Four Steele Prizes Awarded by the AMS in Toronto

Steele Prizes are awarded by the Society each year at the summer meeting; they are supported by income from the Leroy P. Steele Fund. The Steele Fund was created in 1970 by a bequest from Mr. Steele who left the bulk of his estate to the Society for the support of awards to be designated as in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein.

Four Steele Prizes were awarded at the summer meeting in Toronto, each of which is worth fifteen hundred dollars. There are three categories of awards:

(1) For a book or substantial survey or research-expository paper. Two awards were made in this category, one to LARS V. AHLFORS for his three books *Complex analysis*, *Lectures on quasi-conformal mapping*, and *Conformal invariants*; the other to TSIT-YUEN LAM for his book *Algebraic theory of quadratic forms* (1973), and four of his papers: *K_0 and K_1—an introduction to algebraic K-theory* (1975), *Ten lectures on quadratic forms over fields* (1977), *Serre's conjecture* (1978), and *The theory of ordered fields* (1980).

Lars V. Ahlfors

(2) For a paper, whether recent or not, which has proved to be of fundamental or lasting importance in its field, or a model of important research. The 1982 recipient is JOHN W. MILNOR for his paper *On manifolds homeomorphic to the 7-sphere*, Annals of Mathematics (2) **64** (1956), pages 399 to 405.

(3) For the cumulative influence of the total mathematical work of the recipient, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through Ph.D. students. The recipient in 1982 is FRITZ JOHN.

These prizes were awarded by the Council of the American Mathematical Society, acting on recommendations of the Committee on Steele Prizes. The Committee consisted of Stuart Antman, Robin Hartshorne, Rueben Hirsch, M. D. Kruskal, Louis Nirenberg, Alex Rosenberg (Chairman), Max M. Schiffer, Edwin H. Spanier, and Gail S. Young, Jr.

Each recipient was invited to respond to the award on its presentation at the Prize Session in Toronto. The text which follows reproduces the Committee's citations, the recipients' responses, and brief biographical sketches.

Lars V. Ahlfors

Citation. Lars V. Ahlfors is awarded a Steele Prize in the expository category for three of his books: *Complex analysis* (McGraw-Hill Book Company, New York, 1953) which, though quite elementary, has strongly influenced the style and teaching of complex analysis and is a masterpiece of lucid, clear and original exposition; and his two more advanced books *Lectures on quasiconformal mappings* (D. Van Nostrand Co., Inc., New York, 1966) and *Conformal invariants* (McGraw-Hill Book Company, New York, 1973). The latter, although brief, are beautifully written and cover a wealth of material.

Response. I am very proud to have received a Steele Prize, proud, above all, because it is a prize not for mathematics alone, but also for mathematical exposition. I have always been interested in teaching, and writing my first textbook was a real challenge. My *Complex analysis* has been successful, and I ascribe its success to the fact that it was the right book at the right time.

Personally, I learned my analysis from two great teachers, Ernst Lindelöf and Rolf Nevanlinna. My

book owes very much to Lindelöf who educated himself in the French tradition and who made me read the classical French treatises on analysis. I found them fascinating, but written in a language which was more literary than exact and quite unsuitable for young American students. By the time I wrote my book Bourbaki had already revolted against the old style, but I was by no means willing to bourbakize something as pretty as functions of a complex variable. The result was a compromise that made use of modern terminology only to the extent that it was already stabilized.

The other two books mentioned in the citation are quite different in that they are not primarily textbooks. The one on quasiconformal mappings is not only out of print, even the publishing company no longer exists in its original form. Those who are lucky enough to own a copy, should hold on to it. It is on the way to becoming a rare book.

The book on conformal invariants originated as a summer course at Oklahoma A&M. I was later persuaded to revise it and expand it to a short book. It would be all right, but unfortunately there are many misprints that make it hard to read. I don't want to blame the printers, but I wish I knew a way to make sure that the last corrected proof coincides with the printed version.

Let me end by thanking the Society for rewarding me for work that gave me great pleasure when it was in the making.

Biographical Sketch

Lars V. Ahlfors was born on April 18, 1907, in Helsinki, Finland. He received a Ph.D. from the University of Helsinki in 1930. He also holds the honorary degrees of A.M. (Harvard University, 1938), LL.D. (Boston College, 1951), Dr.Phil. (University of Zürich, 1977), and Sc.D. (University of London, 1978). He was adjunct in mathematics at the University of Helsinki from 1933 to 1936. He became assistant professor at Harvard University in 1936, then returned to the University of Helsinki as a professor in 1938. From 1945 to 1946 he was professor at the University of Zürich. Since 1946 he has been professor of mathematics at Harvard University. He was a Rockefeller Foundation Fellow in Paris in 1932.

Professor Ahlfors was member-at-large of the Council of the AMS from 1952 to 1954 and vice president of the Society in 1954 and 1955. He served on the *Transactions* Editorial Committee (1950 to 1955), the Committee to Select Gibbs Lecturers for 1952 and 1953, the Committee to Select Hour Speakers for Annual and Summer Meetings (1963-1964), and the Committees to Select the Winner of the Bôcher Prize for 1948, 1953, 1969 and 1970 (Chairman). He has also been AMS Representative to the Editorial Board of *Annals of Mathematics* (1958–1960).

Professor Ahlfors gave an invited address at the Annual Meeting of the Society in New York (December 1949) and 60-minute addresses at the 1962 International Congress of Mathematicians in Stockholm and the 1978 International Congress of Mathematicians in Helsinki. He has also spoken at a Special Session on Quasiconformal Mappings (Chicago, April 1968).

Professor Ahlfors received the Fields Medal in 1936 and the Wolf Foundation Prize in 1981. He is a member of the National Academy of Sciences, the Finnish Academy of Sciences, the Danish Royal Society, and the Swedish Royal Society. His major areas of research interest include theory of functions of a complex variable, conformal and quasiconformal mappings, and Riemann surfaces.

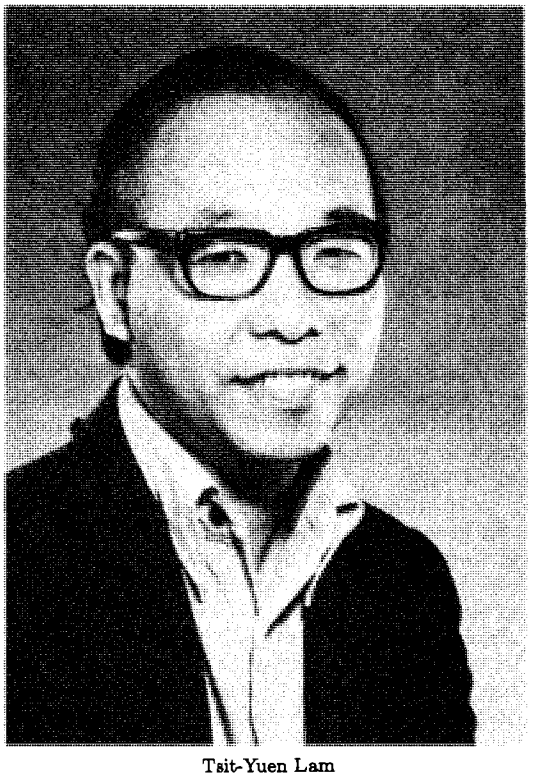
Tsit-Yuen Lam

Citation. In the five works listed below, Lam has given first rate expositions of the theory of quadratic forms, the solution of Serre's problem, and the modern theory of formally real fields. The current very active state of these areas is in no small measure due to Lam's writing. The five works are:

Algebraic theory of quadratic forms, Benjamin, 1973.

(Jointly with Man Keung Siu) K_0 *and* K_1 — *an introduction to algebraic* K*-theory*, American Mathematical Monthly **82** (1975), pages 329 to 364.

Ten lectures on quadratic forms over fields, Queen's Papers in Pure and Applied Mathematics, Number 46, Kingston, Ontario, 1977.



Tsit-Yuen Lam

Serre's conjecture, Lecture Notes in Mathematics, volume 635, Springer-Verlag, 1978.

The theory of ordered fields, Ring Theory and Algebra III, Lecture Notes in Pure and Applied Mathematics, Dekker, 1980.

Response. When I was in graduate school, I could not have dreamed that I would some day become a mathematical author. Yet, no later than five years into my professional career, I succumbed to the temptation of writing a book. Moreover, much to my chagrin, I found that this temptation, like other more earthly temptations, is decidedly of a recurring nature: now fifteen years into my career, I "logged in" at two books and three expository articles. In more sober moments, this leaves me wondering if I might not have overdone myself in the area of expository writing. The Steele Prize came as a surprise, but, more importantly, it also came as a great reassurance to me, from fellow mathematicians, that expository writing is indeed an effective means of stimulating research, and that, as such, it deserves to be reckoned as an integral part of our mathematical culture.

The five works cited for the prize award dealt with several different, but closely interrelated, subject matters, namely, the algebraic theory of quadratic forms, the theory of ordered fields, the solution of Serre's Conjecture, and classical algebraic K-theory. In accordance with the tradition of the Steele Prize award, I would like to take this opportunity to reminisce on some of the circumstances under which these works came into existence.

The algebraic theory of quadratic forms deals with the behavior of quadratic forms over arbitrary fields. Though this theory (in characteristic not 2) had already taken root in Witt's paper in 1937, the modern phase of its development began only in the late 60s with Pfister's penetrating work on the structure of the Witt ring. After reading Pfister's papers, and subsequently Milnor's paper relating quadratic form theory to his K-theory of fields, the great beauty and enormous potential of this area of investigation suddenly became clear to me. I began my own work in this area in the early 70s jointly with my talented student R. Elman, and it was in this period that I wrote my Benjamin notes on quadratic forms. This was my first expository work, so naturally I always tend to look at it with a degree of fondness and satisfaction.

A small dosage of the theory of ordered fields was in my Benjamin book, where it occupied one or two chapters, and was used primarily as a tool for studying quadratic forms. In the 70s, it gradually became clear that one may very well make the study of ordered fields an end in itself, in which case one can turn the table and use the theory of quadratic forms as a tool for studying ordered fields. This philosophy quickly led to the discovery of a plethora of new phenomena for formally real fields, including the now basic notions of SAP fields, superpythagorean fields, and the intimate connections between orderings and valuations. While this study clearly has its origins in the classical work of Artin-Schreier, Krull and Lang, the recent beautiful developments have, in my opinion, opened a modern chapter in field theory, with potentially very important applications to real algebraic geometry. It was with much pleasure and personal satisfaction that I reported on the status of this area of study in my survey article mentioned in the citation.

As for the other works, my interest in classical algebraic K-theory and its applications to Serre's Problem dates back to the time when I wrote my doctoral dissertation. In these areas, everything I know was essentially taught to me by my teacher H. Bass. Like many a graduate student of my time, I had tried to work on Serre's Problem, but of course totally without success. In 1976, the spectacular solutions of this Problem found independently by Quillen and Suslin came to me as a great revelation. In their work, I was able to observe how a mathematician with deep insight can see through some of the key points in a problem which all previous workers had managed to ignore, and thereby obtained an elegant, but nevertheless direct, solution to a long-standing problem. I suppose I was not alone in having marvelled at the simplicity of the Quillen/Suslin solutions of Serre's Problem. In view of this, we would be remiss if we did not also make a serious attempt to understand the deeper historical currents which underlay these deceivingly simple solutions. In my Springer Lecture Notes, I tried to give an account of Serre's Problem from a historical perspective, paying special attention to the sequence of mathematical developments which was inspired by this Problem, and which ultimately led to its full solution. This was a challenging exercise in mathematical exposition, but, to my great delight, it materialized into a wonderful and very rewarding learning experience.

I would like to thank M. K. Siu for his share of contributions to our joint article in the citation, and I thank Alex Rosenberg for suggesting that this article be written. My Kingston Notes on quadratic forms owed their existence to Grace Orzech and Paulo Ribenboim, and the survey article on ordered fields owed its existence to Bernie McDonald. (I plead guilty to my two books which I wrote of my own accord.) To all of these colleagues, my sincere thanks. Last but not least, I should like to record my great indebtedness to the many mathematicians from whose work my various expositions have drawn. Clearly, mathematical expositions can only thrive on good mathematics. As I read over my own expositions, it is evident that what I owe far surpasses what I can give. Therefore, while I am happy beyond words to receive the Steele Prize, I hope it is understood that the honor being conferred is at least equally shared by all the mathematicians whose work has made my expositions possible. In

conclusion, I would simply like to express my deep gratitude to the American Mathematical Society for this wonderful award.

Biographical Sketch

Tsit-Yuen Lam was born on February 6, 1942, in Hong Kong. He received a B.A. from the University of Hong Kong in 1963 and a Ph.D. from Columbia University in 1967. He was a fellow in mathematics at the University of Illinois, Urbana in the summer of 1967, and instructor at the University of Chicago in 1967-1968. He joined the faculty of the University of California, Berkeley as a lecturer in 1968, was assistant professor from 1969 to 1972, associate professor from 1972 to 1976, and was promoted to professor in 1976. Since 1975 he has twice been vice chairman of the department of mathematics. He was an Alfred P. Sloan Foundation Fellow from 1972 to 1974, and was a Miller Research Professor at Berkeley in 1978-1979. Currently he is a John Simon Guggenheim Foundation Fellow.

Professor Lam was a member of the AMS Committee on Translations from Chinese (Chairman, 1980 to 1982) and of the AMS-MAA Arrangements Committee for the San Francisco Meeting (January 1981). He gave addresses at the Symposium on Representation Theory of Finite Groups (Madison, April 1970) and in the Special Session on Quadratic Forms (Hawaii, March 1979). In August 1981, he was Principal Lecturer at an NSF Regional Conference at Carleton College in Northfield, Minnesota. He gave two Karcher Lectures in the Ring Theory and Algebra Conference at the University of Oklahoma in 1979, and was appointed Porcelli Lecturer at Louisiana State University in 1982.

Professor Lam's current research interests are field theory and quadratic forms. He is married and has three daughters.

John W. Milnor

Citation. The award for a paper "which has proved to be of fundamental or lasting importance in its field, or a model of important research" is made to John Milnor for his paper *On manifolds homeomorphic to the 7-sphere*, Annals of Mathematics (2) **64** (1956), pages 399 to 405, in which he exhibited a differentiable 7-manifold homeomorphic to the seven sphere but not diffeomorphic to it. This was the first example of two differentiable manifolds which are homeomorphic but not diffeomorphic.

Biographical Sektch

John Milnor was born February 20, 1931, in Orange, New Jersey. He was educated at Princeton University (A.B., 1951, and Ph.D., 1954) and remained at Princeton until 1967, first as Higgins Lecturer (1954-1955), then assistant professor, associate professor and professor of mathematics (1955 to 1962). In 1962 he became Henry Putnam University Professor, and he served as chairman of the department of mathematics from 1963 to 1966.

From 1968 to 1970 he was professor of mathematics at the Massachusetts Institute of Technology. Since 1970 he has been professor of mathematics at the Institute for Advanced Study. Professor Milnor held an Alfred P. Sloan Foundation Fellowship from 1955 to 1959. He was visiting professor at the University of California, Berkeley in 1959-1960, and visiting professor at the University of California, Los Angeles in 1967-1968.

Professor Milnor served as member-at-large of the Council of the AMS from 1964 to 1966, and as vice president from 1975 to 1977. He has been a member of the Nominating Committee for the 1967 Election, the Committee to Select Hour Speakers for Summer and Annual Meetings (1969-1970), the Committee on Steele Prizes (1970 to 1972), the Committee on National Awards and Public Representation (1972 to 1977), the Committee on Legal Aid (1975), the Committee to Select the Winner of the Veblen Prize (chairman) (1976), the Committee on Prizes (1977 to 1982), the *Colloquium* Editorial Committee (1979 to 1984, Chairman 1982), and served as an Associate Editor for Research Expository Articles in the *Bulletin* (1980 to 1982).

Professor Milnor gave a 30-minute address at the 1958 International Congress of Mathematicians in Edinburgh and a 60-minute address at the 1962 International Congress in Stockholm. He gave an invited address at the April 1959 meeting in New York. He has spoken at the AMS Symposia on Differential Geometry (Tucson, February 1960), on Mathematical Developments Arising from the Hilbert Problems (DeKalb, Illinois, May 1974), and on the Mathematical Heritage of Henri Poincaré (Bloomington, April 1980), and also at the Special Session on Differential Topology (Annual Meeting, Denver, January 1965) and the Summer Research Institute on Differential Geometry (Stanford, July 1973). He delivered the Colloquium Lectures at the Summer Meeting in Madison, Wisconsin, in August 1968.

Professor Milnor was awarded the Fields Medal in 1962 and the National Medal of Science in 1966. He is a member of the National Academy of Sciences and was a representative to the United States National Committee for Mathematics in 1972-1973. His major area of research interest is topology of manifolds.

Fritz John

Citation. The award "for the cumulative influence of the total mathematical work of the recipient, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through Ph.D. students" is presented to Fritz John, whose work has had an enormous influence in many fields: (1) His significant and influential paper on convexity and inequalities, (2) Beautiful important work on ill-posed problems, (3) Difference schemes for parabolic problems that influenced all the subsequent work, (4) Fundamental, deep, work

in elasticity theory—justifying linear approximations to the nonlinear equations, (5) Mappings close to isometries, coming from elasticity theory, and which led to his definition of bounded mean oscillation, (6) Nonlinear hyperbolic problems, blow-up of solutions, or non-blow-up for large time—a series of beautiful papers.

Response. I am highly honored by this award of a Steele Prize by the American Mathematical Society. I just want to make a remark of a more personal nature about my work. The science of mathematics depends for its growth on the flow of information between its practitioners. The joy of discovering new results ought to be matched by the joy in studying the achievements of others. Unfortunately this latter enjoyment is made difficult by the overwhelming volume of mathematical output and the work involved in absorbing the content of even a single paper. Every mathematician has to compromise on the amount of energy he can devote to literature. I myself have been irresistably attracted to mathematical research almost since my childhood, but always was loath to spend the time needed to keep up with developments. This has severely limited my work. Fortunately there was a compensating factor. I was able to spend most of my mathematical life in the stimulating atmosphere of the Courant Institute of Mathematical Sciences at New York University, where I could draw freely on the knowledge and experience of my colleagues.

Biographical Sketch

Fritz John is professor emeritus of mathematics at the Courant Institute of Mathematical Sciences of New York University. He was born June 14, 1910, in Berlin, Germany, and received his Ph.D. in 1933 from the University of Göttingen.

In 1934-1935 he was a research scholar at Cambridge University. In 1935 he became assistant professor at the University of Kentucky, where he was promoted to the rank of associate professor in 1942. He then served as a mathematician for the U.S. War Department from 1943 to 1945 at the Ballistic Research Laboratory at Aberdeen Proving Ground. He became associate professor at New York University in 1946, professor in 1951, and held the Courant Chair at the Courant Institute of Mathematical Sciences at New York University for three years prior to retiring as professor emeritus in 1981. He held a Rockefeller Foundation Fellowship in 1942, a Fulbright Lectureship in 1955, and Guggenheim travel grants in 1963 and 1970. He was a Sherman Fairchild Distinguished Scholar at the California Institute of Technology in 1979 and a Senior U.S. Scientist Humboldt awardee in 1980. In 1950-1951 he served as director of research for the Institute of Numerical Analysis of the National Bureau of Standards.

Fritz John

Professor John has been a member of the *Proceedings* Editorial Committee (1962 to 1966) and the Committee to Select Hour Speakers for Eastern Sectional Meetings (1968-1969). He was an editor of *Communications on Pure and Applied Mathematics* (1966 to 1981), and a co-editor of *Mathematische Annalen* (1968 and 1979).

He gave an invited hour address at the April 1956 meeting of the Society in New York and a 30-minute address at the 1966 International Congress of Mathematicians in Moscow. He has also spoken at Symposia on Special Topics in Applied Mathematics (Evanston, Illinois, January 1953), on Partial Differential Equations (Berkeley, California, April 1960), and on Applications of Nonlinear Partial Differential Equations (New York, April 1964). He delivered the Gibbs Lecture at the Annual Meeting of the Society in Washington, D.C., January 1975.

Professor John was awarded the George David Birkhoff Prize in Applied Mathematics in 1973 (this prize is awarded jointly by the AMS and SIAM). He is a member of the National Academy of Sciences, the Deutsche Akademie der Naturforscher Leopoldina, the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics. His major areas of research interest are partial differential equations, nonlinear elasticity, analysis, and geometry.