Nominations for President Elect

Nomination for James G. Arthur

Robert Langlands

Although the choice of James Arthur as a candidate for the presidency of the AMS came as a surprise to me, I did not hesitate for an instant when asked by the Nominating Committee to write a statement supporting his nomination. I could accept immediately, without reflection, for I have enormous admiration for Jim as a mathematician and as a human being, and my admiration continues to grow. Only now, when setting pen to paper, or my fingers to the keyboard, do I ask myself what the relation is between those qualities that command my respect and the qualifications necessary to be the President of the American Mathematical Society.

There is no question that members of the Nominating Committee will have known what they were about, will have assessed Jim's abilities and capacities, and will have reflected carefully on what he would offer the Society as President. Now it is my turn. Since Jim has been active in the Society for many years, its officers, and a large number of members as well, have had ample time to come to know him. He was a member of the Council of the Society from 1986 to 1988, of the Program Committee from 1989 to 1991, of the Committee on Committees in 1991–92, and was Vice President from 1999 to 2001. I like to think that what weighed above all with the Committee was Jim's stature, stature as a mathematician and as a human being, his judgment and the largeness of his views.

His varied experience in the councils of mathematics in the USA, in Canada, and internationally, will certainly have been taken into account. Chairman of the Panel to Select Speakers in Group 7 (Lie groups and representations) at the International Congress in Kyoto in 1990, he was a member of the Executive Committee of the International Mathematical Union from 1991 to 1998 and of the Selection Committee for the Fields Medals in 2002. Moreover, he has been active in the governance of a number of mathematical institutes, the Centre de recherches mathématiques in Montreal, the Fields Institute, and the Clay Mathematical Institute and, while still finding time for his own research, served on the editorial boards of a number of journals.

I believe that in nominating Jim, the Society is appealing to a tradition that is as old as the Society itself and that has resulted in a list of past-presidents that is almost a roster of the most distinguished of our mathematicians over the past century. Times have changed of course. The Society has grown enormously; mathematics sprawls, so that it is much more of a challenge to sustain its coherence as a profession; the AMS membership is drawn from all its branches and consists of mathematicians with varied responsibilities in research, education, industry, and government. So one's first impulse is to believe that the principal skill of the Society's President must be managerial, and the major secondary criterion, personal involvement in one of the many enterprises—educational, industrial, or social—that sustain the integration of mathematics into modern society. On inquiry, I discover that this is not necessarily so.

On the contrary, as in the days of G. D. Birkhoff or von Neumann, the President still has a major representational function. In particular, he or she is elected to interpret mathematics in all its aspects to the public at large and, at times, to those parts of the public, especially the U. S. Congress, to which it appeals for funds. There is no prescribed type of personality for succeeding in such a task, but a manner that inspires trust, a clarity of views, an ability to articulate them, a patience that can dispense with overbearing arguments, and a willingness to listen carefully to the views and the needs of those represented can, especially when combined in a single individual, accomplish a great deal. These are all among Jim's virtues, as are a lack of pretension and a disarmingly dry sense of humor.

Robert Langlands is professor of mathematics at the Institute for Advanced Study. His email is `rpl@ias.edu`.

Beginning in 1997, and recently appointed for a second five-year term to end in 2007, he has been an Academic Trustee at the Institute for Advanced Study, responsible, in particular, for explaining mathematics and mathematicians to the other members of the Board of Trustees, who are largely drawn from the world of business and finance. He always carefully arms himself with a knowledge of the broad spectrum of scientific activities of the Institute's School of Mathematics and the details of its yearly programs, but his best weapon when articulating our needs and achievements before the Board has perhaps been his conviction of the importance of defending the place of mathematics in the academic world and in society as a whole. I suspect at the same time that he simply enjoys cultivating the art of persuasion.

Thus, although the scale at the Institute is much smaller than at the Society, I have had an opportunity to observe the care with which he listens, individually, to my views and those of each of my colleagues, tempering them or integrating them with his own and those of the larger community, and transmitting them when the opportune occasion arises to the Trustees as a whole. Our Trustees are, by and large, men and women with important positions in the business world, in politics and in large international organizations. Although well-disposed by temperament to the purposes of scientists and scholars, they also have substantial egos and considerable confidence in their own judgment. It is not easy to gain their respect or to change their views. Over the years, they have come, I believe, to trust Jim's wisdom, and on one or two critical occasions, with little else than gentle, patient dissuasion, he has warded off serious danger.

I confess that I have very little familiarity with the Society's organizational structure, but I understand that although the President is not unconcerned with the day-to-day affairs of the Society, responsibility for them lies largely with the Executive Director and the Secretary. The second major duty of the President is, I believe, not to manage the Society but to lead, or better guide, it. His hand will have to be light because, so far as I can see, there are scores of committees, on the order apparently of 150, that are responsible for the manifold policy decisions at various levels and in various domains. The President, acting on advice from within the Society, is responsible for appointments to most of these committees. To make the right appointments, to make the right decisions when they fall to him, he needs good judgment, as broad a knowledge of mathematics and mathematicians as possible, and an understanding of the manifold functions and responsibilities of the Society combined with a genuine respect for their value.

Within the Society itself, as Vice President and as a member of the Committee on Committees, Jim has been a part of the advisory process. It is also clear from his curriculum vitae that at the University of Toronto, where he has served on a large number of interdepartmental committees—a Presidential Search Committee, Presidential Advisory Committee, and many others—the President and the administration in general have had great confidence in Jim's ability to offer sound advice on appointments to important positions and on other matters.

To confirm this, I wrote to Robert Pritchard, the former President of the University, asking him why Jim was so often asked to serve. From his response it is manifest that his view of Jim is similar to mine, for he writes:

"Jim has served on many of the University's most important special committees … Why is he chosen? Because he … personifies our highest aspirations, has superb academic and scholarly judgement, has very high standards, is utterly reliable, is highly courteous, is practical and not just a theorist, always acts in a principled way, and conducts himself with dignity in all situations.

"He is a very special person quite apart from being a superb mathematician. He is extremely considerate of others and listens hard to competing views. He's fair and will always work to do the right thing."

So the answer to my question is that those qualities that have made Jim an admired friend and an exceptionally fine colleague are in large part just the qualities that will also make him a superb President. Jim is an excellent mathematician, with important contributions that have had a major impact on contemporary mathematics to his credit, so that when he speaks for mathematics he speaks with authority. There is no abatement in his scientific activity. He has a long-term program of research underway on which he continues to make progress at the same time as he serves the mathematical community in a large number of other ways. He is fair, with considerable experience in interpreting and defending mathematics, so that all of us, no matter what our interests or responsibilities, can be confident that he will, when the occasion arises, represent our needs forcefully and without bias, and that within the Society he will appoint the right people to formulate its policies—people who are informed, competent, and responsible.

I conclude with a brief biography and a brief description of his mathematics. Jim was educated at the University of Toronto and took his Ph.D. at Yale in 1970. After teaching at Princeton, where he met his wife Dorothy (Penny), a Kentucky native, and at Yale, he became a Professor at Duke, but in 1979 returned to Toronto, where he became a University Professor in 1987. His two sons are at present studying in the U.S.A. His older son James is a graduate student in Creative Writing at the University of Washington, and David, who has won gold medals in Olympiads in mathematics (2000) and in computer science (1999, 2000), is now an undergraduate in mathematics and computer science at Duke.

Jim is a fellow of the Royal Society of London and of the Royal Society of Canada. A speaker at the International Congress, both in Warsaw and in Berlin, he has been awarded a number of prizes, in particular the Henry Marshall Tory Medal of the Royal Society of Canada and the Canada Gold Medal for Science and Engineering of the National Science Engineering and Research Council in Canada.

Jim's name is attached to the formula or technique in the theory of automorphic forms that is referred to either simply as the trace formula or, frequently, as the Arthur-

Selberg trace formula. He has devoted the bulk of his mathematical efforts to it. On the website `www.sunsite.ubc.ca/DigitalMathArchive/Langlands` the interested reader can find a short, historically oriented general introduction to automorphic forms, the trace formula, and Arthur's work that was written as a supplement to the all too brief sketch that follows, as well as a much longer appreciation that appeared in the *Canad. Math. Bull.* (vol. 44, 2001, pp. 160–209) on the occasion of the award of the Canada Gold Medal and that attempts a survey less of the area as a whole than of Arthur's many contributions to it. Here I shall say no more than is necessary to underline the scope and difficulty of his work and its great importance for number theory at the present time and in the future.

The role of the theory of automorphic forms in modern number theory is more familiar than it once was because of the famous Taniyama-Shimura-Weil conjecture, its proof by Wiles, and its application to the Fermat theorem. The deep questions with which we are confronted when attempting to classify and understand algebraic irrationalities and the strikingly beautiful answers to them suggested by the theory are none the less hardly as familiar as they might be. The origins of the modern theory of automorphic forms lie to a considerable degree in the extension not only of quadratic reciprocity to the higher reciprocity laws but also of Gauss's analysis of the arithmetic of roots of unity, thus of the construction of regular polygons, to more recondite irrationalities, those associated to the division of elliptic curves. However, it has other roots as well—quite different—in analysis, both real and complex, in geometry, and in representation theory. It is the sophistication of aims together with the sophistication of proposed techniques that render the subject difficult.

The trace formula itself is an analytic technique that is used to investigate the spectral theory of the homogeneous spaces that link the analysis and the number theory. It is not difficult analytically if the homogeneous space is compact but still very important as Selberg discovered. When the space is not compact but of rank one, the formula is not only important but also difficult and is due to Selberg. For groups of higher rank, where the analytic difficulties are much more severe, it is the work of Arthur.

At the core of the formula in higher rank is the simultaneous spectral theory of several commuting differential operators, whereas in rank one there is only a single operator. The problems to be solved, first of all to obtain a formula in higher rank and then to turn it into an effective tool, lie in many domains: Fourier transforms in several variables, ordinary differential equations, measure theory, convex bodies, local harmonic analysis on real and on p-adic groups.

Arthur has not only had to develop a variety of techniques to handle them but has been led to some deep and important conjectures in representation theory—one global, related to the Ramanujan conjecture, and one local, related to the classification of unitary representations of reductive groups over a local field. Both these conjectures have had a great influence on the work of a number of imortant mathematicians such as Vogan, Waldspurger, and Moeglin.

Although much work and many deep discoveries remain before the full arithmetic depth of the trace formula reveals itself, Arthur has already explored profoundly many aspects of the trace formula, especially invariance and stabilization, and in part in collaboration with Clozel, has made a number of important applications to the transfer of automorphic forms from one form of the general linear group to another or from symplectic and orthogonal groups to a general linear group. His papers will, I believe, be essential reading for those in the field for a long time to come.

Others, too, have found striking applications of the trace formula to major arithmetical conjectures. Kottwitz's proof of an important conjecture of Weil on the volumes of arithmetic quotients exploited the first forms of Arthur's trace formula. The formula of Arthur, but over function fields and not number fields, was an essential tool in the work for which Lafforgue was recently awarded the Fields Medal.

Nomination for Donald G. Saari

Eric Friedlander

Donald Saari would prove to be an excellent president of the American Mathematical Society. He is a fantastic expositor and would be able to explain the role of mathematics to the outside world. His high-quality research encompasses core mathematics, applied mathematics, and economics. As a member of the National Academy of Sciences, he has the stature and credentials expected of someone representing the Society. Don's commitment to advancing the appreciation and understanding of mathematics by the general public should bring considerable benefit to our discipline.

Don's research centers around dynamical systems: the dynamics of celestial mechanics, of voting, and of economic systems. Surely, the best person to explain the role and significance of Don's work is Don himself, and the interested reader can consult his May 1995 *Notices* article (co-authored by Don's former student Jeff Xia) on celestial mechanics, his February 1995 *Notices* article on economic theory, and his expository book *Chaotic Elections! A Mathematician Looks at Voting*, published by the AMS in 2001.

Don's early work revived the study of singularities in celestial mechanics (part of what Don calls "mankind's second oldest profession"). Among his achievements are the solution of the Littlewood conjecture, which asserts

Eric Friedlander is professor of mathematics at Northwestern University. His e-mail address is `eric@math.nwu.edu`.

that collisions are improbable; further work showing "non-collision singularities" are improbable; and the first asymptotic description of the expansion of the N-body problem for any N (extending Newton's work for $N = 2$) as time goes to infinity. Don initiated various aspects of modern work in celestial mechanics associated to classification of systems and singularity theory. Although Don continues to work in this subject, he has dynamically expanded his research (and its popular appeal) into seemingly disparate areas.

Using symmetry as well as dynamics, Don has greatly improved our understanding of the imperfections of voting systems. Don investigated and characterized all possible "voting paradoxes". Don writes of his recent work:

"It is now possible to construct examples illustrating any possible paradox for all standard methods, all paradoxes can be explained and understood…the mathematical structure of the voting methods which give some consistency to election outcomes now is known…"

The best voting method, as Don has explained, is the Borda Count, which is the scheme in which each voter rank-orders all candidates.

In economics Don has used mathematics to argue that one cannot prove the validity of Adam Smith's "Invisible Hand" with current mathematical models. One important contribution of Don's to economic theory is a "benign interpretation" and extension of Arrow's seminal theorem in decision analysis. Recognizing the importance of the information required to reach "economic equilibria", Don has cogently argued that much of current theory does not lead to convergent approaches to equilibria. He continues to investigate "demand and supply", studying vector fields of "excess demand" resulting in foliations of representing foliations. As in the case of voting systems, chaos appears to reign.

Throughout his career, Don has placed great importance on clarity of exposition. Indeed, Don has told me that his overarching ambition in his research is to change the way people think about issues and to encourage a more positive view of mathematics. The MAA has awarded Don the Lester R. Ford Award, the Chauvenet Prize, and the Allendoerfer Award for his well-written articles. Don was tickled to learn that the (now former) president of Mexico was reading one of his economics papers. He has corresponded with members of Congress about voting paradoxes and has been quoted in Chicago newspapers about the force of one of Glenallen Hill's homeruns and the likelihood of space junk causing problems with our space station.

Before he left the wonderful Chicago climate for the hardships of southern California, Don was considered the best teacher in the Northwestern University mathematics department. Indeed, we present to new graduate students and faculty videotapes of Don's calculus lectures. He was prouder of the level of achievement of his students than he was of his student evaluations, which led to many teaching awards. Don would go to elementary schools, to high schools, and to community colleges to demonstrate the fun as well as the challenge of mathematics.

Don inherited the leadership talent of his father, a bold union and community leader. At Northwestern, Don chaired the mathematics department, the General Faculty Committee, and numerous faculty committees. Whether he was taking a strong stand in the Big Ten about the role of academics in athletics or whether he was confronting the administration at Northwestern to provide better health benefits to faculty and staff, Don played an active and constructive role. Don is the director of the Institute for Mathematical Behavioral Sciences at the University of California at Irvine.

NOTE: Erratum added August 26, 2003. See http://www.ams.org/notices/200308/noms-pres-erratum.pdf or http://www.ams.org/notices/200308/noms-pres-erratum.ps.