orbits are necessarily spheres (of dimension 1 or 3 if the isotropy group is the identity). In fact everything seems to lead to the following conjecture: G is equivalent to a linear group, and $\mathbb{R}^n = \mathbb{R}^k \times \mathbb{R}^{n-k}$, where \mathbb{R}^k is the set of fixed points and where either G is transitive on the unit sphere of \mathbb{R}^{n-k} or G is $SU(1)$ or $Sp(1)$ acting in the familiar way leading to the Hopf fibering. I am not yet sure about the former theorem, since my proof is not written in detail and it is rather long and painful. But I would like to know whether you know it or whether you have a counterexample. If it turns out to be true, then maybe Poncet's method can prove the conjecture. Poncet tries to write up a thesis on the subject. He can also prove Mostow's result to the effect that if G operates on a space with a finite number of classes of orbits then the action is linear under a suitable embedding of the space (but he did this only after I had mentioned the theorem to him); he has also obtained some other results. Of course, he is rather isolated here and we would appreciate to have an answer to the preceding questions and well as hints about new events along these lines, if any.

Cordially yours

A. Borel

Ecole Polytechnique Federale
Mathematiques Superieures

cc: Beurling
Gödel
Morse
Oppenheimer ✓
Selberg
Whitney
Mrs. Barnett

Prof. Dr. Armand Borel

Zurich, 1st December 23, '56

Dear Montgomery,

Many thanks for all your letters. I had a 3-week period of military service, and consequently was slow in answering.

Once again, I have to say that we are not enthusiastic about a house, in this case Mr. Jenny's; we would prefer something slightly bigger. Apparently it will be quite a job to find something satisfactory for us and we are somewhat ashamed to disturb you and Mr. Morgan, Mrs. Barnett with that. I am afraid that finally Weyl's house will turn out to be or to have been the best bargain. In view of the difficulty to find a house, it might be good to contact some real estate agent, and I would like you to give me one or two addresses.

As to Kervaire, I would like to follow the procedure you mention: i.e. the fund for my assistant be converted into a grant for him. He writes me that I should send a letter of recommendation to H. Whitney, but, according to your letter, this does not seem to be necessary, and I shall not write a more official letter unless the Faculty asks me to do so.

I gave Vesentini the blanks and I presume he has applied by now. For the moment, I do not have much more to say than in my last letter. I shall try in the next fortnight to get better acquainted with his published work, and then shall write a more detailed letter if necessary. As I told you, I think that the Princeton atmosphere, in particular Kodaira-Spencer, would be good for him, and that so far he has done good, but may be not outstanding work. He seems to me to have good possibilities.

We have received the telegram from Mrs. Barnett asking for certified photostats of diploma, etc. Of course this is not a very favorable time to have this done quickly, but I suppose we shall send them around Dec. 27.

Gaby joins me in sending you and Kay our best wishes for new year.

Sincerely yours,

/s/ A. Borel

cc: Beurling
Gödel
Morse
Oppenheimer ✓
Selberg
Whitney
Mrs. Barnett

The Institute for Advanced Study
Princeton, New Jersey, U. S. A.
January 31, 1957

Professor Armand Borel
Swiss Federal Institute of Technology
Zürich, Switzerland

Dear Armand:

I sent a copy of your most recent letter to Mrs. Barnett and Mr. Morgan and also talked with them about your possible interest in the Weyl house. They seemed to feel that the house will very likely be available for you to consider when you arrive in April, and, in any event, I believe they would inform you before coming to any final decisions in the matter if something unexpected came up in the meantime.

Your photostats arrived, and Mrs. Barnett sent them on to Newark at once. On January twenty-third the Newark office notified the Institute that it had approved the Institute's application for your preference visa and that this approval had been sent to the State Department in Washington for transmittal to Switzerland. The people we have consulted seemed to feel that these latter stages should not take very much time, but, in order to keep a check on the situation, I wish you would write in a week or ten days and tell us whether or not anything has happened at your end.

I also passed along your letter of recommendation for Vesentini. Everyone has formed a high opinion of him, but at present he is one of about six or eight people for whom everyone has very high regard but for whom we do not at present have funds available. Some reservations which have been made, for example for Adams, may later be returned to us, but even so it seems doubtful that we will have enough to take care of all this group that I mentioned. Two others in this group are Azumaya and Hyhill both of whom have applied two or three times before. For this reason I can't be sure what will happen about the Vesentini matter, but we'll do our best, and if it doesn't work out for him this year, I certainly hope that he applies again and if he does, I believe there would be a very good chance.

Sincerely yours,

DM:MM

Deane Montgomery

Borel

28 January 1957

Memorandum to: Mr. Morgan
Miss Underwood

This is to record our understanding that Professor Borel is expected to spend the months of April, May and June of 1957 at the Institute, during which time he will receive a grant-in-aid of \$1,250 a month, or a total of \$3,750, to be charged to the Mathematics Stipend fund.

Verna Hobson

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

SCHOOL OF MATHEMATICS

August 14, 1956

Dear Robert:

In a note at the bottom of Borel's letter I mentioned that Gödel, Selberg, and myself have agreed with Morse's suggestion. By telephone last evening Beurling told me that he also agreed. Since Whitney is in Mexico, this represents the unanimous view of all of us who are available, and I should think it could be considered as a conclusive vote and a basis for action in case Borel decides to adopt this plan.

Sincerely yours,



Deane Montgomery

DM:MMM

cc: Beurling
Gödel
Morse
Selberg
Whitney

ECOLE POLYTECHNIQUE FEDERALE
Mathematiques Superieures

Prof. Dr. Armand Borel

cc: Beurling
Gödel
Morse
Oppenheimer ✓
Selberg
Whitney

ZURICH, le 8/8/56

Dear Montgomery,

Many thanks for all your very kind letters. I am really ashamed for not having answered sooner but you had given me quite complete information and it did not seem to me worthwhile to write before I had made up my mind. I hope you will not mind my long silence too much.

Having not yet received any answer from Prof. Oppenheimer, I do not know whether I shall come to the Institute in April or in October 1957. In many respects it would be simpler to come in October, but I would prefer the former date for mathematical reasons. Indeed, I would enjoy being there with Bott, Mostow in particular. I think that if this can be done, I shall try to write those Notes on symmetric spaces next Spring, to be mimeographed by the Institute, and the presence of Bott and Mostow would be particularly useful for that. Of course it is possible to do this later, but first the need for such Notes seems to me rather generally felt now and second next Fall with Serre there, and with a possible Seminar on algebraic groups, I shall have less time for it. But please consider this as unofficial as possible and not as commitments to be claimed "urbi et orbi". Anyhow, nothing can be done before I have a letter from the Institute about it. Also it is not one hundred per cent sure that the President of the E.T.H. will like to accept the resignation for next Spring but Eckmann told me the Math. Dept. would not oppose it; thus it should be possible.

I have indeed received a manuscript from Yamabe. The least one can say, I think, is that it needs re-writing. E.g. the lemmas at the beginning are never really used or quoted, it does not say why he needs the important Bochner-Montgomery result (and, it seems to me, needs only a trivial special case of it). And in the last two pages there are points which seem to me quite unproved, and I agree with you about the existence of gaps. (E.g. why is $r \rightarrow J[v]$ 1-1 and why has $J[v]$ no fixed pts if $v \neq 0$; his arguments only show that $v \rightarrow J[v]$ has discrete kernel.) I wrote him a very detailed answer, but did not get any reply. Thus if you see him, could you please ask him whether he has received my letter and, if so, whether he plans to answer.

Mostow's theorem is very interesting. The trans groups are not so nasty after all!

Sincerely yours,

/s/ A. Borel

NOTE:

Oppenheimer wrote Borel on August 3 in reply to Borel's acceptance so no doubt Borel now has the information. I agree with Morse's suggestion of a grant of \$5000 to cover Borel's stay here in the spring months if he comes then and his arrival is too late for his official appointment to begin before July. Gödel and Selberg have remarked in conversation that they too agree.

D. Montgomery

20 August 1956

To whom it may concern:

This will certify that Armand Borel has been appointed Professor in the School of Mathematics in the Institute for Advanced Study, Princeton, New Jersey. Professor Borel's appointment takes effect July 1, 1957, and remains effective until the July 1 following his sixty-eighth birthday. At the present time, the salary of an Institute Professor is Eighteen Thousand Dollars (\$18,000.00) a year.

This will certify, further, that Armand Borel has been admitted as a Member of the School of Mathematics of the Institute for Advanced Study for the second term of the academic year 1956-57, from January 1957 through June 1957; and that a grant-in-aid will be made to him, for the period that he spends at the Institute, of One Thousand Two Hundred Fifty Dollars (\$1,250.00) a month, up to a total of Five Thousand Dollars (\$5,000.00).

Robert Oppenheimer

cc to LDU

20 August 1956

Dear Dr. Borel:

Thank you for your letter of August 18th. I am pleased that the proposed arrangements are satisfactory to you. Your travel grant will automatically become available on the first of July, 1957, and can be advanced a little earlier than that.

We have known something of the negotiations with M.I.T., and I can well understand both the human and scientific reasons for your going there in the spring of '58. I believe the trustees of the Institute, to whom I should report your request for leave, will concur in my judgment that it should be granted, and that it will be quite safe for you to make plans on that basis.

With this letter I am sending you an official certification of your appointment, in duplicate. We will apply for your classification on the preferred list for immigration. This will, however, take a little while since there are many forms. I would like to do this with the cooperation of your more immediate colleagues, but by the middle of September the application should be submitted.

As for housing: The Dysons have bought the Placzek house. Hermann Weyl's house is immediately available, although it is under consideration by a few other members of the Faculty; and there are one or two less immediate prospects. I have asked Mr. Morgan to write to you about all this, partly because we have recently adopted a new procedure for making housing available to members of the Faculty for less than their appraised value; and partly because you may need some assistance in deciding whether you like the Weyl house, which you may have seen, at most rather casually, when you were here before. I have told Mrs. Barnett of the fact that, if a suitable house is not available next April, you would like an apartment. By that time of year, there should be no great problem.

Very sincerely,

Robert Oppenheimer

Dr. Armand Borel
Dunanstrasse 1
Zürich 44, Switzerland

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

20 August 1956

Dear Dr. Borel:

Thank you for your letter of August 18th. I am pleased that the proposed arrangements are satisfactory to you. Your travel grant will automatically become available on the first of July, 1957, and can be advanced a little earlier than that.

We have known something of the negotiations with M.I.T., and I can well understand both the human and scientific reasons for your going there in the spring of '58. I believe the trustees of the Institute, to whom I should report your request for leave, will concur in my judgment that it should be granted, and that it will be quite safe for you to make plans on that basis.

With this letter I am sending you an official certification of your appointment, in duplicate. We will apply for your classification on the preferred list for immigration. This will, however, take a little while since there are many forms. I would like to do this with the cooperation of your more immediate colleagues, but by the middle of September the application should be submitted.

As for housing: The Dysons have bought the Placzek house. Hermann Weyl's house is immediately available, although it is under consideration by a few other members of the Faculty; and there are one or two less immediate prospects. I have asked Mr. Morgan to write to you about all this, partly because we have recently adopted a new procedure for making housing available to members of the Faculty for less than their appraised value; and partly because you may need some assistance in deciding whether you like the Weyl house, which you may have seen, at most rather casually, when you were here before. I have told Mrs. Barnett of the fact that, if a suitable house is not available next April, you would like an apartment. By that time of year, there should be no great problem.

Very sincerely,

Robert Oppenheimer

Dr. Armand Borel
Dunanstrasse 1
Zürich 44, Switzerland

C O P Y

Ecole Polytechnique Federale
Mathematiques Superieures

Zurich, le August 18, 1956

Professor R. Oppenheimer,
The Institute for Advanced Study
Princeton, N.J.

Dear Prof. Oppenheimer,

Many thanks for your letter of August 3rd. Your suggestion to make my official appointment start on July 1st and to give me a grant if I can come sooner suits me very well since it is a very flexible arrangement and I shall probably not know for some time whether I shall be able to spend next Spring in Princeton or not. I must say that it is only on mathematical grounds that I want to do so, because from all other points of view, it would be simpler to leave Switzerland in Fall. Consequently I intend at present to go alone to Princeton for April, May, June '57, then come back to Europe and bring my family around September-October.

You mention a possible grant of \$5000.- for 4 months, i.e. of \$1250.- a month, with which I would quite agree. However, I would then like to be allowed to draw on the \$1000.- for professional travels to pay my Summer trip to Europe, for which there are also one, may be two, mathematical motives. Bourbaki Congress; these are in fact private affairs, reserved for members, of which I am, held 3 times a year. The second one might be the Nice Conference, if I accept the invitation. The latter has of course a more official character, but, since this will occur repeatedly, I would like to know whether I am right in assuming that a trip to attend a Bourbaki congress may be considered as a professional one, although it is not a public Conference. I do not intend to participate to all of them in the future, but I consider it important for me to be able to take part to the work of Bourbaki.

Last Fall, M.I.T. invited me for one year or one term; because of administrative difficulties, this caused a certain amount of negotiations and, just before receiving your offer, I said that I could probably accept it for one term, more precisely for the Spring term 1958; my letter having been left unanswered for quite some time, I thought the matter had been dropped altogether and did not mention it to you; but a recent letter from Prof. Hurewicz informs me that it is all right. In view of the change in my situation, and since the formal invitation has not yet been handed over to me, I suppose I could still say no. However, I would prefer to accept it since, mathematically speaking, I would enjoy spending some time in Boston; and also because this has been under discussion for such a long time. Thus I may have to ask for an unpaid leave of absence for the M.I.T. Spring term 1958; I realize that it is somewhat peculiar to ask for a leave during a first year of appointment, but this is in fact a commitment prior to the Institute offer, and therefore I hope that it will be granted.

Of course, I want to apply as soon as possible for the immigration visa. For this I need an official letter from the Institute stating that I am appointed as a Professor and giving the salary. It should also mention that I shall be

supported by the Institute from April '57 on. If you think it is simpler not to enter into distinctions between official appointment and invitation, between salary and grant, and if you prefer to state simply that I am appointed as Professor from April 1st on, I shall not consider this as an engagement of the Institute to pay me my regular salary before July 1st 57. I have to join this statement to my application and beg you to send it to me. Besides that, it would certainly help if I could be put in the first preference class; it seems to me that it might be done in my case, and I am enclosing a sheet giving instructions about this.

Finally there is the housing problem. We would like to have our own house, not necessarily a new one. In this respect, my wife liked very much the house in which Prof. Placzek used to live, but also recalls that it needed much repair. Is it available, and if so, is it worthwhile in spite of the repairs? Are there other possibilities, and how can we get information about them? Of course, if there is nothing of that kind, we shall take an Institute apartment, but we would prefer to start directly with a more or less definitive arrangement, if possible.

Many thanks too for the information on the Institute Conference. I would certainly like to attend it but, in view of all the circumstances, do not know yet what I shall do.

Sincerely yours.

/s/ A. Borel

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

3 August 1956

Dear Dr. Borel:

Thank you for your letter of the 24th of July. It caused us great jubilation. You may be sure that all of us will do what we can so that you will not have occasion to regret your decision.

As for the conference in September of 1957, I am asking Miss Underwood to send you all the papers concerned with it. It is a conference called at the request of the Office of Scientific Research of the Air Forces by the mathematicians in the School of Mathematics at the Institute on some problems in analysis. Morse, Baurling, and Selberg are in charge of the arrangements. It would certainly be most appropriate and desirable that you be here during that Congress, but it is surely not necessary that you be here, if you feel greater interest or greater obligation to be in Nice. Perhaps when you have seen the papers that we are sending you, it will be easier to make a decision.

With regard to the scheduling of your coming here, we shall be guided by your desires and our own wish that you come as soon as you can. There will certainly be some people here in the spring semester next year who would look forward very much to your presence.

The reason that Morse and I took the January and July dates as starting dates is that these are the formal beginnings of the two halves of the Institute's academic (and fiscal) years, and that, generally speaking, all appointments start and terminate on one or another of these dates. There is a slightly more substantive reason: The Institute has two semesters; next year they run from 1 October to 21 December 1956, and from 14 January to 12 April 1957. A Professor at the Institute does not have many duties except to his own work; but we do expect Professors to be in residence throughout the greater part, if not all of these brief periods; and when that is not possible, we grant a leave of absence, generally without pay, for the semester in question. Thus it was natural for us to assume that, if your appointment were to take effect in the new year of 1957, you would be here at least for a good part of our actual semester.

In view of all the circumstances, I would think that if you arrived within a month of the beginning of term, we would make your appointment effective January 1st. If that is too early for you, and you can not come until some time in March, I suggest that we make your Professorial appointment effective July 1st, and give you a grant to cover your expenses in the intervening months from March to June. I believe that your colleagues in the School of Mathematics

-2-

would regard \$5,000.00 as an appropriate sum, and one that they could afford. If these proposals do not really meet your requirements, if they leave unanswered any questions that you have, or if you would like to make counter-proposals, write quite freely about it.

I should like to conclude this letter as I began, by welcoming your acceptance and welcoming you. I wish you many years of fruitful scientific work and good companionship in the time ahead.

Very sincerely,

Robert Oppenheimer

Professor Armand Borel
Dunanstasse 1
Zürich 44, Switzerland

C O P Y

Perd- Fac meeting

Ecole Polytechnique Fédérale

Mathématiques Supérieures

Prof. Dr. Armand Borel

Zurich, 1e July 24, '56

Prof. R. Oppenheimer
The Institute for Advanced Study
Princeton, N.J.

Dear Professor Oppenheimer:

Many thanks for your kind letters. I hope that you will forgive my long silence, but there was hardly any point in answering before I had made up my mind; and I want first to tell you that I accept your offer.

In spite of all the advantages of a professorship at the Institute, I needed a long time to take a decision for several reasons: notably, it involves a profound change in the life of my family; also, from the professional point of view, I do not know whether I am really fully qualified to hold such a position; I hope that it will be the case and that I shall deserve the confidence you and your colleagues put in me.

We shall have to adjust the dates of my resignation here and of my appointment at the Institute. I may leave the E.T.H. either in March 1957 (end of Winter term), or in July-August 1957 (end of Summer term); you and Prof. Morse wrote me that an appointment at the Institute would normally start on January 1st or July 1st. Thus the simplest would be to choose July; I must say that I would prefer to leave the E.T.H. in March, even if this involves going back to Europe for part of the Summer, since this would give me sooner more time for research and allow us to be well settled at the beginning of the academic year 1957-58. Do you think this might be arranged?

I understand there will be a Conference on one and several complex variables at the Institute in September 1957. Could you tell me exactly when? I am invited to give a lecture at a "Congrès des mathématiciens d'expression latine" to be held in Nice, France, September 12-18, 1957, and would like to know more about the Institute conference before giving a definitive answer.

Finally I want to thank you and the Institute very much for the contribution to my moving expenses. As I told you, it is a great relief; when asking for it, I had not suspected that it had never been done, and I am all the more grateful for it.

I am writing from Amsterdam, but shall soon be back in Switzerland, and therefore beg you to answer to my usual address: Dunanstr 1, Zürich 44.

Sincerely yours,

s/A. Borel

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

18 June 1956

Memorandum to File:

R. O. called Mr. Leidesdorf on June 18, 1956, and described to him the content of the correspondence with Borel, specifically: Borel's letter of May 12th, Mrs. Hobson's answer of May 16th, Borel's letter of June 9th, Morse's letter of June 15th, the Mathematics Faculty vote of May 22nd, and Morse's letter to Borel of June 15th. Mr. Leidesdorf said that he thought that in cases like this the Director should be free to make whatever arrangements seemed reasonable to him and to the Faculty.

Robert Oppenheimer

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

18 June 1956

Dear Professor Borel:

Your letter of June 9th came during my brief absence from Princeton. I had occasion to discuss it fully with Professor Morse last week, and have before me a copy of his letter to you. I have been able to set forth our proposals to the officials of the Institute's Board of Trustees, who have authorized me to make a reasonable contribution toward the expenses that you would incur in bringing your household to Princeton. For that purpose, we can make available to you a sum of up to \$1,500. For the expenses of your own transportation, you may, of course, draw upon part of the \$1,000 a year which is regularly made available to you for the expenses of your travel for professional purposes. Your colleagues here all hope that this will help the solution of your problem.

Let me add that we are more concerned that your answer to our invitation be affirmative than that it be prompt. We know that it is a difficult decision with which we have confronted you. We hope very much that after reflecting about the whole future of your scientific development, you will decide to come here.

Very sincerely,

Robert Oppenheimer

Professor Armand Borel
Dunanstasse 1
Zürich 44, Switzerland

THE INSTITUTE FOR ADVANCED STUDY

PRINCETON, NEW JERSEY

cc: ✓ Mrs. Hobson

June 15, 1956

Professor Armand Borel
Dunanstrasse 1
Zürich 44, Switzerland

Dear Armand:

Your letter regarding your traveling and moving expenses arrived when Dr. Oppenheimer was away. Your request will be given the most careful consideration. We have never done this for professors invited to the Institute. It would doubtless be of interest to you to know that if you decide to come here the beginning of the second term of 1957-58 your salary would start with January 1. If you decide to come beginning in the fall of 1957 your salary would begin July 1. So you would have more than two months' salary to draw upon if you decide to come in the fall.

Dr. Oppenheimer and I think it would be a good thing to establish the precedent of paying the moving expenses for professors invited from abroad to come to the Institute. However such an action would have to be approved by the Trustees. It will be presented to the Trustees and we are hopeful of a favorable response. You will be informed by Dr. Oppenheimer of the result in a week or so.

The conditions of the first paragraph for paying your salary are already established and do not depend upon any action by the Trustees if you decide to come.

Please accept my best wishes for you and your family.

Cordially yours,

Marston Morse

MMedu

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

SCHOOL OF MATHEMATICS

June 15, 1956

Dr. Robert Oppenheimer
Institute for Advanced Study

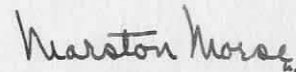
Dear Robert:

The mathematicians met together yesterday noon and considered the letter from Borel concerning his traveling and moving expenses. Selberg and Beurling pointed out that it is usually the custom in Europe for a university to pay such expenses when it invites a professor from another university to a permanent chair. In the case of Carl Siegel, Göttingen paid all of his traveling and moving expenses when he left Princeton.

The mathematicians unanimously recommend that we pay these expenses for Borel up to the amount of \$1,500. If other funds are not available the mathematicians recommend that this amount be taken from the School's grants-in-aid fund. This fund now has a balance of \$22,709.34. There is some precedent for this on a small scale since we frequently increase a man's grant by several hundred dollars because of his traveling expenses.

The mathematicians feel that this technical adjustment should not be allowed to interfere with the main act of getting Borel here. If the Borel appointment falls through, then, apart from the difficult task of finding an adequate replacement, much time and energy would be consumed in obtaining agreement, making investigations, convincing the faculty, and finally the Trustees.

Very truly yours,


Marston Morse

MMcdu
Enclosure

Ecole Polytechnique Fédérale
MATHÉMATIQUES SUPÉRIEURES

ZURICH, le

June 9, 1956

Prof. Dr. Armand Borel

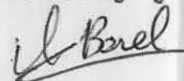
Prof. R. Oppenheimer,
The Institute for advanced study
Princeton.

Dear Prof. Oppenheimer,

Many thanks for your kind letter and for your patience. Unfortunately, you did not answer my second question, that of moving expenses. In view of the conditions offered by the Institute, I certainly hate to come back on that point, but it is really for me a rather serious problem. Therefore, I would like to know whether I could get some help in that matter, in case I accept your offer. Although I do not want at all to make out of this a "sine qua non" condition, I must say that it would be a relief.

I hope you will not mind my asking a question instead of giving an answer, but anyway I could not give a positive answer before knowing how I could arrange my trip.

Sincerely yours



(A. Borel)

Handwritten notes:
J.W. -
H.L.
reg. mail
T. 20
12

Copy sent: Borel
Ridel
Montgomery
Morse
Sullivan
Whitely
5/17/56
mm

16 May 1956

Dear Dr. Borel:

Thank you for your letter of May 12th. Dr. Oppenheimer is away from Princeton, giving some scientific lectures at Northwestern University, but I told him of your letter by telephone today. He asked me to let you know that he hopes you will consider your decision most carefully, and feel under no pressure in arriving at it. The date of the appointment could, of course, be adjusted to suit your convenience in meeting your other obligations.

Sincerely yours,

(Mrs. Wilder Hobson)
Secretary to the Director

Dr. Armand Borel
E. T. H.
Zürich
Switzerland

Zurich, May 12, 1956

Professor R. Oppenheimer,
The Institute for advanced study
Princeton.

Dear Professor Oppenheimer,


I feel deeply honored by the offer of a professorship at the Institute and I want first to thank you and the Faculty very much for it. However, it is such an important decision to take that I hope you will not mind my asking for some delay before giving a final answer. Of course, a professorship at the Institute is in many respects the best position one can think of, but by this very fact, and in view of the importance of the Institute, it seems to me to involve a very high responsibility. Also, I came back with the idea of staying permanently in Switzerland and my position at the E.T.H. is a very good one, and I did not expect to have to put that into question again so soon. For these and other more personal reasons, I would like to have some time to think about your offer.

Our terms at the E.T.H. are from October to February and from April to July. In any case I would not be able to leave the E.T.H. before the end of the Winter term 1956-57; also, it is hard to foresee how long it would take to get an immigration visa; Thus, if I should accept your offer, some adjustment might be needed concerning the date of my appointment.

The financial conditions you mention are of course exceptionnally good, and I hope you will forgive me if, in spite of that, I allow myself to raise one question about money : we have here a certain amount of household furniture, as well as books, etc, which we donnot want to be separated from. In case I accept, would it be possible to get an indemnity for the cost of traveling and moving ?

I hope you do not mind this letter. Of course, I realize the value of a permanent position at the Institute and I am extremely flattered by the choice of the Faculty; but you understand that also other factors have to be taken into account before deciding whether one should settle down with a family in Europe or in the States.

Sincerely yours.


(A. Borel)

cc: Baurling
Gödel
Morse
Oppenheimer ✓
Selberg
Whitney

Zürich, May 12, 1956

Professor D. Montgomery
The Institute for Advanced Study
Princeton

Dear Montgomery,

Many thanks for your letter. Yes, I have received the formal offer from Prof. Oppenheimer. I must say this was a great surprise and I feel extremely flattered by this choice. It is a great honor indeed, so great that I wonder whether I really deserve it. I dare suppose that you have some responsibility for the offer made to me, and I thank you for showing so much confidence in me.

As I wrote to Prof. Oppenheimer, I would like to have some time to think about it. I have now to make a choice which will greatly influence not only my mathematical life, but also the life of Gaby and of our children. We are very fond of many features of the American life, but not of all, and in particular we are not enthusiastic at all about the bringing up of children and the schools in the U.S.A. Also, my mind was so to say tuned on a permanent settling in Zürich and some psychological adjustment is needed to put that under discussion again.

You kindly offer to answer questions, and I shall make use of that opportunity. The retirement plan you and Prof. Oppenheimer mention seems adequate by American standards but is not very good by ours. You say that you are also under Federal Security System. Could you tell me what that means? As I understand it, no pensioning is foreseen for the children in case Gaby and I would die or for Gaby and the children in case I would die. Also is there anything provided in case of a grave illness of mine, do the permanent members have a group insurance plan? All in all, the E.T.H. seems to offer a greater security and may be a greater stability, depending on the State and not on private funds.

I hope you do not mind these questions, but I am of the worried type; this has been going on for almost 33 years and I cannot help it.

Kindest regards from both of us to Kay and yourself.

Sincerely yours,

/s/ A. Borel

(A. Borel)

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

cc: Mrs. Hobson

May 22, 1956

Dear Colleagues:

In response to the needs of Armand Borel it is recommended that he be allowed to spend any or all of the \$1,000 allotted to him for scientific traveling expenses to cover the traveling expenses of his family on coming to the Institute.

Sincerely yours,

M. Morse

Marston Morse

Professors: ☒ Beurling

☐ Gödel

☐ Montgomery

☐ Oppenheimer

☐ Selberg

☐ Whitney

Approve

Disapprove

Yes A.B.

✓
✓

yes

yes

Please return your vote to Miss Underwood.

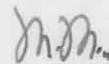
THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

May 22, 1956

Dear Colleagues:

In response to the needs of Armand Borel it is recommended that he be allowed to spend any or all of the \$1,000 allotted to him for scientific traveling expenses to cover the traveling expenses of his family on coming to the Institute.

Sincerely yours,



Marston Morse

Approve

Disapprove

Professors Beurling

Gödel

Montgomery

✓ Oppenheimer

Selberg

Whitney

Please return your vote to Miss Underwood.

cc: Mrs. Haberm

The Institute for Advanced Study
Princeton, New Jersey
November 30, 1956

Professor Armand Borel
Swiss Federal Institute of Technology
Zürich, Switzerland

Dear Armand:

Mr. Jenny's house is about one quarter of a mile farther from town than our house. His address is as follows: Mr. Dietrich Jenny, 78 Clover Lane, Princeton, New Jersey, and you could write directly to him if you had enough interest to do so. The house on Newlin Road is a two-story house of a rather colonial looking style except that the outside is stained dark brown. It probably has about five or six rooms and a couple of bathrooms, and I imagine the price is something over \$30,000. Mr. Morgan is probably going to go into the house in the next few days, and I will send you more precise information when I get it. Land in the area of town near the Institute is very expensive and the lot on which this house stands may very well be worth \$10,000 without any house at all on it. One advantage, of course, of having a house on a lot bought from the Institute is that the prices on such lots are substantially lower than for other lots in the area.

Dealing with a real estate agent doesn't commit you in any particular way. The procedure is simply that if you buy a house you hear of through an agent, then this agent collects a commission from the seller. However, the dealer wouldn't show you a house unless he had already entered into an arrangement with the seller and with the seller in advance being prepared to pay the commission. There is, therefore, really no obligation incurred by consulting an agent. As I said before, I would be glad to send you the names of one or two if you like, or talk to them for you. By the way, the house on Newlin Road is not yet officially on the market, but is one which Mr. Morgan happened to hear about because he is acquainted with the owner.

Your analysis of the situation regarding assistants seems to me to be completely correct. Of course you can ask an assistant to really assist you if you wish. There is another procedure which you might wish to follow in this case. A professor has the privilege of asking that the fund for his assistant be converted to a grant for the man involved. In this case the Department has to go through the formality of voting membership, but it is highly unlikely that such membership would ever be denied, and in the case of Kervaire I think there is no doubt at all that this would be an automatic formality. For a man with a wife and two children the amount would normally be \$4700. In general, there is no difference in amount between the assistants salaries and stipends. If you wish to follow this procedure, just let us know at once and we will take care of the details as quickly as possible.

Sincerely yours,

Deane Montgomery

DM:MMM

Fac Borel

11/30/56

Professor Montgomery called to say that he had written to Borel in answer to several questions, including one about the Assistant's Fund. Montgomery told him that this was at the disposition of the Professor, who could appoint his Asst., that he could also convert it to a grant, in which case membership must be voted by the Faculty.

3cc: cdu
copy for Math

Ecole Polytechnique Fédérale
MATHÉMATIQUES SUPÉRIEURES

ZURICH, le August 18, 1956

Prof. Dr. Armand Borel

Professor R. Oppenheimer,
The Institute for advanced study
Princeton, N.J.

Dear Prof. Oppenheimer,

Many thanks for your letter of August 3rd. Your suggestion to make my official appointment start on July 1st and to give me a grant if I can come sooner suits me very well since it is a very flexible arrangement and I shall probably not know for some time whether I shall be able to spend next Spring in Princeton or not. I must say that it is only on mathematical grounds that I want to do so, because from all other points of view, it would be simpler to leave Switzerland in Fall. Consequently I intend at present to go alone to Princeton for April, May, June '57, then come back to Europe and bring my family around September-October.

You mention a possible grant of \$5000.- for 4 months, i.e. of \$1250.- a month, with which I would quite agree. However, I would then like to be allowed to draw on the \$1000.- for professional travels to pay my Summer trip to Europe, for which there are also one, may be two, mathematical motives. The first one is to attend the Summer and possibly the Fall Bourbaki Congress; these are in fact private affairs, reserved for members, of which I am; held 3 times a year. The second one might be the Nice Conference, if I accept the invitation. The latter has of course a more official character, but, since this will occur repeatedly, I would like to know whether I am right in assuming that a trip to attend a Bourbaki congress may be considered as a professional one, although it is not a public Conference. I do not intend to participate to all of them in the future, but I consider it important for me to be able to take part to the work of Bourbaki.

Last Fall, M.I.T. invited me for one year or one term; because of administrative difficulties, this caused a certain amount of negotiations and, just before receiving your offer, I said that I could probably accept it for one term, more precisely for the Spring term 1958; my letter having been left unanswered for quite some time, I thought the matter had been dropped altogether and did not mention it to you; but a recent letter from Prof. Hurewicz informs me that it is all right. In view of the change in my situation, and since the formal invitation has not yet been handed over to me, I suppose I could still say no. However, I would prefer to accept it since, mathematically speaking, I would enjoy spending some time in Boston, and also because this has been under discussion for such a long time. Thus I may have to ask for an unpaid leave of absence for the M.I.T. Spring term 1958; I realize that it is somewhat peculiar to ask for a leave during a first year of appointment, but this is in fact a commitment prior to the Institute offer, and therefore I hope that it will be granted.

Of course, I want to apply as soon as possible for the immigration visa. For this I need an official letter from the Institute stating that I am appointed as a Professor and giving the salary. It should also mention that I shall be supported by the Institute from April '57 on. If you think it is simpler not to enter into distinctions between official appointment and invitation, between salary and grant, and if you prefer to state simply that I am appointed as Professor from April 1st on, I shall not consider this as an engagement of the Institute to pay me my regular salary before July 1st 57. I have to join this statement to my application and beg you to send it to me. Besides that, it would certainly help if I could be put in the first preference class; it seems to me that it might be done in my case, and I am enclosing a sheet giving instructions about this.

Finally there is the housing problem. We would like to have our own house, not necessarily a new one. In this respect, my wife liked very much the house in which Prof. Placzek used to live, but also recalls that it needed much repair. Is it available, and if so, is it worthwhile in spite of the repairs? Are there other possibilities, and how can we get information about them? Of course, if there is nothing of that kind, we shall take an Institute apartment, but we would prefer to start directly with a more or less definitive arrangement, if possible.

Many thanks too for the information on the Institute Conference. I would certainly like to attend it but, in view of all the circumstances, do not know yet what I shall do.

Sincerely yours.

A handwritten signature in dark ink, appearing to read 'A. Borel'. The signature is fluid and cursive, with a long horizontal stroke extending from the end.

(A. Borel)

Professor Montgomery stopped in to leave message about date of Borel's appt. He would be in favor of having him come in March, as he thinks there will be several people here (e.g. Mostow) who would want to see him.

I did not show Montgomery the copy of your letter to Morse.

*Aug 2 - Prof. Montgomery + RD discussed
the above matter in afternoon.*

28 July 1956

Dear Marston:

Since this is good news—to my way of thinking, very good news—I do not hesitate to interrupt your vacation with it. I called Deane as soon as the letter arrived; there is a copy of the letter in Caroline's office.

Borel raises two questions which require an answer. As for the congress, I will, with Caroline's help, get to him a description of the subject of the conference, and of the relation of the mathematicians at the Institute to it; and a list of invitees. My impression is that it would be desirable, but not mandatory, that he be here for it; but I will not try to settle that question for him. As for the time that he comes, I think that I must write him frankly about the time and duration of our semesters, and indicate that prolonged absence during a semester requires approval, and in general cannot be granted with pay; and then just leave it to him to decide whether to push things and get here by the end of January, or to make the transfer as of July 1st. I do not believe we should start out this relationship with another leave of absence with pay, and I would expect that this will all seem straightforward to him; however, on the chance that you may have other views, I will hold up writing to Borel until Friday, August 3rd. You can always call or wire or write.

For the rest, things here are tranquil. We hope they are good with you and Louise and your family.

All greetings,

Robert Oppenheimer

Professor Marston Morse
China Lake
Maine

File in F - Borel

cc: Morse
Underwood

3 August 1956

Dear Dr. Borel:

Thank you for your letter of the 24th of July. It caused us great jubilation. You may be sure that all of us will do what we can so that you will not have occasion to regret your decision.

As for the conference in September of 1957, I am asking Miss Underwood to send you all the papers concerned with it. It is a conference called at the request of the Office of Scientific Research of the Air Forces by the mathematicians in the School of Mathematics at the Institute on some problems in analysis. Morse, Beurling, and Selberg are in charge of the arrangements. It would certainly be most appropriate and desirable that you be here during that Congress, but it is surely not necessary that you be here, if you feel greater interest or greater obligation to be in Nice. Perhaps when you have seen the papers that we are sending you, it will be easier to make a decision.

With regard to the scheduling of your coming here, we shall be guided by your desires and our own wish that you come as soon as you can. There will certainly be some people here in the spring semester next year who would look forward very much to your presence.

The reason that Morse and I took the January and July dates as starting dates is that these are the formal beginnings of the two halves of the Institute's academic (and fiscal) years, and that, generally speaking, all appointments start and terminate on one or another of these dates. There is a slightly more substantive reason: The Institute has two semesters; next year they run from 1 October to 21 December 1956, and from 14 January to 12 April 1957. A Professor at the Institute does not have many duties except to his own work; but we do expect Professors to be in residence throughout the greater part, if not all of these brief periods; and when that is not possible, we grant a leave of absence, generally without pay, for the semester in question. Thus it was natural for us to assume that, if your appointment were to take effect in the new year of 1957, you would be here at least for a good part of our actual semester.

In view of all the circumstances, I would think that if you arrived within a month of the beginning of term, we would make your appointment effective January 1st. If that is too early for you, and you can not come until some time in March, I suggest that we make your Professorial appointment effective July 1st, and give you a grant to cover your expenses in the intervening months from March to June. I believe that your colleagues in the School of Mathematics

-2-

would regard \$5,000.00 as an appropriate sum, and one that they could afford. If these proposals do not really meet your requirements, if they leave unanswered any questions that you have, or if you would like to make counter-proposals, write quite freely about it.

I should like to conclude this letter as I began, by welcoming your acceptance and welcoming you. I wish you many years of fruitful scientific work and good companionship in the time ahead.

Very sincerely,

Robert Oppenheimer

Professor Armand Borel
Dunantstrasse 1
Zürich 40, Switzerland

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

SCHOOL OF MATHEMATICS

July 30, 1956

Dr. Robert Oppenheimer
Institute for Advanced Study

Dear Robert:

I am not wholly clear as to what Borel's salary conditions are at E.T.H. It seems that if he leaves E.T.H. at the end of February 1957 and comes to us he might lose salary from March through June, four months. Might it not be practicable to give him an ordinary grant from March through June out of the School funds, or out of a contract, something of the order of \$5,000, and so avoid any such loss to him, or the granting of leave of absence from us?

The family, apart from Louise (7), Virginia, and myself, is climbing Mt. Katahdin today. I hope you and Kitty get relief from Princeton exactions for some months.

Sincerely yours,

Marston Morse
Marston Morse

MMedu

cc: Professors Beurling
Gödel
Montgomery
Selberg
Whitney

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

28 July 1956

Dear Marston:

Since this is good news--to my way of thinking, very good news--I do not hesitate to interrupt your vacation with it. I called Deane as soon as the letter arrived; there is a copy of the letter in Caroline's office.

Borel raises two questions which require an answer. As for the congress, I will, with Caroline's help, get to him a description of the subject of the conference, and of the relation of the mathematicians at the Institute to it; and a list of invitees. My impression is that it would be desirable, but not mandatory, that he be here for it; but I will not try to settle that question for him. As for the time that he comes, I think that I must write him frankly about the time and duration of our semesters, and indicate that prolonged absence during a semester requires approval, and in general cannot be granted with pay; and then just leave it to him to decide whether to push things and get here by the end of January, or to make the transfer as of July 1st. I do not believe we should start out this relationship with another leave of absence with pay, and I would expect that this will all seem straightforward to him; however, on the chance that you may have other views, I will hold up writing to Borel until Friday, August 3rd. You can always call or wire or write.

For the rest, things here are tranquil. We hope they are good with you and Louise and your family.

All greetings,

Robert Oppenheimer

Professor Marston Morse
China Lake
Maine

cc 1 - Morse - eps.
Underwood

Ecole Polytechnique Fédérale
MATHÉMATIQUES SUPÉRIEURES

ZURICH, le July 24, '56

Prof. Dr. Armand Borel

Prof. R. Oppenheimer
The Institute for advanced study
PRINCETON U.S.

Dear Professor Oppenheimer,

Many thanks for your kind letters. I hope that you will forgive my long silence, but there was hardly any point in answering before I had made up my mind, and I want first to tell you that I accept your offer.

In spite of all the advantages of a professorship at the Institute, I needed a long time to take a decision for several reasons: notably, it involves a profound change in the life of my family; also, from the professional point of view, I do not know whether I am really fully qualified to hold such a position; I hope that it will be the case and that I shall deserve the confidence you and your colleagues put in me.

We shall have to adjust the dates of my resignation here and of my appointment at the Institute. I may leave the E.T.H. either in March 1957 (end of Winter term), or in July-August 1957 (end of Summer term); you and Prof. Morse wrote me that an appointment at the Institute would normally start on January 1st or July 1st. Thus the simplest would be to choose July; I must say that I ~~pre~~ would prefer to leave the E.T.H. on March, even if this

involves going back to Europe for part of the summer, since this would give me sooner more time for research and allow us to be well settled at the beginning of the academic year 1957-58. Do you think this might be arranged?

I understand there will be a conference on one and several complex variables at the Institute in September 1957. Could you tell me exactly when? I am invited to give a lecture at a "Congrès des mathématiciens d'expression latine" to be held in Nice, France, September 12-18, 1957, and would like to know more about the Institute conference before giving a definitive answer.

Finally I want to thank you and the Institute very much for the contribution to my moving expenses. As I told you, it is a great relief; when asking for it, I had not suspected that it had never been done, and I am all the more grateful for it.

I am writing from Amsterdam, but shall soon be back in Switzerland, and therefore beg you to answer to my usual address: Dunantstr 1, Zürich 44.

Sincerely yours.
A. Borel

C O P Y

Ecole Polytechnique Fédérale

Mathématiques Supérieures

Prof. Dr. Armand Borel

Zurich, 1e July 24, '56

Prof. R. Oppenheimer
The Institute for Advanced Study
Princeton, N.J.

Dear Professor Oppenheimer:

Many thanks for your kind letters. I hope that you will forgive my long silence, but there was hardly any point in answering before I had made up my mind; and I want first to tell you that I accept your offer.

In spite of all the advantages of a professorship at the Institute, I needed a long time to take a decision for several reasons: notably, it involves a profound change in the life of my family; also, from the professional point of view, I do not know whether I am really fully qualified to hold such a position; I hope that it will be the case and that I shall deserve the confidence you and your colleagues put in me.

We shall have to adjust the dates of my resignation here and of my appointment at the Institute. I may leave the E.T.H. either in March 1957 (end of Winter term), or in July-August 1957 (end of Summer term); you and Prof. Morse wrote me that an appointment at the Institute would normally start on January 1st or July 1st. Thus the simplest would be to choose July; I must say that I would prefer to leave the E.T.H. in March, even if this involves going back to Europe for part of the Summer, since this would give me sooner more time for research and allow us to be well settled at the beginning of the academic year 1957-58. Do you think this might be arranged?

I understand there will be a Conference on one and several complex variables at the Institute in September 1957. Could you tell me exactly when? I am invited to give a lecture at a "Congrès des mathématiciens d'expression latine" to be held in Nice, France, September 12-18, 1957, and would like to know more about the Institute conference before giving a definitive answer.

Finally I want to thank you and the Institute very much for the contribution to my moving expenses. As I told you, it is a great relief; when asking for it, I had not suspected that it had never been done, and I am all the more grateful for it.

I am writing from Amsterdam, but shall soon be back in Switzerland, and therefore beg you to answer to my usual address: Dunanstr 1, Zürich 44.

Sincerely yours,

s/A. Borel

C O P Y

Ecole Polytechnique Fédérale

Mathématiques Supérieures

Prof. Dr. Armand Borel

Zurich, 1^e July 24, '56

Prof. R. Oppenheimer
The Institute for Advanced Study
Princeton, N.J.

Dear Professor Oppenheimer:

Many thanks for your kind letters. I hope that you will forgive my long silence, but there was hardly any point in answering before I had made up my mind; and I want first to tell you that I accept your offer.

In spite of all the advantages of a professorship at the Institute, I needed a long time to take a decision for several reasons: notably, it involves a profound change in the life of my family; also, from the professional point of view, I do not know whether I am really fully qualified to hold such a position; I hope that it will be the case and that I shall deserve the confidence you and your colleagues put in me.

We shall have to adjust the dates of my resignation here and of my appointment at the Institute. I may leave the E.T.H. either in March 1957 (end of Winter term), or in July-August 1957 (end of Summer term); you and Prof. Morse wrote me that an appointment at the Institute would normally start on January 1st or July 1st. Thus the simplest would be to choose July; I must say that I would prefer to leave the E.T.H. in March, even if this involves going back to Europe for part of the Summer, since this would give me sooner more time for research and allow us to be well settled at the beginning of the academic year 1957-58. Do you think this might be arranged?

I understand there will be a Conference on one and several complex variables at the Institute in September 1957. Could you tell me exactly when? I am invited to give a lecture at a "Congrès des mathématiciens d'expression latine" to be held in Nice, France, September 12-18, 1957, and would like to know more about the Institute conference before giving a definitive answer.

Finally I want to thank you and the Institute very much for the contribution to my moving expenses. As I told you, it is a great relief; when asking for it, I had not suspected that it had never been done, and I am all the more grateful for it.

I am writing from Amsterdam, but shall soon be back in Switzerland, and therefore beg you to answer to my usual address: Dunanstr 1, Zürich 44.

Sincerely yours,

s/A. Borel

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

18 June 1956

Dear Professor Borel:

Your letter of June 9th came during my brief absence from Princeton. I had occasion to discuss it fully with Professor Morse last week, and have before me a copy of his letter to you. I have been able to set forth our proposals to the officials of the Institute's Board of Trustees, who have authorized me to make a reasonable contribution toward the expenses that you would incur in bringing your household to Princeton. For that purpose, we can make available to you a sum of up to \$1,500. For the expenses of your own transportation, you may, of course, draw upon part of the \$1,000 a year which is regularly made available to you for the expenses of your travel for professional purposes. Your colleagues here all hope that this will help the solution of your problem.

Let me add that we are more concerned that your answer to our invitation be affirmative than that it be prompt. We know that it is a difficult decision with which we have confronted you. We hope very much that after reflecting about the whole future of your scientific development, you will decide to come here.

Very sincerely,

Robert Oppenheimer

Professor Armand Borel
Dunanstrasse 1
Zürich 44, Switzerland

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

18 June 1956

Memorandum to File:

R. O. called Mr. Leidesdorf on June 18, 1956, and described to him the content of the correspondence with Borel, specifically: Borel's letter of May 12th, Mrs. Hobson's answer of May 16th, Borel's letter of June 9th, Morse's letter of June 15th, the Mathematics Faculty vote of May 22nd, and Morse's letter to Borel of June 15th. Mr. Leidesdorf said that he thought that in cases like this the Director should be free to make whatever arrangements seemed reasonable to him and to the Faculty.

R.O.

Robert Oppenheimer

Copy to Miss Underwood

18 June 1956

Dear Professor Borel:

Your letter of June 9th came during my brief absence from Princeton. I had occasion to discuss it fully with Professor Morse last week, and have before me a copy of his letter to you. I have been able to set forth our proposals to the officials of the Institute's Board of Trustees, who have authorized me to make a reasonable contribution toward the expenses that you would incur in bringing your household to Princeton. For that purpose, we can make available to you a sum of up to \$1,500. For the expenses of your own transportation, you may, of course, draw upon part of the \$1,000 a year which is regularly made available to you for the expenses of your travel for professional purposes. Your colleagues here all hope that this will help the solution of your problem.

Let me add that we are more concerned that your answer to our invitation be affirmative than that it be prompt. We know that it is a difficult decision with which we have confronted you. We hope very much that after reflecting about the whole future of your scientific development, you will decide to come here.

Very sincerely,

Robert Oppenheimer

Professor Armand Borel
Dunanstasse 1
Zürich 44, Switzerland

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

18 June 1956

Dear Professor Borel:

Your letter of June 9th came during my brief absence from Princeton. I had occasion to discuss it fully with Professor Morse last week, and have before me a copy of his letter to you. I have been able to set forth our proposals to the officials of the Institute's Board of Trustees, who have authorized me to make a reasonable contribution toward the expenses that you would incur in bringing your household to Princeton. For that purpose, we can make available to you a sum of up to \$1,500. For the expenses of your own transportation, you may, of course, draw upon part of the \$1,000 a year which is regularly made available to you for the expenses of your travel for professional purposes. Your colleagues here all hope that this will help the solution of your problem.

Let me add that we are more concerned that your answer to our invitation be affirmative than that it be prompt. We know that it is a difficult decision with which we have confronted you. We hope very much that after reflecting about the whole future of your scientific development, you will decide to come here.

Very sincerely,

Robert Oppenheimer

Professor Armand Borel
Dunanstrasse 1
Zürich 44, Switzerland

PRINCETON UNIVERSITY
Princeton New Jersey

cc: Beurling
Dyson
Gödel
Morse
Oppenheimer ✓
Pais
Selberg
Whitney
Yang

Department of
Mathematics

December 1, 1955

Professor D. Montgomery
Institute for Advanced Study

Dear Deane:

This is a reply to your request for my opinion of the mathematical work of Armand Borel.

Briefly, he is a mathematician of the first rank. If I had to order the younger mathematical group, I would place Serre first, then Borel and Thom in a tie for second. I don't know any young American mathematician who belongs in the same class with these three.

I met Borel in May 1951. At that time Leray spoke very highly of Borel's thesis (which Leray was reading then). At my urging, Borel published his thesis in the Annals. It took some time before the algebraic topologists of this country could understand and appreciate his achievement. During the year 1952-53, while he was at the Institute, he lectured at my seminar for two months.

As you know, the greater part of his work has to do with the cohomology of Lie groups and of their classifying spaces. It constitutes the first big advance in the subject since the work of Poincaré and Hopf. It also comes close to finishing the subject. At least it is difficult to find questions which have not been answered.

Borel's methods are being extended and applied by H. Cartan, G. Whitehead, and J. Moore to the study of the spaces of loops of topological spaces. They are an integral part of the present program for calculating the homotopy groups of spaces.

I place Serre's work ahead of Borel's for several reasons. First, Serre's results have been more startling; second, Serre's work covers more ground, it is more varied in scope and interest; and finally, his ability as an expositor is excellent. I grant that Borel is a good expositor on the level of generalities (witness his recent article in the Bulletin); however, when it comes to the details of proofs, he borders on incomprehensibility. Serre's papers are beautifully clear.

Sincerely yours,

/s/ Norman E. Steenrod

Norman E. Steenrod

NES:vn

Fac

Borel

30 April 1956

Memorandum to Professors Beurling, Gödel, Montgomery, Morse,
Selberg and Whitney:

The Board of Trustees of the Institute, meeting on
April 25th, approved the election of Borel and Serre, as
originally recommended by the School of Mathematics. Copies
of the letters of invitation are on file in the Office of the
School, and in the Director's Office.

Robert Oppenheimer

cc C.D.U.

copy to Mr. Morgan
Miss Underwood

26 April 1956

Dear Dr. Borel:

It is with great pleasure that I write to offer you a Professorship in the School of Mathematics at the Institute for Advanced Study. I do this after the vote of the Faculty and with the concurrence of the Trustees of the Institute.

You know the Institute well enough so that I can usefully mention to you only those respects in which a Professorship differs from your former position as a Member. You may retire at any time after your 65th birthday, and according to our present rules must retire on the June 30th after your 68th birthday. Your salary has been set at \$18,000 a year. We shall make available to you \$1,000 a year to cover the expenses of travel for professional purposes, and this fund is cumulative up to a total of \$3,000. We should be glad to contribute 5% of your salary each year toward provision for your retirement, provided you do the same. You are entitled to have a professional research assistant should you desire one, or to contribute the fund so budgeted as a grant for a member in whose work you are interested.

As a Professor, you will share with your colleagues and me the responsibility for the academic policies of the School of Mathematics and for important academic policies involving the Faculty as a whole. Occasionally there may be administrative matters which are either important or interesting to the Faculty. For the rest, it would be our hope that the fruitful work and warm human companionship which have characterized your past years here would continue and be enhanced.

If you desire to accept this appointment as of the 1st of July of this year, we shall be delighted. We understand, however, that even if you can accept you may not be able to do so next year. In that case, we shall be glad to defer the date of your appointment either to January 1, 1957 or to July 1, 1957. We would like in this matter to be guided wholly by the requirements of your scientific work, your obligations, and your desires.

Very sincerely,

Robert Oppenheimer

Dr. Armand Borel
Department of Mathematics
E. T. H.
Zürich, Switzerland

ARMAND BOREL

The School of Mathematics nominates Armand Borel for a professorship. As a young man who has already achieved great distinction in the field of mathematics there is every indication that he has a great career before him.

Borel and his wife are Swiss (French) and at present he has a professorship at the Technical University of Zurich (ETH) where Professor Weyl was a professor for many years at the beginning of his career. He obtained his Ph.D. at Zurich under Hopf and then studied for two years in Paris where he was influenced by H. Cartan and Leray. It was at this time that he met Serre. The two have had a number of common interests and have written several important joint papers. After his stay in Paris he taught for a year in Lausanne, where his chief colleague was de Rham, and then came to the Institute for two years. While in Princeton he wrote a great deal and was very active in conducting seminars both here and at the University. His lectures were influential both places, especially the ones at the University on his own contributions to homogeneous spaces and the ones here on symmetric spaces which he presented in a very clear way and with many improvements of his own.

In the summer between his two years here he was invited for six weeks to the Summer Institute on Lie Groups conducted in Maine by the American Mathematical Society. At this meeting he was one of the chief speakers and while there he began collaborations with Chevalley and Mostow. In the same summer he was invited to lecture in Mexico City and according to report his lectures there were well received. Both he and his wife have more of an interest in art and archeology than the average layman and they found Mexico of interest for this reason as well as others.

While at the Institute he gave invited hour addresses at a number of places, possibly the most important of these was one at a meeting of the American Mathematical Society in New York. He was offered temporary or permanent positions at several leading universities, including California, Chicago, Illinois, Princeton, and Yale. He took a position at Chicago for the year after he left here (1954-1955). Throughout his stay in the United States he was aware that Hopf, Eckmann, and the other mathematicians at Zurich were anxious to have him return there. He was conscious of the advantages of both Europe and America but when he was formally offered a newly created professorship at Zurich he accepted and returned to Switzerland in August 1955. Massachusetts Institute of Technology plans to offer him a visiting position next year at a salary of \$11,000 and he has already been approached in an informal way about this.

His main mathematical interests are in topology, continuous groups, and differential geometry, although his most recent work has been in algebraic groups using the methods of algebraic geometry. At Zurich he received a thorough training under Hopf in the first three topics, as all of Hopf's students do. Hopf has had many students, including Eckmann and Samelson, who have become fine mathematicians, but it is agreed that Borel is unquestionably the outstanding one of these and that he ranks among a very few of the best young mathematicians in the world. Serre, for example, has given it as his considered opinion that no young man is a stronger candidate for a position here. His knowledge is unusually wide and thorough and his many papers are uniformly on a very high and powerful level. He communicates freely and easily with others and his judgment is balanced and thorough. He is a very clear lecturer and as a colleague is friendly and has diverse interests.

- 2 -

Since 1948 Mathematics has lost five permanent people by death or retirement (Alexander, Mayer, Siegel, Veblen, Weyl) and during this period has gained only four permanent people (Beurling, Montgomery, Selberg, Whitney). In addition von Neumann is on leave so that the number of mathematicians here on permanent appointment, which has always been rather small, has been reduced. On the other hand the field of mathematics has grown tremendously so that a modest expansion, rather than the opposite, is necessary.

It is against this background that this nomination is made. Although age has not been a determining factor, it has played a small part and the fact that Borel is 32 would have the advantage of giving a variety in ages and thereby contributing to the continuity and stability of the department. His interest is somewhat more algebraic than is the case for most of us and this would be advantageous, although a man's field, like his age, would not by itself be a decisive factor.

A great deal of his work has been in the topological properties of Lie groups and their homogeneous spaces, a subject in which early contributions were made by Weyl and especially by E. Cartan. The work was carried on by Pontrjagin and Hopf and later by H. Cartan, Chevalley, A. Weil and others. In the last few years the major contributions have been made by Borel. For compact Lie groups and their homogeneous spaces, great progress has been made, though many important questions remain. For the case of compact homogeneous spaces of non-compact groups rather little progress has been made and this topic remains largely unexplored. Borel has some contributions in this direction and it is one of several topics, which, with his background, he might be led to pursue.

Before stating a few of Borel's results we mention and describe certain of the tools and concepts of frequent occurrence in this work. Some of these are spectral sequences, Whitney characteristic classes, principal bundles, universal bundles, transgressions and classifying spaces. Given a compact Lie group G and a closed subgroup H it is possible to form the homogeneous space G/H on which G acts transitively. Spectral sequences were devised by Leray to study the relations among the homology properties of a fiber space, the fiber, and the base space. One important case is that where G is the fiber space, H is the fiber, and G/H the base space. The use of spectral sequences by Borel was by no means routine, and in fact it has been work by him and Serre which has helped to establish the importance of spectral sequences. The transgression is a relation between certain cycles in G and in G/H . A space E is a principal bundle with structural group G if G is a transformation group acting on E in such a way that no element of G except the identity leaves any point fixed. The space E or E_G is called n -universal if its homology groups are trivial up to dimension n . Such spaces exist for any n including n infinite. The base space (the space of orbits) of such a universal bundle E_G is called a classifying space B_G .

We shall now mention a few of Borel's results more or less at random. In one of his first papers, written with de Siebenthal, all closed subgroups of a compact Lie group of equal rank with the group are determined. In another he determined all compact Lie groups which can be transitive on a sphere or a torus. There had been work on this problem before but he introduced entirely new methods which simplified and completed the analysis of this situation. If G is a connected Lie group (in general not compact) and H a closed connected subgroup then G/H has at most two "ends". In case it has two ends it is the topological product of a compact subspace and a line. If H is not connected G/H may have many ends. Together with Serre he proved that Euclidean space cannot be fibered with a compact fiber. He also proved

- 3 -

that if Euclidean space is fibered by a non-compact fiber, then both the fiber and the base have the homology properties of a Euclidean space, and that it is impossible to fiber a sphere with a fiber which is a product of spheres.

In a joint paper with Serre a study was made of the Steenrod reduced powers for the classical groups and their classifying spaces. As an application it was proved that no sphere, except S^2 and possibly S^0 , can be given a complex analytic structure. In another joint paper with Serre it was shown that some of the five exceptional groups have torsion. This was done by defining and studying the p -rank of compact Lie groups.

In a long paper in the Annals of Mathematics a few years ago, Borel gave an extension of Hopf's theorem on homology of groups on H -spaces to many kinds of coefficients. Roughly speaking the result is that the homology of a group space is like the homology of a topological product of odd dimensional spheres. It is in this paper that he obtains results on the homology of classifying spaces, and connects it with the homology of G through the use of transgression and the universally transgressive elements of G . In the same paper are many new results on the homology of compact Lie groups and their homogeneous spaces. Combined with later papers his results in these directions are very thorough and complete. The simultaneous study of groups, homogeneous spaces, and universal bundles has shed new light on all these subjects. The development of this approach has been one of his best achievements. The results have been many and varied.

He has written two short notes with Lichnerowicz on differential geometry, and recently has collaborated with Hirzebruch to obtain results on the Whitney classes of homogeneous spaces. A great deal of his most recent work has been on algebraic groups. Using the methods of algebraic geometry he has written a paper to appear in the Annals in which he extends and simplifies the results of Chevalley's two recent books on algebraic groups.

A paper of his in the Proceedings of the National Academy studies homogeneous spaces with an invariant complex Kähler structure. In the compact case all such manifolds are algebraic and admit a complex analytic cellular decomposition. In the non-compact case they are complex analytically fibered with compact fibers. As an application he gives a partial solution to one of E. Cartan's problems by showing that a bounded complex domain with a transitive semi-simple group is symmetric. Some of his work with Mostow has been on Lie algebras and fixed points of automorphisms.

Some of Borel's expository lectures have been published in mimeographed form and have been widely read. The ones given in Zurich in 1951 (95 pages) are a very clear and readable introduction to fiber spaces and the methods of Leray with application and improvements by Borel.

Bibliography of Armand Borel

- Some remarks about Lie groups transitive on spheres and tori, Bull. A.M.S. 53 (1949) 580-587
- (With J. de Siebenthal) Les sous-groupes fermés de rang maximum des groupes de Lie clos, Comment. Math. Helv. 23 (1949) 200-220
- Limites projectives de groupes de Lie, Comptes Rendus 230 (1950) 1197-1199
- Sections locales de certains espaces fibrés, Comptes Rendus 230 (1950) 1246-1248
- Le plan projectif des octaves et les sphères comme espaces homogènes, Comptes Rendus, 230 (1950) 1378-1380
- (With J. P. Serre) Impossibilité de fibrer un espace euclidien par des fibres compactes, Comptes Rendus 230 (1950) 2258-2260
- Remarques sur l'homologie filtrée, Jr. Math. Pur. Appl. 29 (1950) 313-322
- Impossibilité de fibrer une sphère par un produit de sphères, Comptes Rendus, 231 (1950) 943-945
- Sur la cohomologie des variétés de Stiefel et de certains groupes de Lie, Comptes Rendus 232 (1951) 1628-1630
- La transgression dans les espaces fibrés principaux, Comptes Rendus, 232 (1951) 2392-2394
- Sur la cohomologie des espaces homogènes des groupes de Lie compacts, Comptes Rendus, 233 (1951) 569-571
- (With J. P. Serre) Détermination des p-puissances réduites de Steenrod dans la cohomologie des groupes classiques. Applications, Comptes Rendus 233 (1951) 680-682
- Sur la cohomologie des espaces fibrés principaux et des espaces homogènes de groupes de Lie compacts, Thesis, Annals of Math. 57 (1953) 115-207
- (With A. Lichnerowicz) Groupes d'holonomie des variétés riemanniennes, Comptes Rendus, 234 (1952) 1835-1837
- (With A. Lichnerowicz) Espaces riemanniens et hermitiens symétriques, Comptes Rendus, 234 (1952) 2332-2334
- Cohomologie des espaces localement compacts, d'après J. Leray, Ecole polytechnique fédérale, Zürich, 1951
- Les fonctions automorphes de plusieurs variables complexes, Bull. Soc. Math. de France, 80 (1952) 167-182

Bibliography of A. Borel cont'd.

(With J. P. Serre) Sur certains sous-groupes des groupes de Lie compacts, Comment. Math. Helv. 27 (1953) 128-139

La cohomologie mod 2 de certains espaces homogènes, Comment. Math. Helv. 27 (1953) 165-197

(With J. P. Serre) Groupes de Lie et puissances réduites de Steenrod, Am. J. Math. 75 (1953) 409-448

Les bouts des espaces homogènes de groupes de Lie, Annals of Math. 58 (1953) 443-457

Homology and cohomology of compact connected Lie groups, Proc. N.A.S. 39 (1953) 1142-1146

Sur l'homologie et la cohomologie des groupes de Lie compacts connexes, Am. J. Math., 76 (1954) 273-342

Kählerian coset spaces of semisimple Lie groups, Proc. N.A.S. 40 (1954) 1147-1151

Nouvelle démonstration d'un théorème de P. A. Smith, Comment. Math. Helv. 29 (1955) 27-39

(With C. Chevalley) The Betti numbers of the exceptional groups, Memoirs of A.M.S. No. 14 (1955) 1-9

(With G. D. Mostow) On semi-simple automorphisms of Lie algebras, Annals of Math. 61 (1955) 389-405

Groupes linéaires algébriques, Annals of Math. to appear (92 typewritten pp.)

C O P Y

C O P Y

C. Chevalley
1 Rue de Prony
Paris (17) France

December 20, 1955

Dear Professor Morse,

Since Serre is out of the race, I do not think that any mathematician of the post-war generation would have better titles to recommend him for a professorship at the Institute than Armand Borel. His work this far extends in two different directions, although in both cases it is centered around group theory. Chronologically, his first subject of interest was the topology of Lie groups. The homology with real coefficients had already been determined, but the very difficult question of the homology with integral coefficients (or with coefficients modulo p) was practically unexplored (except for some isolated results). Borel introduced a general method for the study of this problem and his results give an almost complete determination of the homology groups. The core of his work lies in a wide generalization of the algebraic content of Hopf's theorem, a generalization which applies to algebras over fields of any characteristic. Borel's most recent work is concerned with the theory of algebraic groups, and, specifically, with applications of algebraic geometry to this theory. Here again, progress was blocked before him because the known methods (use of the Lie algebra) were unable to give any information on the case of positive characteristic. Borel created an entirely new method, and obtained very deep results not only on groups of characteristic $\neq 0$, but also on classical groups over the complex numbers (in particular, a proof of a result stated about 15 years ago by Morozov, but which had never been correctly established). What is perhaps even more important, Borel's method gives an entirely new insight on the significance of the notions of weights and roots in the classical representation theory of Lie groups.

Generally speaking, Borel's work may be characterized by an alliance of two qualities: power of the results and elegance of the methods, which it is rare to find together to such an extent in the work of any mathematician. Besides, he is very versatile in his interests; he is not only familiar with topology, with group theory and with algebraic geometry, but he also knows differential geometry very well, although he has not published anything on this subject yet. As for his qualities as an expositor and a professor, I think that I have no need to tell you about them, since you have had the opportunity to observe them at first hand in Princeton.

However, since Borel has just been called to the Polytechnicum in Zurich, it is not at all certain that he would accept an invitation at the Institute, should you decide to proffer such an invitation; I have no guess myself as to what his reaction would be in such a case. In case Borel would not be available, I would like to bring to your attention the names of some other mathematicians of about the same age group who would, in my opinion, deserve full consideration: I think particularly of Harish-Chandra, of Tate and of Kolchin.

Sincerely yours,

/s/ C. Chevalley

C O P Y

C O P Y

Report on Armand Borel

Armand Borel is one of the best young mathematicians in the world. He is comparable with Gleason in the United States, and with Jean-Pierre Serre in France.

He is 32 years old; he was 26 when he published his first papers. Without ceasing since that time he has published numerous and very valuable papers and increased widely the domain of his knowledge which now includes a large part of mathematics.

He knows thoroughly the theory of Lie groups, algebraic topology and differential geometry. He knows very well the theory of several complex variables and algebraic geometry.

A simple look at his papers shows how rich and diversified are the theorems he has obtained. The study of their proofs is necessary for understanding the deep originality of his work: often he finds such fundamental properties of the theory he is using that this theory takes a new character.

He is a great worker; passionately fond of mathematical research, with an exceptionally powerful mind. Somewhat shy formerly, he has now a fair and reasonable self-confidence. He has always been very cooperative.

Jean Leray

December 2, 1955

C O P Y

PRINCETON UNIVERSITY
Princeton New Jersey

C O P Y

Department of
Mathematics

December 1, 1955

Professor D. Montgomery
Institute for Advanced Study

Dear Deane:

This is a reply to your request for my opinion of the mathematical work of Armand Borel.

Briefly, he is a mathematician of the first rank. If I had to order the younger mathematical group, I would place Serre first, then Borel and Thom in a tie for second. I don't know any young American mathematician who belongs in the same class with these three.

I met Borel in May 1951. At that time Leray spoke very highly of Borel's thesis (which Leray was reading then). At my urging, Borel published his thesis in the Annals. It took some time before the algebraic topologists of this country could understand and appreciate his achievement. During the year 1952-53, while he was at the Institute, he lectured at my seminar for two months.

As you know, the greater part of his work has to do with the cohomology of Lie groups and of their classifying spaces. It constitutes the first big advance in the subject since the work of Pontrjagin and Hopf. It also comes close to finishing the subject. At least it is difficult to find questions which have not been answered.

Borel's methods are being extended and applied by H. Cartan, G. Whitehead, and J. Moore to the study of the spaces of loops of topological spaces. They are an integral part of the present program for calculating the homotopy groups of spaces.

I place Serre's work ahead of Borel's for several reasons. First, Serre's results have been more startling; second, Serre's work covers more ground, it is more varied in scope and interest; and finally, his ability as an expositor is excellent. I grant that Borel is a good expositor on the level of generalities (witness his recent article in the Bulletin); however, when it comes to the details of proofs, he borders on incomprehensibility. Serre's papers are beautifully clear.

Sincerely yours,

/s/ Norman E. Steenrod

Norman E. Steenrod

NES:vn

Faculté des Sciences
INSTITUT HENRI POINCARÉ
11, rue Pierre-Curie (5e)

UNIVERSITÉ DE PARIS

Paris, le 15 décembre 1955

Professor Marston Morse
The Institute for Advanced Study
Princeton, N.J.

Cher Monsieur,

Excusez-moi, je vous prie, de n'avoir pas pu répondre immédiatement à votre lettre du 30 novembre.

Vous me demandez mon opinion sur Armand Borel. Je ne puis pas prétendre connaître à fond toute son oeuvre scientifique, qui est déjà considérable; mais je pense en avoir cependant une idée assez précise pour me permettre d'exprimer un jugement d'ensemble. Ce jugement est extrêmement favorable, et je sais que d'autres collègues mathématiciens, bien placés pour juger son oeuvre, l'ont également en très haute estime.

Borel est aujourd'hui l'un des hommes qui connaissent le mieux la théorie des groupes de Lie sous ses aspects algébrique et topologique, et dans ses relations avec la géométrie différentielle et la géométrie algébrique. Il n'est pas du tout un "spécialiste" au sens étroit du terme: s'il possède parfaitement les techniques et les résultats auxquels il a d'ailleurs apporté une contribution originale essentielle, il domine suffisamment les problèmes pour ne jamais perdre de vue les connexions nécessaires avec les autres domaines des mathématiques. Il a une grande puissance de travail, et est capable d'assimiler beaucoup sans devenir superficiel; jamais satisfait, il s'attaque constamment à de nouveaux problèmes, qu'il choisit difficiles; et il réussit à étendre toujours son champ d'action tout en évitant la dispersion.

Il est évident que Borel a tiré un profit considérable des années qu'il a récemment passées aux Etats-Unis. Je ne sais s'il désire y retourner dans un avenir immédiat.

Vous me demandez de vous suggérer éventuellement le nom d'un autre mathématicien de moins de quarante ans. Je pense qu'on pourrait aussi songer à Harish-Chandra, dont l'oeuvre extrêmement brillante autorise tous les espoirs et le place dès maintenant parmi les mathématiciens de grande envergure. Je ne voudrais pas établir un classement entre Armand Borel et Harish-Chandra.

Puis-je profiter de cette occasion pour vous prier d'accepter, cher Monsieur, ainsi que Mrs. Morse, nos meilleurs voeux de Noël et de nouvel an? Ma femme est très sensible à votre aimable souvenir et se joint à moi pour vous exprimer nos sentiments respectueux.

/s/ H. Cartan

Henri Cartan
95 boulevard Jourdan
Paris (14)

ECOLE POLYTECHNIQUE FEDERALE
Mathematiques Superieures

cc: Beurling
Gödel
Morse
Oppenheimer
Selberg
Whitney
Mrs. Barnett

Prof. Dr. Armand Borel

Zurich, 1e January 25, '57

Dear Montgomery,

Many thanks for your latest letter, about Aydelotte's house. This is by far much too high for us and we do not want to consider it. As I told you we are not too enthusiastic about Weyl's house at first, but from what I have seen so far, it seems to be the best bargain, and there is a definite possibility that we might want it, after all. Therefore please tell Mr. Morgan that I would appreciate it very much if the house can be kept free until I have a chance to see it, in April.

I sincerely hope that the photostats have arrived. The man to whom I had given them to be certified has, so he told me anyway, sent them about the 10th of January. I had chosen him because he was an old friend of my wife's family, but apparently this was the wrong choice, and he acted very slowly.

I am sorry to have been so slow to send some comments on Vesentini, but anyway this just says in more words what I wrote you on two occasions. Not knowing who is in competition with him, I do not want to say that he must by all means get a fellowship, but it seems to me that he should be given the opportunity to stay in Princeton. I am glad that things turned out well for Kervaire.

Sincerely yours,

/s/ A. Borel

Borel

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

copy to Mr. Morgan
Miss Underwood

OFFICE OF THE DIRECTOR

26 April 1956

Dear Dr. Borel:

It is with great pleasure that I write to offer you a Professorship in the School of Mathematics at the Institute for Advanced Study. I do this after the vote of the Faculty and with the concurrence of the Trustees of the Institute.

You know the Institute well enough so that I can usefully mention to you only those respects in which a Professorship differs from your former position as a Member. You may retire at any time after your 65th birthday, and according to our present rules must retire on the June 30th after your 68th birthday. Your salary has been set at \$18,000 a year. We shall make available to you \$1,000 a year to cover the expenses of travel for professional purposes, and this fund is cumulative up to a total of \$3,000. We should be glad to contribute 5% of your salary each year toward provision for your retirement, provided you do the same. You are entitled to have a professional research assistant should you desire one, or to contribute the fund so budgeted as a grant for a member in whose work you are interested. 2X

As a Professor, you will share with your colleagues and me the responsibility for the academic policies of the School of Mathematics and for important academic policies involving the Faculty as a whole. Occasionally there may be administrative matters which are either important or interesting to the Faculty. For the rest, it would be our hope that the fruitful work and warm human companionship which have characterized your past years here would continue and be enhanced.

If you desire to accept this appointment as of the 1st of July of this year, we shall be delighted. We understand, however, that even if you can accept you may not be able to do so next year. In that case, we shall be glad to defer the date of your appointment either to January 1, 1957 or to July 1, 1957. We would like in this matter to be guided wholly by the requirements of your scientific work, your obligations, and your desires.

Very sincerely,

Robert Oppenheimer

Dr. Armand Borel
Department of Mathematics
E. T. H.
Zürich, Switzerland

Form I-129
UNITED STATES DEPARTMENT OF JUSTICE
IMMIGRATION AND NATURALIZATION SERVICE
(Rev. 12-24-52)

Date of Receipt

Form approved.
Budget Bureau No. 43-R314.2.

PETITION FOR CLASSIFICATION OF QUOTA IMMIGRANT FOR ALIEN WHOSE SERVICES ARE NEEDED URGENTLY IN THE UNITED STATES

NOTE.—This form is for use by a person, institution, firm, organization, or governmental agency for whom the services are to be performed, and who is seeking the classification of quota immigrant (under section 204(b) of the Immigration and Nationality Act) for an alien whose services are needed urgently in the United States. Attach the required remittance. (See instructions.)

(NOT TO BE FILLED IN BY PETITIONER)

ACTION BY DISTRICT DIRECTOR AT _____:

☐ Approved. ☐ Disapproved.

(Signature of District Director)

Date _____, 19____

ON APPEAL OR CERTIFICATION

☐ Approved. ☐ Disapproved.

(Signature of Assistant Commissioner)

Date _____, 19____

REMARKS:

The Secretary of State is hereby informed that the person in whose behalf this petition was filed is entitled to the classification requested.

Petition was filed at _____ M. on _____. The approval of this petition is valid until _____.

(Signature)

(Title)

(PETITIONER NOT TO WRITE ABOVE THIS LINE)

IMMIGRATION AND NATURALIZATION SERVICE:

I hereby apply, pursuant to the provisions of part 204, title 8, Code of Federal Regulations for classification of the person named below as an immigrant under section 203(a) (1) (A) of the Immigration and Nationality Act.

1. Location of American consulate at which application for visa will be made:

American Consulate General, Talacker 35, Zurich, Switzerland

2. Name and address of (check appropriate block) ☐ person, ☒ institution, ☐ firm, ☐ organization, or ☐ governmental agency filing this petition:

The Institute for Advanced Study, Olden Lane, Princeton, New Jersey

3. If petitioner is a corporation, date and place of incorporation:

May 20, 1956, Newark, New Jersey

4. Brief nontechnical description of nature of business conducted by petitioner and net annual income derived therefrom:
Professor of Mathematics (research) with annual income of \$18,000.

5. Description of work, labor or services to be performed by the beneficiary, and the terms and conditions of employment:
Research in mathematics. Direction of research in mathematics of Members in the Institute. Employment for life. Retirement at 68 years of age. Selection of mathematicians from abroad.

6. The prospective immigrant is identified as follows:

| Full name (And any other names ever used or by which known) | Marital Status | Birthplace | Birth Date |
|--|----------------|------------------------------------|---------------------|
| Armand Borel | Married | Chaux-de-Fonds, Switzerland | May 21, 1923 |

7. Present address of prospective immigrant:

| (Street) | (City) | (Province) | (Country) |
|------------------------|---------------|--------------------|-----------|
| Dunantstrasse 1 | Zürich | Switzerland | |

8. The prospective immigrant Has at any time been in the United States. (If ever in the United States, give information requested below):
(Has) (Has not)

| Alien Registration No. | Place of last entry | Date of last entry | Date of departure |
|------------------------|----------------------|---------------------------|-----------------------|
| V 1848701 | New York City | September 22, 1952 | August 3, 1955 |

9. If admitted to the United States, the beneficiary of this petition will perform the services at:

| (Number and street) | (City) | (Zone No.) | (State) |
|---|------------------|-------------------|---------|
| The Institute for Advanced Study | Princeton | New Jersey | |

10. The prospective immigrant will be accompanied by his or her spouse **Gabrielle Aline Borel** and by his or her children:
(Name of husband or wife)

| Name | Date of Birth | Sex |
|-------------------------------|---------------------------|---------------|
| Dominique Susan Borel | May 4, 1954 | Female |
| Anne Christine Borel | September 20, 1955 | Female |
| Gabrielle Aline (wife) | June 2, 1922 | Female |

11. Attached hereto and made a part of this petition are (check appropriate boxes): (See Instructions)

- ☐ Clearance order bearing a statement from the United States Employment Service concerning the availability of like labor in the United States.
- ☐ Affidavit as to period of time required to become skilled or proficient, in the field of work, labor or services to be performed by the beneficiary.
- ☐ Statements of efforts made to find, within the United States, persons qualified to perform the work, labor or services which will be rendered by the beneficiary.
- ☐ Statement as to manner in which services of beneficiary will be substantially beneficial prospectively to the national economy, cultural interests, or welfare of the United States.
- ☐ Description of high education, technical training, specialized experience, or exceptional ability of the beneficiary, and supporting affidavits.

I do swear that I have read the foregoing petition and that the statements contained therein are true and correct to the best of my knowledge and belief.

Signature _____

Name **Robert Oppenheimer**
(Type or print)

Title **Director**

(Must be petitioner himself or authorized representative of institution, firm, organization, or governmental agency filing this petition. See instructions.)

Subscribed and sworn to before me this **7th** day of **December**, 19**56**, at **Princeton, N.J.**

My commission expires **May 23, 1960**

Signature of officer administering oath

(SEAL) **/s/ Verna Hobson**

Title **Notary Public of New Jersey**

THE INSTITUTE FOR ADVANCED STUDY

PRINCETON, NEW JERSEY

December 4, 1956

Immigration and Naturalization Service
1004 Broad Street
Newark, New Jersey

Dear Sirs:

The Institute for Advanced Study has appointed Armand Borel to a permanent position on its faculty as a professor of mathematics. He has accepted this appointment and wishes to begin residence about April 1, 1957, this time being especially convenient and desirable for a number of reasons.

Borel is one of the leading mathematicians of the world and his presence at the Institute will substantially strengthen the mathematical and scientific program at the Institute as well as in the United States in general. This will be in part because of his own highly important contributions, in part because of his stimulation of the many young American mathematicians who visit the Institute each year, and in part because of the advice and counsel he can give with his unusually broad and profound knowledge. He was selected for the position, because in the opinion of the present faculty, no one else could so adequately fulfill the requirements. His arrival at the Institute next April is of great importance to the Institute and to the scientific and cultural strength of the United States. I hope that everything possible will be done to enable him to arrive when he plans which is already later than we had originally hoped.

Sincerely yours,

Deane Montgomery
Professor of Mathematics

DM:MM

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

December 5, 1956

Immigration and Naturalization Service
1004 Broad Street
Newark, New Jersey

Dear Sir:

Professor Armand Borel has been invited by the Institute for Advanced Study to become a professor of mathematics with life tenure. This means that he will hold his position until he reaches the retirement age of 68.

In making this appointment the Institute for Advanced Study sought the ablest mathematician in the world who would be available for this position and it is believed we have such a man in Armand Borel. He is regarded as one of the two young mathematicians in Europe who stand out as superior to all others of approximately the same age. His first duties at the Institute will be to pursue his researches. He will be expected to participate in the deliberations of the faculty which are particularly important for the Institute.

At the present time there are 65 mathematicians at the Institute selected from all over the world coming from at least ten different nations. The men from the foreign countries are selected for what they can bring to this country in the form of new mathematical concepts and researches taking account also of the advantage which will come to the Western world from their own further development. The American mathematicians are chosen for similar reasons with particular emphasis on their value to this country. It is particularly important, therefore, that we select those from other countries with the greatest discretion, in order that both they and we will profit by the exchange of ideas.

Armand Borel was trained in France and is, at the moment, Professor in Zürich, Switzerland. Because of these associations there is hardly any other man in Europe who could help us more in this problem of interchange of men and mathematical ideas. Certainly no American mathematician has the knowledge of the European mathematical scene which Borel has.

In addition, in his fields of algebra and Lie theory he is one of the great innovators of the present day. The importance of bringing over a few of these exceptional men will be clear to all those who reflect on American history in the last twenty years. John von Neumann was brought

Immigration and Naturalization Service - 2 -

December 5, 1956

to the Institute for Advanced Study at a similar age and for similar reasons. He rose to be Atomic Energy Commissioner in the United States, and has been specially recognized by Congress.

Professor Borel has made plans to come to this country in April 1957, terminating his services with the Eidgenossische Technische Hochschule in Zürich. His income, therefore, will stop at that time unless he is able to come to this country. More importantly, the research which he intends to do with us will be postponed unless his plans can be carried out. Both the Institute and Professor Borel will be at a loss to know what to do in case he cannot come here in April, as planned.

I trust that the Immigration Offices will do everything that is within the law to facilitate the admission of Armand Borel and his family under our Immigration laws.

Sincerely yours,

MMcdu

Marston Morse
Professor of Mathematics

Form I-171
(Rev. 4-5-56)

UNITED STATES DEPARTMENT OF JUSTICE
Immigration and Naturalization Service
1004 Broad Street, Newark 2, N. J.

COPY

Date January 23, 1957

Visa Petition No. VP-24-I-3194 (TC)

NOTICE OF APPROVAL OF VISA PETITION

The Institute for Advanced Study
Olden Lane
Princeton, New Jersey

Dear Sirs:

Attention: School of Mathematics

Your Visa Petition has been approved by this Service and forwarded to the Department of State for transmission to the appropriate American Consul. The actual issuance of visas is a function of American Consular officers who serve under the Visa Division of the Department of State. The American Consular office having jurisdiction over the place where the intended immigrant resides will notify him as soon as the approved petition is received and inform him of all further steps necessary to apply for a visa. It is unnecessary for you or the prospective immigrant to take any further action until receipt of appropriate notice from the American Consular office.

Sincerely yours,



District Director ~~or Officer in Charge~~

(NOTE: For Petitions filed on Form I-129, Classification of Quota Immigrant for Alien whose Services are Needed Urgently in the United States:

Date Petition Filed: December 10, 1956.
Time Petition Filed: 3:00 P.M.
Date on which approval expires: January 20, 1958.
Beneficiary: Prof. Armand Borel.

cc Miss Underwood

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

OFFICE OF THE DIRECTOR

7 December 1956

Immigration and Naturalization Service
100 1/2 Broad Street
Newark, New Jersey

Dear Sirs:

As Director, I should like to ask on behalf of the Institute for Advanced Study that you facilitate, within the provisions of the law, the admission of Armand Borel, and his family, as quota immigrants. The reason for this request is simple.

Last year we considered it desirable to add to the Faculty in Mathematics at the Institute for Advanced Study. We had lost Einstein and Hermann Weyl by death, and von Neumann had left to join the Atomic Energy Commission. We considered carefully the eminent mathematicians throughout the world, regardless of age or nationality, and concluded without dissent that Armand Borel was our man. We value him for the power and depth of his own mathematical work, for the inspiration and assistance that he will give to our members—young Americans as well as students from abroad—and for the weight of his judgment in promoting mathematical science here, in the United States, and thus throughout the world. He wishes to come to this country to take his part in an enterprise important for the national welfare; and we are happy that he has agreed to do this.

Very sincerely,

Robert Oppenheimer

cc Miss Underwood

7 December 1956

Immigration and Naturalization Service
1004 Broad Street
Newark, New Jersey

Dear Sirs:

As Director, I should like to ask on behalf of the Institute for Advanced Study that you facilitate, within the provisions of the law, the admission of Armand Borel, and his family, as quota immigrants. The reason for this request is simple.

Last year we considered it desirable to add to the Faculty in Mathematics at the Institute for Advanced Study. We had lost Einstein and Hermann Weyl by death, and von Neumann had left to join the Atomic Energy Commission. We considered carefully the eminent mathematicians throughout the world, regardless of age or nationality, and concluded without dissent that Armand Borel was our man. We value him for the power and depth of his own mathematical work, for the inspiration and assistance that he will give to our members—young Americans as well as students from abroad—and for the weight of his judgment in promoting mathematical science here, in the United States, and thus throughout the world. He wishes to come to this country to take his part in an enterprise important for the national welfare; and we are happy that he has agreed to do this.

Very sincerely,

Robert Oppenheimer

cc: A. Beurling
F. Dyson
K. Gödel
D. Montgomery
✓ A. Oppenheimer
A. Selberg
H. Whitney
C. N. Yang
A. Pais

Report on Armand Borel

Armand Borel is one of the best young mathematicians in the world. He is comparable with Gleason in the United States, and with Jean-Pierre Serre in France.

He is 32 years old; he was 26 when he published his first papers. Without ceasing since that time he has published numerous and very valuable papers and increased widely the domain of his knowledge which now includes a large part of mathematics.

He knows thoroughly the theory of Lie groups, algebraic topology and differential geometry. He knows very well the theory of several complex variables and algebraic geometry.

A simple look at his papers shows how rich and diversified are the theorems he has obtained. The study of their proofs is necessary for understanding the deep originality of his work: often he finds such fundamental properties of the theory he is using that this theory takes a new character.

He is a great worker; passionately fond of mathematical research, with an exceptionally powerful mind. Somewhat shy formerly, he has now a fair and reasonable self-confidence. He has always been very cooperative.

Jean Leray

December 2, 1955

30 June 1954

Dear Professor MacLane:

Dr. Armand Borel has been a member of the School of Mathematics of the Institute for Advanced Study for the past two academic years: 1952-1953 and 1953-1954. He entered the United States on September 30, 1952 under our Exchange Visitor's Program, number P-156. Dr. Borel's membership expires today, and he is hereby released from assignment to our P number.

With every good wish,

Robert Oppenheimer

Professor Saunders MacLane, Chairman
Department of Mathematics
The University of Chicago
Chicago 37, Illinois

*Dep. Secy
E.T.H.
2 weeks*

THE UNIVERSITY OF CHICAGO
CHICAGO 37 • ILLINOIS
DEPARTMENT OF MATHEMATICS

April 6, 1954

Professor Robert Oppenheimer
Director
Institute for Advanced Study
Princeton
New Jersey

Dear Professor Oppenheimer:

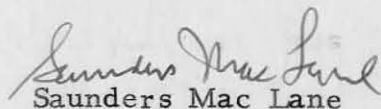
This has to do with the status of Dr. Armand Borel, currently a member of the School of Mathematics at the Institute for Advanced Study. Dr. Borel has accepted an appointment as a Visiting Professor of Mathematics at the University of Chicago for next year and in fact his appointment is scheduled to date from July 1, 1954.

In connection with Dr. Borel's visa, the University of Chicago would like to assign him to the Exchange Visitor's Program under the number P-100 which has been assigned to the University of Chicago. In order to do this, it appears that we need an official release from you for Borel under the current assignment to your P number at the Institute for Advanced Study. This release should be presumably dated as of June 30, 1954.

I suggest that this letter be sent directly to me.

It was a pleasure meeting you during my recent, all too brief stay at the Institute.

Sincerely yours,



Saunders Mac Lane
Chairman
Department of Mathematics

SM:mre