SPECIAL SECTION

2011 American Mathematical Society Election

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2011 AMS Elections

Special Section

List of Candidates–2011 Election

President
(one to be elected)

John M. Guckenheimer
David A. Vogan, Jr.

Vice President
(one to be elected)

Andrew Odlyzko
A. G. (Loek) Helminck

Trustee
(one to be elected)

Ruth Charney
Nassif Ghoussoub

Member at Large of the Council
(five to be elected)

Dan Abramovich
Rodrigo Bañuelos
Hélène Barcelo
Arthur Benjamin
James Carlson
Lloyd Douglas
Robert McCann
Vicki Powers
Bruce Sagan
Ileana Streinu

Nominating Committee
(three to be elected)

Steven Bell
Fred Cohen
Susan Friedlander
Fan Chung Graham
John C. Meakin
Steven Smith

Editorial Boards Committee
(two to be elected)

Ralph Greenberg
Jonathan Hall
David Hoff
Dana Randall

Ballots

AMS members will receive email with instructions for voting online by August 22, or a paper ballot by September 15. If you do not receive this information by that date, please contact the AMS (preferably before October 1) to request a ballot. Send email to ballot@ams.org or call the AMS at 800-321-4267 (within the U.S. or Canada) or 401-455-4000 (worldwide) and ask to speak with Member Services. The deadline for receipt of ballots is November 4, 2011.

Write-in Votes

It is suggested that names for write-in votes be given in exactly the form that the name occurs in the *Combined Membership List* (www.ams.org/cml). Otherwise the identity of the individual for whom the vote is cast may be in doubt and the vote may not be properly credited.

Replacement Ballots

For a paper ballot, the following replacement procedure has been devised: A member who has not received a ballot by September 15, 2011, or who has received a ballot but has accidentally spoiled it, may write to ballot@ams.org or Secretary of the AMS, 201 Charles Street, Providence, RI 02904-2294, USA, asking for a second ballot. The request should include the individual's member code and the address to which the replacement ballot should be sent. Immediately upon receipt of the request in the Providence office, a second ballot, which will be indistinguishable from the original, will be sent by first class or airmail. Although a second ballot will be supplied on request and will be sent by first class or airmail, the deadline for receipt of ballots cannot be extended to accommodate these special cases.

Biographies of Candidates

The next several pages contain biographical information about all candidates. All candidates were given the opportunity to provide a statement of not more than 200 words to appear at the end of their biographical information.

Description of Offices

The **president** of the Society serves one year as president elect, two years as president, and one year as immediate past president. The president strongly influences, either directly or indirectly, most of the scientific policies of the Society. A direct effect comes through the president's personal interactions with both members of the Society and with outside organizations. In addition, the president sits as member of all five policy committees (Education, Meetings and Conferences, Profession, Publications, and Science Policy), is the chair of the Council's Executive Committee, and serves ex officio as a trustee. Indirect influence occurs as the president appoints chairs and members of almost all committees of the Society, including the policy committees. The president works closely with all officers and administrators of the Society, especially the executive director and the secretary. Finally, the president nominates candidates for the Nominating Committee and the Editorial Boards Committee. Consequently, the president also has a long-term effect on Society affairs.

The **vice president** and the **members at large of the AMS Council** serve for three years on the Council. That body determines all scientific policy of the Society, creates and oversees numerous committees, appoints the treasurers and members of the Secretariat, makes nominations of candidates for future elections, and determines the chief editors of several key editorial boards. Typically, each of these new members of the Council also will serve on one of the Society's five policy committees.

The **Board of Trustees**, of whom you will be electing one member for a five-year term, has complete fiduciary responsibility for the Society. Among other activities, the trustees determine the annual budget of the Society, prices of journals, salaries of employees, dues (in cooperation with the Council), registration fees for meetings, and investment policy for the Society's reserves. The person you select will serve as chair of the Board of Trustees during the fourth year of the term.

The candidates for vice president, members at large, and trustee were suggested to the Council either by the Nominating Committee or by petition from members. While the Council has the final nominating responsibility, the groundwork is laid by the **Nominating Committee**. The candidates for election to the Nominating Committee were nominated by the current president, Eric M. Friedlander. The three elected will serve three-year terms. The main work of the Nominating Committee takes place during the annual meeting of the Society, during which it has four sessions of face-to-face meetings, each lasting about three hours. The Committee then reports its suggestions to the spring Council, which makes the final nominations.

The **Editorial Boards Committee** is responsible for the staffing of the editorial boards of the Society. Members are elected for three-year terms from a list of candidates named by the president. The Editorial Boards Committee makes recommendations for almost all editorial boards of the Society. Managing editors of *Journal of the AMS*, *Mathematics of Computation*, *Proceedings of the AMS*, and *Transactions of the AMS*; and Chairs of the *Collqouium*, *Mathematical Surveys and Monographs*, and *Mathematical Reviews* editorial committees are officially appointed by the Council upon recommendation by the Editorial Boards Committee. In virtually all other cases, the editors are appointed by the president, again upon recommendation by the Editorial Boards Committee.

Elections to the **Nominating Committee** and the **Editorial Boards Committee** are conducted by the method of approval voting. In the approval voting method, you can vote for as many or as few of the candidates as you wish. The candidates with the greatest number of the votes win the election.

A Note from AMS Secretary Robert J. Daverman

The choices you make in these elections directly affect the direction the Society takes. If the past election serves as a reliable measure, about 13 percent of you will vote in the coming election, which is comparable with voter participation in other professional organizations which allow an online voting option. This is not mentioned as encouragement for you to throw the ballot in the trash; instead, the other officers and Council members join me in urging you to take a few minutes to review the election material, fill out your ballot, and submit it. The Society belongs to its members. You can influence the policy and direction it takes by voting.

Also, let me urge you to consider other ways of participating in Society activities. The Nominating Committee, the Editorial Boards Committee, and the Committee on Committees are always interested in learning of members who are willing to serve the Society in various capacities. Names are always welcome, particularly when accompanied by a few words detailing the person's background and interests. Self-nominations are probably the most useful. Recommendations can be transmitted through an online form (`www.ams.org/committee-nominate`) or sent directly to the secretary (`secretary@ams.org`) or Office of the Secretary, American Mathematical Society, 237Ayres Hall, University of Tennessee, 1403 Circle Drive, Knoxville, TN 37996-1320.

PLEASE VOTE.

A Proposal for a Fellows Program of the AMS

The January 2011 Council directed that the following proposal be presented to the membership in 2011 for their vote to support or oppose an AMS Fellows Program. The Council further directed that the ballot be accompanied by this statement: "If more than 1/2 of the members voting on this issue are in favor, then the AMS will implement the program."

Information about the history of the AMS Fellows Proposals can be found at `www.ams.org/about-us/governance/elections/fellows-info`

The Fellows program is created and updated by the Council of the AMS. The program below describes in general terms what a new Fellows program will look like. If approved, some details of the program may be changed by the AMS Council prior to implementation in order to address practical needs. Future Councils can make further changes, keeping in mind the intent of the membership in approving the initial program.

The goals of the Fellows Program are:

- To create an enlarged class of mathematicians recognized by their peers as distinguished for their contributions to the profession.

- To honor not only the extraordinary but also the excellent.
- To lift the morale of the profession by providing an honor more accessible than those currently available.
- To make mathematicians more competitive for awards, promotion, and honors when they are being compared with colleagues from other disciplines.
- To support the advancement of more mathematicians in leadership positions in their own institutions and in the broader society.

I. Program (steady-state)

A. The Fellows program of the American Mathematical Society recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics.

B. The responsibilities of Fellows are:

- To take part in the election of new Fellows,
- To present a "public face" of excellence in mathematics, and
- To advise the President and/or the Council on *public matters* when requested.

C. The target number of Fellows will be determined by the AMS Council as a percentage of the number of members.[1] The target percentage will be revisited by the Council at least once every ten years and may be increased or decreased in light of the history of the nomination and selection process. The intended size of each year's class of new Fellows should be set with this target size in mind.

D. Following a selection process (see below), individuals are invited to become Fellows. They may decline and they may also resign as Fellows at any time.

E. Fellows receive a certificate and their names are listed on the AMS website. The names of new Fellows are also included in the *Notices* each year.

F. If they are not already Fellows, the AMS President and Secretary are made Fellows when they take office.

II. Initial Implementation

A. In the initial year of the program, all eligible AMS members during both the years 2010 and 2011 as of January 1, 2012 and who have done one or more of the following will be invited to become AMS Fellows.[2]

1. Given an invited AMS address (including at joint meetings).[3]
2. Been awarded an AMS research prize.[4]
3. Given an invited address at an International Congress of Mathematicians (ICM) or an International Congress of Industrial and Applied Mathematicians (ICIAM).[3]

B. An additional 50 members who are AMS members during both the years 2010 and 2011 as of January 1, 2012, will be selected to become AMS Fellows. These will be chosen by a committee appointed by the President with the advice of the Executive Committee of the Council. Attention will be paid to selecting AMS members recognized for their contributions beyond research.

III. Selection Process

A. New Fellows are selected each year after a nomination process. The nomination process is carried out under the direction of the Secretary with help from the AMS staff. The procedures for nominating AMS Fellows will be available on the AMS website.

B. The Selection Committee will consist of twelve members of the AMS who are also Fellows, each serving a three-year term, and with four new members appointed each year. The AMS president, in consultation with the Executive Committee of the Council, nominates the new members of the Selection Committee in November of each year. At the same time, the President nominates a continuing member of the Selection Committee to serve as Chair.

C. The Selection Committee accepts nominations for Fellows between February 1 and March 31 each year. Nominations are made by members of the AMS. A member can nominate no more than 2 nominees a year.

D. To be eligible for nomination to Fellowship, an individual must be an AMS member for the year in which he or she is nominated as well as for the prior year.

E. A nominator must supply a package with the following information on the nominee:

1. A Curriculum Vitae *of no more than five pages.*
2. A citation of fifty words or less explaining the person's accomplishments.
3. A statement of cause of 500 words or less explaining why the individual meets the criteria of Fellowship.
4. The signatures of the nominator and three additional AMS members who support the nomination, with at least two of these individuals current Fellows.

F. Any person who is nominated and is not selected a Fellow will remain an active nominee to be considered by the Selection Committee for possible selection for a further 2 years.

G. Each year the January Council provides a guideline for the number of Fellows to be selected.[5] The Selection Committee chooses Fellows from the nominations bearing in mind this guideline, diversity of every kind, and the quality and quantity of the external nominations. The Selection Committee has the discretion to make nominations to fulfill the general goals of the fellowship.

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[1] *This proposal's recommendation to Council is 5% of members. At present there are about 30,000 members so the number of Fellows would be about 1,500.*

[2] *The seeding process described in II.A would produce offers of Fellows status to more than 800 current AMS members.*

[3] *An invited address is one given at the invitation of the program committee and delivered before January 1, 2012.*

[4] *These are the Birkhoff, Bôcher, Cole, Conant, Doob, Eisenbud, Fulkerson, Moore, Robbins, Satter, Steele, Veblen, Whiteman, and Weiner prizes. These prizes must have been awarded before January 1, 2012.*

[5] *It is anticipated that during a transition period of approximately 10 years about 75 new Fellows will be appointed each year. In the steady state of 1500, it is anticipated that about 40 new Fellows positions will occur annually due to attrition.*

H. Those members who are chosen by the Selection Committee are invited by the President to become new Fellows of the AMS.

Frequently Asked Questions about the AMS Fellows Proposal

***Q.** How was the AMS Fellows program proposal developed?*

A. Over the past decade various committees and subcommittees of the AMS have discussed the possibility of instituting an AMS Fellows Program, partly influenced by the existence of such programs in a number of other scientific societies. In 2003 an ad hoc committee on Fellows gave a report to the Council in which arguments were presented for and against the concept. Because it is hard to judge a program in the abstract, a smaller committee was appointed with the charge to formulate a specific proposal. This committee included the Council members John Franks, Susan Friedlander (Chair) and Sheldon Katz. After months of analysis of earlier committee reports, discussions with many AMS members, comparative research into other Fellows programs, and deliberation of what kind of program might suit the AMS, the committee reported back to the Council in 2006 with a specific proposal.

The Council, after strenuous debate, voted to put the proposal on the 2006 AMS ballot. The members could vote for or against the proposal with the information that if two-thirds of the vote was in favor, the program would be implemented. The vote in 2006 was 63.2% in favor.

The proposal brought to the membership in 2008 was a modified version of the 2006 proposal. It took into account certain issues raised by members and also benefitted from feedback between the AMS proposal and a proposal for SIAM Fellows that has since been implemented.

In 2011, the AMS Council voted almost unanimously (with one negative vote) to place the latest proposal on the 2011 AMS ballot; the overwhelming sentiment of the Council was to support this proposal.

***Q.** Is excellence in research the only criterion for being a Fellow?*

A. Research excellence is not the sole criterion envisioned for selection of AMS Fellows. The Fellows program could recognize excellence in educational activities and "diversity of every kind".

***Q.** What are the goals of the Fellows program?*

A. The goals are:

- To create an enlarged class of mathematicians recognized by their peers as distinguished for their contributions to the profession.
- To honor not only the extraordinary but also the excellent.
- To lift the morale of the profession by providing an honor more accessible than those currently available.
- To make mathematicians more competitive for awards, promotion, and honors when they are being compared with colleagues from other disciplines.
- To support the advancement of more mathematicians in leadership positions in their own institutions and in the broader society.

***Q.** What are arguments in favor of a Fellows program?*

A. Here are some of the arguments in favor:

1. The celebration of newly created Fellows of the AMS would bring positive publicity to mathematics and to excellent mathematicians.
2. The proposed initial procedure and the relatively large number of AMS Fellows envisaged for the program would enable a more diverse group of mathematicians to be recognized.
3. Mathematics has been somewhat reluctant to recognize excellence in its midst, other than truly exceptional achievement. The Fellows Programs will enable broader recognition of mathematicians.
4. AMS Fellows individually and departments associated with AMS Fellows would be given an external recognition which could bring additional resources to mathematics.
5. The AMS Fellows Program should raise the visibility of the AMS within the mathematics community and could increase the sense of connectivity of mathematicians with the AMS.
6. SIAM has instituted a fellows program very similar to that of the proposed AMS Fellows Progam with almost no negative reaction or response.

***Q.** What are arguments against a Fellows program?*

A. Here are some of the arguments against:

1. An AMS Fellows Program could be viewed as not consistent with the tradition of egalitarianism.
2. Fellows are likely to be those people who already have been recognized in other ways.
3. Mathematicians named AMS Fellows and their departments are already sufficiently distinguished that the selection of AMS Fellows will lack importance.
4. Any selection process will necessarily be somewhat political and could be divisive.
5. Some not chosen to be Fellows may feel a weaker connection to the AMS.

***Q.** Where can I find more detailed discussions?*

A. Pro and con articles concerning an AMS Fellows program appeared in the AMS *Notices* in advance of the 2006 vote (Vol 53, Aug 2006, pp. 754–756, also found at `http://www.ams.org/notices/200607/fea-fellows.pdf`.)

***Q.** Do other societies in the mathematical sciences have Fellows programs?*

A. Yes. For example, the American Statistical Association, Association for Computing Machinery, INFORMS and the Society for Industrial and Applied Mathematics all have Fellows programs.

Q. How does the proposed AMS program compare to the size of the programs of other societies?

A. In its steady state the proposed AMS Fellowship would be approximately 5% of the total membership (i.e., about 1,500 Fellows out of about 30,000 members). In some other societies surveyed the Fellowship varies between about 5% and about 13%.

In its steady state it is expected that the number of new Fellows elected each year will be approximately 0.2% of the membership. Each year, the American Physical Society elects no more than 0.5 % of all members and the American Statistical Association elects no more than 0.33% of all members.

Q. How will the AMS Fellowship be started and how will new Fellows be elected?

A. This is spelled out in detail in the proposal itself.

Q. How many Fellows will there be in the "seed pool" and how will the steady state be achieved?

A. The seed process is expected to generate approximately 1,000 Fellows in January 2012. In future years, guidelines for the number of new Fellows would be set by the AMS Council with an expectation of 75 new Fellows appointed in each year of the first decade of the program. See the proposal for further detail.

Q. Why is there a start-up procedure?

A. There are several reasons for starting the program with a well defined set of criteria for selecting an initial set of Fellows.

- If the program is worth having then it should be up and running from the start with a substantial number of Fellows, so that it is a healthy program.
- A well specified algorithm is required to avoid an otherwise massive task of individual evaluation of the initial set of Fellows. The algorithm should be clear in advance to avoid questions after the fact regarding who was selected and why.

Q. How will the Fellows program be changed in the future?

A. The current proposal for the Fellows program was created by the Council, and it can be modified by the Council in the future. The details of administering the program may be changed in the future to address practical needs, even as the program is initially implemented.

Q. How can I find out more about the Fellows program?

A. Updated information will appear at

http://www.ams.org/secretary/fellows-info.

That site will also contain a form to ask questions about the program.

Nominations for President

Nomination of John Guckenheimer

Martin Golubitsky

When I was approached to write an article for the *Notices* in support of John Guckenheimer's candidacy for president of the American Mathematical Society, I had two initial reactions. First, I was reminded of John's extraordinary breadth in both research and policy making, and how he has so often managed to translate his ideas into actions. Second, I was slightly surprised since John had been president of SIAM and to my knowledge no one has ever been given the opportunity to serve as president of both AMS and SIAM. Since the AMS Nominating Committee knew of John's SIAM connection, I focused on why that committee had asked John to run for the AMS presidency. On reflection, I believe that the committee has made a really inspired choice.

Presidents of professional societies help steer their profession in a variety of ways that include:

- Research environment (books and journals, conferences, advocacy in Washington and elsewhere, and prizes)
- Pedagogy (texts, best practices)
- The society itself (chairing the Council, representing the Society, participating in decisions that can alter the directions of the society in future years).

I have known John for nearly forty years; he thinks deeply about problems facing the mathematics community and he follows trends in a large number of areas in mathematics. I have seen John perform admirably on a variety of assignments that demonstrate that he would be a superb AMS president, in ways that I will now discuss.

Research

John Guckenheimer's research is a broad, delightful, and rare blend of the theoretical, the computational, and the applied. He is a distinguished researcher who has made significant contributions in dynamical systems, bifurcation theory, computational methods and scientific software, neuroscience, and a variety of engineering application areas. Based on his research John was appointed Abram R. Bullis Professor in Mathematics at Cornell and elected a Fellow of the American Academy of Arts and Sciences.

Martin Golubitsky is professor of mathematics at Ohio State University. His email address is `mgolubitsky@mbi.osu.edu`.

Specifically, John has contributed to theoretical dynamical systems (for example, universality of periods in one-dimensional maps; chaotic properties of the Lorenz attractor, and canard dynamics in multi-time-scale systems; indeed he was the first to define a *geometric* Lorenz attractor). In a remarkable series of papers, John demonstrated the universality of periods of stable periodic orbits and the Holder-continuity of entropy for a wide class of unimodal smooth maps. This research helped explain chaotic properties of the Lorenz attractor. John has also worked on multiple time-scale systems, in particular the forced van der Pol equation. Cartwright, Littlewood, Levinson and Levi showed that this system had chaotic solutions, which inspired Smale's development of the horseshoe map that is now a central concept in the analysis of chaotic systems. With collaborators, Guckenheimer showed how horseshoes occur in the periodically forced van der Pol equation, thus providing a capstone to this line of research.

A 1988 paper by Guckenheimer and Holmes contains one of my personal favorite bifurcation theory results. The authors show that intermittency observed in a fluid dynamics experiment and in associated models is driven by heteroclinic cycles that are structurally stable because of symmetry. This seminal paper spawned a vast literature exploring heteroclinic cycles in equivariant dynamical systems.

In computational dynamical systems John and his collaborators created *DSTool*, a widely used "toolbox" for interactive investigation of dynamical systems. John is among the pioneers of computer-generated proofs, and he invented important algorithms for approximating periodic orbits and invariant manifolds.

In mathematical neuroscience John worked with a team of neurobiologists led by Harris-Warrick. Together they constructed detailed models of motor neural networks in the lobster nervous system and the mouse spinal cord. These models predicted parameters that provided experimentalists with a key insight into understanding how neurons generate rhythmic behavior.

John's forays into engineering applications include work on fluid mechanics (relationships between chaotic dynamics and complicated fluid motion) and robotics (specifically the derivation of models for legged motion). Recently, I spoke to one of John's engineering collaborators and was truly impressed by how much he valued John's contributions.

Pedagogy

In 1983 Guckenheimer and Holmes published *Nonlinear Oscillations, Dynamical Systems, and Bifurcation of Vector Fields*, a text that has become a classic and that has trained a generation of researchers in applied dynamical systems, as well as researchers in core mathematics, applied mathematics, and a number of applied disciplines.

In recent years John has worked both on core dynamical systems and on applications in the biological sciences. As is John's way, to do this he spent much effort understanding the important issues in a variety of areas in the biological sciences and how mathematics could contribute to these areas. These efforts led to an undergraduate text on *Dynamic Models in Biology* co-authored with Steve Ellner (a noted ecologist) in 2006.

Policy

John Guckenheimer has participated in important policy discussions about the mathematical sciences over the past 20 years in at least two distinct ways. First, in his association with SIAM, John helped create two of the largest SIAM activity groups—one in Computational Science and Engineering and the other in the Life Sciences. Indeed, John was the founding chair of the Life Sciences AG. In each case John was ahead of the curve in seeing the need to support emerging fields within the mathematical sciences and acting to help create that support. Not surprisingly, John has also served as chair of the Dynamical Systems Activity Group. These three AGs are now among the six largest of the 16 SIAM Activity Groups.

A second way that John has participated in policy issues is by serving on panels to explore new directions in the Mathematical Sciences. I point to two such efforts that were both timely and effective: Mathematics and Biology in 1992 and Foundations for Complex Systems Research in the Physical Sciences and Engineering in 2008.

Advocacy in Washington is an activity that the American mathematics profession cannot afford to ignore. Our community needs to explain the myriad of ways that the mathematical sciences contribute to societal goals. Indeed, AMS, SIAM, and MAA all have strong and cooperative (through JPBM) Washington presences. John has contributed to these efforts for many years and in many ways, from testifying before congressional committees, to visiting congressional staffers, to writing white papers on specific needs, to discussing funding directions at NSF.

Publications

One of the important challenges that will affect professional societies is how to continue publications in the electronic age. John has had broad experience in publication: from writing successful books to serving on multiple editorial boards.

In summary, John Guckenheimer has the talents, past experiences, and wisdom, along with a deep love of the mathematical sciences, to make an ideal AMS president. If elected, John would undoubtedly further the interests of mathematics, both in its core and in its applications, and he would promote excellence in research, teaching, and exposition.

Nomination of David A. Vogan Jr.

Jeffrey Adams

David Vogan is an eminent research mathematician with a broad view of mathematics, its future, and its role in

Jeffrey Adams is professor of mathematics at the University of Maryland. His email address is jda@math.umd.edu.

society. David has a powerful sense of commitment to mathematics, and has worked tirelessly over the years on behalf of his students, colleagues, and the mathematical community. He is an effective administrator with extensive experience at MIT, with the AMS, and elsewhere. He would be a superb president of the American Mathematical Society.

David has been at the forefront of representation theory of Lie groups since his revolutionary Ph.D. thesis. His energy, generosity, and outgoing nature have put him at the center of an ongoing research program at the highest level. Currently, David is spearheading an innovative project to use computers to study representation theory. He has had many collaborators, has directed 28 Ph.D. students, and has mentored many postdocs. David is a talented writer and speaker—he has written four books and numerous expository articles, and he continuously travels the world lecturing to audiences at all levels.

David Vogan is an outstanding candidate for president of the AMS because of his mathematical accomplishments, his service to the mathematical community, and his administrative experience. I will discuss his mathematics, followed by his service.

Mathematics

David studies representations of Lie groups, which are named after the nineteenth-century mathematician Sophus Lie, and are continuous symmetry groups. The concept of symmetry is woven deep in the fabric of mathematics, and Lie groups are ubiquitous. A great deal of mathematics begins with the measure-preserving action of a group G on a measure space X. Understanding this action is at the heart of some of the most important subjects in mathematics. A powerful technique is to linearize the action of G on X by replacing it with the action of G, by linear operators, on the Hilbert space $L^2(X)$ of square-integrable functions. Such an action is a representation of G, and translates questions about the action of G on X to questions in representation theory, which are often more tractable.

Furthermore, these representations inherit from $L^2(X)$ the property of being unitary: they preserve the positive definite Hermitian form $(f,g)=\int^X f\bar{g}dx$. The action of G on $L^2(X)$ can be decomposed into irreducible representations of G (those with no closed invariant subspaces). Therefore it is of great interest to understand the irreducible unitary representations of G. This is the problem of the unitary dual, one of the most important unsolved problems in representation theory, and indeed in all of mathematics.

Hermann Weyl's approach to quantum mechanics is an example of this, with a Lie group G acting on a phase space X. On the other hand, taking X to be the quotient of $SL(2, \mathbb{R})$ (two-by-two real matrices of determinant one) by a discrete subgroup gives the setting of the solution to Fermat's Last Theorem. Generalizations to other groups, such as $GL(n, \ )$ (all $n\times n$ invertible matrices), form the basis of much of number theory, including the Langlands program, which is currently a topic of intense study.

David has made numerous contributions to this broad field, many of which are motivated by the goal of understanding the unitary dual of an arbitrary Lie group. Work on the unitary dual has generated a great deal of mathematics of independent interest, in much the same way that Fermat's Last Theorem has led to deep results in algebraic geometry and number theory.

Prior to David's 1976 MIT thesis, representation theory of Lie groups had been primarily an analytical subject. David turned many analytic questions into algebraic ones, thus bringing powerful techniques from algebra to bear. This gives a new approach to the study of representation theory, providing very different information than that provided by analytical methods. David's 1981 book, *Real Reductive Lie Groups*, laid the foundation for this theory.

One potential disadvantage of the algebraic approach is that it is not, a priori, well suited to studying unitary representations. In the algebraic setting, a representation may have an invariant Hermitian form. To be unitary this form must be positive definite, leading to the problem of computing signatures of invariant Hermitian forms.

In David's groundbreaking 1984 paper, "Unitarizability of certain series of representations", he defined the signature character of a representation, which makes it possible to study signatures of invariant Hermitian forms, and hence unitarity, in the algebraic setting. This deep result gives substantial new information about the structure of the unitary dual.

Recently, David's work on the unitary dual has turned in an innovative new direction. In his 1984 paper, David formulated an algorithm for computing the unitary dual. However, this algorithm depends on computing some signs which were inaccessible at the time. In 2002, David was a founding member of the "Atlas of Lie Groups and Representations", dedicated to exploring the possibility of completing this algorithm. The first goal of the project is to implement representation theory of Lie groups on a computer, for use by researchers and as an educational tool. The second is to use the software to compute the unitary dual.

Carrying out this project has required carefully rethinking the entire subject from the ground up, with explicit algorithms in mind. This is a project for which David is uniquely qualified. One of his hallmarks is his precision and attention to detail (he *never* makes mistakes). As David foresaw, this process has led to a deeper understanding of the mathematics, and David recently had a fundamental new insight into the subject. He observed that using a modification of the invariant Hermitian form on a representation resolves the issues of signs, which had remained intractable since 1984, and makes it possible to complete the algorithm to compute the unitary dual. This observation also suggests deep connections between the unitary dual and the theory of mixed Hodge modules. The Atlas project is now on the verge of tackling the final step: computing signatures of Hermitian forms, and the unitary dual.

Essential to understanding the representation theory of a (semisimple) Lie group are its Kazhdan-Lusztig-Vogan (KLV) polynomials. The problem of computing these polynomials is a famously difficult one. A demanding test case of the computation is for the largest real exceptional Lie group, E_8. In 2006, after substantial mathematical and computational advances, the Atlas project achieved a notable milestone in the computation of the KLV polynomials for E_8. The project put out a press release on the computation, and the resulting media attention heightened awareness of research mathematics worldwide.

Service

David Vogan is a gifted expositor, not only for specialists, but also for students and the general public. David's charming 2007 *Notices* article on the E_8 calculation (see the end of the previous section), an accessible description of the calculation for the nonspecialist, was the winner of the 2011 AMS Levi Conant Prize for mathematical exposition. His 1987 book, *Unitary Representations of Reductive Lie Groups*, is an excellent overview of the subject, and is a valuable entry point for graduate students and anyone else interested in the field. David co-authored the book *Cohomological Induction and Unitary Representations* with Anthony Knapp, which is the standard reference for the subject. He has also co-authored one other research-level book and a number of expository articles.

David Vogan has given many distinguished lectures, including a plenary address at the International Congress of Mathematicians in Berkeley, the Hermann Weyl Memorial Lectures at Princeton, and the Ritt Lectures at Columbia. Every year David lectures at conferences and departments around the world, often in developing countries. David's dedication to mathematics worldwide is also reflected in his past membership on the Committee on the Human Rights of Mathematicians.

Everyone who knows David Vogan is aware of his quiet dedication to all facets of mathematics, and he brings the same energy and intellectual rigor to these aspects of mathematical life as he does to his research. David has served the AMS in many ways over the years, including as a member of both the AMS Council and the Science Policy Committee. David was a founder of the electronic AMS journal *Representation Theory*. Thanks in part to David's efforts, it has become one of the top journals in the subject. David has also served on the editorial boards of the *Bulletin of the AMS* and *International Mathematical Research Notices*, and was a corresponding editor for Princeton University Press.

I have often heard David speak passionately of his commitment to education and mentoring, and how rewarding he finds these aspects of his job. Except for a stint as a postdoc at the Institute for Advanced Study, David has been teaching and doing research at MIT continuously since he was a graduate student, where he has been a mentor to a continuous stream of postdocs and visiting researchers. Indeed many of the young (or not so young anymore) people working in the subject have either been David's students or have been mentored by him. For over thirty years, David has organized the MIT Lie groups seminar, an important forum for new developments in the subject. He has also helped to organize numerous conferences, including the graduate component of a summer Park City Mathematics Institute.

David is equally committed to undergraduate education, and has played a leading role in the undergraduate mathematics program at MIT. Over the years, he has served multiple terms as chair of both the graduate and undergraduate committees. From 1993–1998 David served on the AMS Task Force on Excellence in Mathematics Scholarship.

David was head of the Department of Mathematics at MIT from 1999–2004. He is highly regarded for his work in this demanding position, leading a large and prestigious department that includes both pure and applied mathematics. As head, David was a forceful advocate for women, as he has been his entire career—eight of his Ph.D. students are women, as well as two of his Master's students.

The president of the AMS should be a first-rate research mathematician with a perspective on all aspects of mathematics. He should be a spokesman for the subject, and skillful at explaining mathematics to all audiences. He should be committed to the mathematical community, and be an effective administrator. These are all qualities that David Vogan has embodied throughout his career, and that would make him an outstanding president.