Mathematics People

Moser Receives Wolf Prize

Jürgen Moser of the Eidgenössische Technische Hochschule in Zürich will receive the 1994–1995 Wolf Prize in Mathematics. The noted German mathematician will be honored with the $100,000 award by the Israel-based Wolf Foundation for his "fundamental work on stability in Hamiltonian mechanics and his profound and influential contributions to nonlinear differential equations."

The 1994–1995 Wolf Prizes will be presented in March by the president of Israel, Ezer Weizman, at the Knesset (Parliament) building in Jerusalem. A total of $600,000 will be awarded for outstanding achievements in the fields of agriculture, chemistry, physics, medicine, the arts, and mathematics. The Wolf Foundation was established by the late Ricardo Wolf, an inventor, diplomat, and philanthropist.

Among Moser's most important achievements is his role in the development of KAM (Kolmogorov-Arnold-Moser) theory, which describes the structure and stability of dynamical systems which are close to being completely integrable. It has shaped the modern theory of Hamiltonian mechanics and has wide applications in science.

Moser is also known for his proof of the so-called Harnack inequality in elliptic and parabolic differential equations, which has become a standard tool in nonlinear partial differential equations. In addition, he did fundamental work in analysis related to complex, symplectic, and differential geometry, in particular the classification of local invariants of complex manifolds, nonlinear Sobolev inequalities, deformation techniques for symplectic structures, and stability of foliations.

Moser was born in 1928 in Königsberg, Germany. He received his doctorate in 1952 from the University of Göttingen. The following year he was a Fulbright Fellow at New York University and after that became an assistant professor there. He was an associate professor at the Massachusetts Institute of Technology (1957–1960) and a professor at the Courant Institute of Mathematical Sciences (1960–1980). From 1967 to 1970 he served as the director of Courant. Since 1980 he has been a professor at ETH–Zürich, where he has served as director of the mathematics research institute since 1984.

Moser served as the president of the International Mathematical Union from 1983 to 1986. Among his awards and honors are the George David Birkhoff Prize in Applied Mathematics of the AMS and the Society for Industrial and Applied Mathematics (1968), the Craig Watson Medal of the U.S. National Academy of Sciences (1969), the John von Neumann Lectureship of SIAM (1984), the L. E. J. Brouwer Medal (1984), an Honorary Professorship at the Instituto de Matematica Pura e Applicada (1989), and an honorary doctorate from the University of Bochum (1990). Moser is a member of the U.S. National Academy of Sciences.

—from Wolf Foundation News Release

Aisenstadt Prizes Announced

The Centre de Recherches Mathématiques in Montreal has announced that the third and fourth André Aisenstadt Mathematics Prizes have been awarded to NIGEL D. HIGSON of Pennsylvania State University and MICHAEL J. WARD of the University of British Columbia.

Higson was cited for his contributions to operator algebras, particularly the algebraic K-theory of C^*-algebras. He is responsible for important developments in Kasparov's KK-theory and in the index theory for operator algebras. Higson received his B.S. and M.Sc. from Dalhousie University in Halifax, Nova Scotia. In 1986 he received his Ph.D., under the direction of P. A. Fillmore, from that same institution. Higson then went to the University of Pennsylvania and in 1990 moved to Pennsylvania State University, where he is currently an associate professor. He held a Sloan Foundation Research Fellowship (1992–1994).

Michael Ward was recognized for his work in asymptotics, scientific computing, and mathematical modeling with emphasis on modern applications of physical applied mathematics. His research has applications to semiconductor device modeling, steady-state combustion theory, diffusion in singularly perturbed domains, reaction diffusion models exhibiting interfacial dynamics and metastable behavior, and strong localized inhomogeneities in various physical systems. Ward received his B.Sc. in mathematics from the University of British Columbia and his Ph.D. in applied mathematics in 1988 from the California Institute of Technology, under the direction of Donald S. Cohen. After stays at Stanford University and the Courant Institute for Mathematical Sciences, he returned in 1992 to the University of British Columbia, where he is currently an assistant professor.

The Aisenstadt Prize of $3,000, named for the philanthropist André Aisenstadt, is intended to recognize and reward talented young Canadian mathematicians. The winners were selected by a CRM steering committee of distinguished mathematicians.

—from CRM News Release

Obituaries

Fritz John, 1910–1994

Fritz John died in New Rochelle, NY, on February 10, 1994. With his death the mathematical community lost an outstanding analyst whose remarkable and original work will continue to influence and inspire mathematicians in the future.

Fritz John was born June 14, 1910, in Berlin. He spent his school years in Danzig (nowadays Gdansk, Poland) and subsequently studied in Göttingen, where, after four years, he received his Ph.D. in 1933. This was the year the Hitler regime began having its devastating effect on Germany, on science, and, in particular, on the university in Göttingen. F. John's life was immediately deeply affected by this event, and it was only through good luck and the help of colleagues that John was able to receive his degree. His official advisor, as one would say in the U.S., was Courant, who was kicked out of his professorship that year; it was Courant's student, Franz Rellich, who took over the task of granting the degree to Fritz John.

During the same year, and under tense political circumstances, Fritz John and Charlotte Woellmer were married in Göttingen and left the country in 1934 for Cambridge, England. In 1935 he succeeded in obtaining an assistant professorship at the University of Kentucky, where he stayed for eight years. He subsequently served for over two years at the Aberdeen Proving Ground as a mathematician for the U.S. War Department. After the war in 1946, John received a position at New York University, where he joined Courant, Friedrichs, and Stoker in building the institute which later became the Courant Institute of Mathematical Sciences. Here his most important work was created, and aside from a year (1950–1951) spent at the National Bureau of Standards, he remained at this Institute until he retired in 1981. In fact, he remained active at the Institute as Professor Emeritus.

For most mathematicians Fritz John's name is probably associated with his remarkable work on partial differential equations. His book on partial differential equations had an enormous impact on the development of the subject and the training of younger mathematicians. Important as this work is, it represents merely a small part of John's widespread publications. Other fields of his research include: Radon transform, ill-posed problems, convex geometry, numerical analysis, elasticity theory, etc. But such a list does not reflect the broad spectrum and the originality of John's work. For him the separation of pure and applied mathematics was meaningless. In fact, his work exemplifies the unity of mathematics as well as its elegance and beauty. This is not the place to discuss in any detail F. John's work, which is largely accessible in his *Collected works*. Let me illustrate John's mastery in handling interconnections between pure and applied problems by several examples.

The first is John's work on the Radon transform, which was the theme of his dissertation. It was inspired by G. Herglotz in Göttingen, for whom and for whose mathematical style Fritz John had a great admiration. Later, in 1955, Fritz John developed this topic in a beautiful book, *Plane waves and spherical means*, which made this circle of problems and their solution widely known. The book also contains an elegant construction of the fundamental solution for partial differential equations. The later connection of the Radon transform to tomography is well known, although this aspect was never pursued by F. John. His goal was to lay the foundations and make the first approaches.

One of the most striking contributions of Fritz John is his seminal paper on rotation and strain in 1961, which led him to introduce the space of functions of bounded mean oscillations as well as the concept of quasi-isometric mappings. Motivated by problems of elasticity theory, he raised some basic geometrical questions: What can be said about mappings of the Euclidean space (or domains in it) having "small strain", that is, mappings for which the Jacobian, multiplied from the left by its transpose, differs only little from the identity? From this local condition one can infer that in the maximum norm the mapping differs little from a rigid motion—at least if the domain is not too slender. Next, John raised the question whether the first derivatives also deviate little from a constant matrix and showed that this cannot be expected if one employs the maximum norm. However, such a statement is true in the L^p-norm for any p. More precisely, one should use the so-called BMO-norm, and it is at this point that F. John was led to introduce the class of functions of "bounded mean oscillations" which became so important soon after he discovered them. It was C. Fefferman who subsequently identified this function space as the long-sought-after dual of the Hardy-space H^1. This discovery made the space of BMO functions a basic tool in harmonic analysis as well as in other areas of analysis, and by now more than one hundred publications have appeared on the subject. Through the work of A. Garsia, Gundy, Burkholder, and others, this topic entered probability theory, and the relevant results were formulated in terms of martingale theory.

For me, this discovery of F. John was connected with an unforgettable personal experience. Since F. John and I lived in New Rochelle, we often met on the New Haven railroad commuting to New York. On such occasions, we talked about mathematics, and in those cases the frequent delays of the train were most welcome for me. Once, during my first year at NYU, Fritz told me about his work on mappings with small strain and explained the subtle estimates for the derivatives it led to. At that time Fritz John and L. Nirenberg were working on the fundamental inequality for BMO-functions. I found this all very interesting, but I must confess that I did not appreciate the depth of this result at that time. But the next morning it just hit me that this inequality provided precisely the tool I needed for overcoming a major difficulty, namely, the missing link in my attempts to prove a Harnack inequality for elliptic differential equations. Never again did I have such luck that a theorem was invented just at the time when I urgently needed it.

The same work on rotation and strain had another outgrowth: the topic of quasi-isometric mappings. This basic concept—different but related to quasi-conformal maps—leads to interesting geometrical theorems and problems in Banach spaces. Even the "John discs" recently studied in connection with iteration of rational functions (L. Carleson, P.W. Jones, and J.C. Yoccoz, Julia and John, *Bol. Soc. Brasil. Mat.* **25**(1994) 1–30) have their origin in this work.

This work is a typical example showing how F. John created basic geometrical and analytical theories motivated from a field of application, in this case elasticity theory. To be sure, he also pursued the more applied aspects of elasticity theory and studied the corresponding nonlinear systems of partial differential equations in great depth. On this topic he always had close and fruitful contact with his colleague and friend, J. Stoker.

To mention another result of great impact by F. John, consider his work on convex geometry. He showed in 1948 that the boundary of any convex region in R^n lies between two concentric homothetic ellipsoids of ratio $1/n$. This basic result has become very important for nonlinear programming (e.g., M. Grötschel, L. Lovasz, A. Schriov, *Geometric algorithms and combinatorial optimization*, Springer, 1988). I do not want to omit F. John's basic contributions to numerical analysis. His paper on difference methods for parabolic equations was influential for later work by Kreiss, Lax, and others. His lectures on advanced numerical methods appeared in book form.

John's originality is particularly apparent in his work on ill-posed problems. I recall his paper (1960) on continuous dependence on data of solutions for partial differential equations. This was the starting point of many other investigations, including those of Hörmander a decade later. An intriguing instance is his discussion of the wave equation $u_{tt} = u_{xx} + u_{yy}$ and the weak sense of the continuity dependence of the solutions on the data in a spacelike direction. Although the solutions are uniquely determined by the data in a cylinder $x^2 + y^2 < r^2$ (for all t), the solutions have only a very weak, namely, logarithmic, continuous dependence!

Fritz John had a deep dedication to his mathematical ideas, which he pursued independently of current fashion. He was able to continue his research to an advanced age and never lost his creative power. When he was over seventy, he was working in a new area, namely, on the formation of singularities in nonlinear wave equations. He made basic discoveries in this field; in particular, he noted that the lifetime of solutions is larger in higher dimension due to stronger dispersion. This work was also motivated by elasticity theory. It has inspired many younger mathematicians; in particular through the work of S. Klainerman, F. John's former student, it has led to remarkable results in relativity theory.

Of the many honors awarded to F. John, let me mention the G.D. Birkhoff Prize of the AMS and SIAM in 1973, the Steele Prize of the AMS in 1982, the Humboldt award in 1980–1981, and a Fellowship of the MacArthur Foundation in 1984. He was a member of the National Academy of Sciences, a member of the Deutsche Akademie der Naturforscher Leopoldina in Halle, a fellow of the American Association for the Advancement of Science, and a Benjamin Franklin Fellow of the Royal Society of Arts, Manufacture, and Commerce. He received honorary degrees from Brown University and the Universities of Rome, Bath, Heidelberg, and Berlin.

It is strange to note that much of the recognition came rather late in F. John's life. Although the depth and originality of F. John was always known to a group of experts, it took considerable time until it reached a wider circle of mathematicians. This has certainly taken place in the recent past, and one can confidently predict that his deep ideas will continue to influence our mathematics in the future.

I met the John family on my first visit to the United States, and in spring 1954 they took me on an exciting car trip to the Smoky Mountains and Oak Ridge, Tennessee. Later a close friendship developed between our families; in the 1960s we all lived in New Rochelle and often met in our respective homes. I remember well the interesting discussions with Fritz which ranged over many fields besides mathematics. He had an extensive knowledge of world history about which he liked to talk and philosophize. We also shared an interest in astronomy and compared notes about our modest telescopic observations.

John was a delightful human being with a great, though understated, dry sense of humor and tremendous modesty. Perhaps the following characterization of F. John by R. Courant, made some twenty-five years ago, is most fitting:

"There is no doubt that John is one of the most original and deep mathematical analyst of our time. He is a true scholar in the truest sense, profoundly dedicated to his academic task in research and teaching, completely uncorrupted by the activity of the marketplace, yet a full personality with wide intellectual interests."

—Jürgen Moser
ETH-Zürich, Switzerland

Erratum

The November/December 1994 issue of the *Notices* carried a list of new doctorates as part of the AMS-MAA Annual Survey. On page 1148 of the list, the name of Louis Zulli, who received his doctorate from Cornell University, was misspelled. His thesis title was *A matrix for computing the Jones polynomial of a knot.* The *Notices* regrets the error.