THE INSTITUTE FOR ADVANCED STUDY

Princeton, New Jersey

SCHOOL OF MATHEMATICS

ARMAND BOREL

Armand Borel was born May 21, 1923, in Chaux-de-Fonds, Switzerland. He obtained his Ph.D. at Zürich under Hopf and then studied for two years in Paris where he was influenced by H. Cartan and J. Leray. He taught for a year, 1951-52, in Lausanne, where his chief colleague was de Rham, and then came to the Institute for two years, 1952-54. Then followed a year at the University of Chicago, and from 1955-57 he was professor at the Federal Institute of Technology in Zürich. In 1957 he accepted the appointment to Professor of Mathematics at the Institute for Advanced Study.

His main interests are in topology, continuous groups, differential geometry, algebraic geometry and algebraic groups. His work is highly original. It is characterized by depth and is done from a broad perspective. Few--if any--living mathematicians have his breadth of knowledge.

1969

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 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.

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 occurence 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

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^6, 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.

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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 C O P Y

PRINCETON UNIVERSITY
Princeton New Jersey

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 POINCARE
11, rue Pierre-Curie (5e)

UNIVERSITÉ DE PARIS

Paris, le 15 décember 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)

THE INSTITUTE FOR ADVANCED STUDY

PRINCETON, NEW JERSEY

To: Director's Office

From: R. Barnett

Dr. Armand Borel left IAS on July 12, 1954

R.B.

Mexico, 9/26/53
Armand Borel
Mathematical Institute
Tacuba 5
Mexico City

Dear Mrs.Barnett,

We will arrive at Princeton on October 15th.

I do not remember exactly how these things are arranged, but of course I agree to pay the rent of our appartment (7F Goodman Road), from October 1st, if this is customary.

Sincerely yours

A Borel

(A.Borel)

May 17, 1954

Dear Dean Stozier:

This is to certify that the Institute for Advanced Study designated Dr. Armand Borel as a participant in our Exchange-Visitor Program when he was invited to come as a Member of the Institute for the academic years 1952-1953 and 1953-1954. The number assigned to the Program of the Institute is No. P-156.

We are very glad to recommend that he be released from our Exchange-Visitor Program and accepted as a participant in the Exchange-Visitor Program of the University of Chicago, as his Membership at the Institute for Advanced Study concluded with the academic year and he will be under the sponsorship of the University of Chicago after July 1, 1954.

Sincerely yours,

(Mrs. Ruth W. Barnett)
Assistant to the General Manager

Dean Robert M. Stozier
The University of Chicago
Chicago 37, Illinois

March 20, 1954

Dear Mr. Zimmerman:

I am enclosing an application to extend the time of temporary stay for Mrs. Gabrielle Aline Borel, wife of Dr. Armand Borel, a visiting Member of the Institute for Advanced Study for the academic years 1952-1953 and 1953-1954.

Dr. Borel, as a Member of the Institute is engaged in full time advanced research in our School of Mathematics, and is supported by a grant-in-aid of $4,250.00 for the year. Mrs. Borel would appreciate an extension of six months in order to remain with her husband who expects to complete his researches in the summer of 1954.

Also enclosed is Passport # 2091491, Visitor's Permit # T1802285, and Dr. Borel's check to the amount of $10.00.

The Institute for Advanced Study will greatly appreciate every consideration shown Mrs. Borel's application for a renewal of her permit.

Sincerely yours,

(Mrs. Ruth W. Barnett)
Assistant to the General Manager

Mr. Karl I. Zimmerman
District Director
Immigration and Naturalization Service
Lafayette Building
5th and Chestnut Streets
Philadelphia 6, Pennsylvania

Enc:

29 January 1954

Dear Dr. Hestenes:

At the request of Dr. Lowell C. Paige, I am glad to give you the following information about Dr. Armand Borel:

Born: May 21, 1923, Chaux de Fonds, Switzerland

Degrees: Diploma for mathematician, Federal Institute of Technology, Zurich, April 1947

Attaché de recherches au Centre de la recherche scientifique, Paris, Nov.49 - July 50

Assistant, Federal Institute of Technology, Zurich, 1947-49

Supplying Professor for Algebra, University of Geneva, 1950-52

Member, Institute for Advanced Study, 1952-53, 1953-54

I hope this information is satisfactory.

Sincerely yours,

(Mrs. Wilder Hobson)
Director's Office

Dr. Magnus R. Hestenes, Chairman
Department of Mathematics
University of California
Los Angeles, California

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

SCHOOL OF MATHEMATICS

February 23rd, 1953

Prof.
R. Oppenheimer

Dear Prof. Oppenheimer,

I thank you very much for your letter informing me that I am offered a renewal of my membership in the Institute for the next academic year.

Of course, I accept with great pleasure this offer, which will allow me to work for another year under perfect conditions.

Sincerely yours

A. Borel

(A.Borel).

cc: Directors files.

THE INSTITUTE FOR ADVANCED STUDY

PRINCETON, NEW JERSEY

February 2.1952.

Dear Dr Borel:

Your letter to Dr Oppenheimer on the subject of visa arrangements has been referred to me, and I am glad to be able to furnish what information we have available.

Many, if not most, of our members from abroad have come to the Institute under the Exchange program, and on the whole this might be the preferable course for you to adopt. However, I am sure you will understand that it is not always easy for us in Princeton to make positive recommendations as to modes of entry in cases where there are alternatives to chose from, since the choice naturally depends upon the plans and preferences of the member.

The Exchange program method though will bring you to Princeton with a minimum of red tape; and should you decide to use this method, the necessary documentation is enclosed.

A quota immigration visa is another possibility but it is a plan that is usually selected by members who expect to be residing for long periods in the United States, or who expect to become United States citizens.

A third possibility is to make use of Section 4(d) of the Immigration Act which permits the entrance of certain classes of people outside the quota. It permits entry of:

> "An immigrant who continuously for at least two years immediately preceding the time of his application for admission to the United States has been, and who seeks to enter the United States solely for the purpose of carrying on the vocation of minister of any religious denomination, or professor of a college, academy, seminar or university; and his wife and his unmarried children under 18 years of age, if accompanying or following to join him."

Some further descriptive matter on Section 4(d) may be of interest:

> "An applicant for a non-quota immigration visa as a 'professor'....ordinarily should be required to show that he has actually been engaged in giving instruction to students

as a member of the faculty in a recognized college, academy, seminary or university and that this vocation has constituted his principal occupation....."

And again:

"A professor may be required to present a contract of employment in an educational institution as evidence of his purpose in coming to the United States...."

And further:

"Non-quota status under section 4(d) of the Act should be accorded to the wife and children of a minister or professor only when the latter obtains or has obtained a section 4(d) immigration visa thereby showing he has qualified under the section cited."

I hope this brief outline may be of some service and if there is anything at any time we can do to facilitate your visit please do not hesitate to let us know.

Naturally entry under the Immigration Act takes a good deal of time owing the amount of checking involved, and how much time depends largely on the state of the quota. There is a wide variation between different countries.

For example in the summer of 1951, in England, it was actually simpler to obtain entry as a quota immigrant than it was to obtain non-quota entry under section 4(d). This was because the quota was wide open. Insofar as your own country is concerned Consular officials will be able to supply full particulars.

Sincerely Yours

Ruth Barnett
Assistant to the General Manager

Dr Armand Borel,
17 Rue de la Fleche,
Geneva, Switzerland.

Geneva, 1/28/52
Armand Borel
17 rue de la Flèche
Geneva
Switzerland

Dear Dr. Oppenheimer,

As you wrote to me last November, I have got a membership in the Institute (School of Mathematics), for the Academic Year 1952-53, with a grant in aid of S 3500.-;

Now I want to write to you about my visa. In the Consulate general in Geneva I have been told that I could not go to the States with a simple visitor visa, as I shall receive money from the Institute. Two solutions were proposed to me.

a) The Institute sends me a letter testifying that I am a visitor under the Exchange Program P-156 (if I am not mistaken) of the Institute. This allows me to receive money from the Institute, but from no othe source, with a visitor visa.

b) I get an immigration visa. This of course gives me complete freedom, but there are some possible drawbacks, for instance it often costs much time to get it.

I have been advised to adopt the second solution, especially as I do not know exactly what I shall do after my sojourn in Princeton; but I have been told that the Institute is very well informed about such matters, and probably more qualified to tell me the best thing to do; therefore, before undertaking anything definite, I would appreciate it deeply if I could receive advice from the Institute. Also if you think the first solution is the better, I should be very thankful to you if you send me the required letter.

I thank you very much in advance for your care in that matter and I am

faithfully yours

A. Borel

(A.Borel)

Wrote
I'll return
by Friday

Geneva, Dec.6th, '51
Armand Borel
Dept. of Mathematics
University of Geneva
Geneva, Switzerland

Returned
Thanks
CDL

Dear Dr. Oppenheimer,

I thank you very much for your letter. Of course I accept with great pleasure the membership in the Institute which is offered to me for the academic year 1952-53.

I am very thankful to the Institute for this membership, which will allow me to do research work under perfect conditions and with the help of Professors I have been admiring for a long time

Very truly yours

A Borel

A .Borel

THE INSTITUTE FOR ADVANCED STUDY
PRINCETON, NEW JERSEY

Copy: Mrs. Russell

November 27, 1951

Dr. Armand Borel
17 rue de la Flèche
Geneva, Switzerland

Dear Dr. Borel:

It gives me great pleasure to tell you that the School of Mathematics of the Institute for Advanced Study has recommended that you be offered a membership at the Institute for 1951-1952 with a grant of $3500. You will presently receive formal notice of this from Dr. Oppenheimer, the Director of the Institute for Advanced Study. Your remarkable work in topology has aroused great interest here.

You can learn much about living conditions in Princeton from Heinz Hopf. The academic year at the Institute runs from about September 29, 1952, to about April 9, 1953. For further information concerning housing you can write to Mrs. Ruth Barnett, Assistant to the General Manager, stating how many rooms you need. The Institute for Advanced Study has a small number of apartments which may become available. It is necessary to apply at the earliest moment.

We hope that you can accept this offer. With every good wish, I am

Very truly yours,

Marston Morse

MMcdu

THE INSTITUTE FOR ADVANCED STUDY

PRINCETON, NEW JERSEY

cc: Mrs. Russell

Application for Membership

School of Mathematics Academic Year 1952/53 First or Second Term Only both

Name in Full BOREL Armand Date of Application November 11th, '51

Permanent Address 17 rue de la Flèche Citizenship Swiss

Present Address Geneva- Switzerland Place of Birth Chaux de Fonds-Switzerland

Academic Degrees (Please give date and place received) Date of Birth 5/21/23

B.S./A.B. Diplom for mathematician, from the Marital Status married

M. A. Federal Institute of Technology, Number of Children none

Ph.D. Zurich, Switzerland - April 1947 Ages of Children

Major Subject algebraic topology Please indicate whether your wife and/or children will accompany you:

Minor Subjects Lie groups [X] Wife; [ ] Children

Proposed Field of Work algebraic topology and continuous groups

Former Fellowships or Scholarships Held (Please give name, dates and places of study)

Dates	Name	Place
Nov.49-July50	attaché de recherches au Centre de la recherche scientifique	Paris, France

Former and Present Teaching Positions (Please give dates, place and rank)

Dates	Place	Rank
1947-49	Federal Institute of Technology, Zurich	assistant
1950-52	University of Geneva	supplying Prof. for algebra

References (Names of three professors under whom you have worked or studied. The applicant himself must ask that letters of recommendation from these individuals, testifying as to character and scientific abilities, be directed to the individual at the Institute with whom application directly is being made.)

Name	Address
Prof. H. Hopf	E.T.H, Zurich, Switzerland
Prof. E. Stiefel	E.T.H. Zurich, Switzerland
Prof. J. Leray	

Honors and Societies member of the Swiss mathematical Society and of the French mathematical Society

Intended Research: Please submit with this application, in duplicate, a brief outline of your previous and intended research.

Publications: A list of publications, with titles and complete references, should be attached in duplicate. ~~Copies~~ TITLE of your thesis should be sent to us, as well as reprints of publications that are available. (Copy of thesis not required ~~for School of Historical Studies.~~)

Grant-in-aid Only a limited number of memberships are available each year with grants-in-aid. It would therefore be helpful to us to know: (please check)

[X] Whether you will require financial assistance;

[ ] Whether you are able to accept a membership without a grant; or

[ ] Whether you plan to come to the Institute under a fellowship from another source: (please indicate source)

(Please return this form in duplicate to the individual with whom applicant has been in contact.)