Seattle, Washington

Washington State Convention Center and Sheraton Seattle

January 6–9, 2016

Wednesday–Saturday

Meeting #1116

Joint Mathematics Meetings, including the 122nd Annual Meeting of the AMS, 99th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association of Symbolic Logic (ASL), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).
AMS Associate Secretary: Michel Lapidus
Announcement issue of *Notices*: October 2015
Program first available on AMS website: To be announced

Deadlines

For organizers: Expired
For abstracts: September 22, 2015
The scientific information listed below may be dated. For the latest information, see `www.ams.org/meetings/national.html`.

Joint Invited Addresses

Jennifer Chayes, Microsoft Research, *Network Science: From the online world to cancer genomics*; Saturday, 3:00 pm (MAA-AMS-SIAM Gerald and Judith Porter Public Lecture)

Kristin Lauter, Microsoft Research, *Title to be announced*; Friday, 11:10 am (AMS-MAA**).**

Xiao-Li Meng, Harvard University, *Statistical paradises and paradoxes in big data*; Friday, 11:10 am (AMS-MAA**).**

Karen E Smith, University of Michigan, *Title to be announced*. Thursday, 10:05 am (AWM-AMS Noether Lecture).

Joint Prize Session

In order to showcase the achievements of recipients of the various prizes, the AMS and MAA are co-sponsoring this event at 4:25 pm on Thursday. A cash bar reception will immediately follow. All participants are invited to attend. The AMS, ASA, MAA, and SIAM will announce the JPBM Communications Award winner. The AMS, MAA, and SIAM will award the Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student. The AMS and SIAM will announce the Norbert Wiener Prize in Applied Mathematics. The AMS will announce the winners of the Award for Distinguished Public Service, Chevalley Prize in Lie Theory, Levi L. Conant Prize, E. H. Moore Research Article Prize, David P. Robbins Prize, Leroy P. Steele Prizes, and the Oswald Veblen Prize in Geometry. The MAA will award the Chauvenet Prize, Euler Book Prize, Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics, and the Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics. The AWM will present the Louise Hay Award for Contributions to Mathematics Education, the M. Gweneth Humphreys Award for Mentorship of Undergraduate Women in Mathematics, and the Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman.

122nd Meeting of the AMS

AMS Invited Addresses

Panagiota Daskalopoulos, Columbia University, *Title to be announced*; Saturday, 9:00 am

Alex Eskin, University of Chicago, *The SL(2,ℝ) action on moduli space*; Friday, 10:05 am

Timothy Gowers, University of Cambridge, *Generalizations of Fourier analysis, and how to apply them*. Wednesday–Friday, 1:00 pm (Colloquium Lectures)

Marta Lewicka, University of Pittsburgh, *Prestrained elasticity: curvature constraints and differential geometry with low regularity*; Wednesday, 10:05 am

Daniel A. Spielman, Yale University, *Title to be announced*; Wednesday, 8:30 pm (Josiah Willard Gibbs Lecture)

David Vogan, Massachusetts Institute of Technology, *Conjugacy classes and group representations*; Thursday, 3:20 pm (AMS Retiring Presidential Address)

Steven M. Zelditch, Northwestern University, *Title to be announced*; Thursday, 2:15 pm

AMS Special Sessions

If you are volunteering to speak in a Special Session, you should send your abstract as early as possible via the abstract submission form found at `jointmathematicsmeetings.org/meetings/abstracts/abstract.pl?type=jmm`.

Some sessions are co-sponsored with other organizations. These are noted within the parentheses at the end of each listing, where applicable.

Advances in Free Analysis: the Theory and Applications of Noncommutative Functions, Inequalities, and Domains, **Joseph A. Ball**, Virginia Polytechnic Institute, and **Paul S. Muhly**, University of Iowa, Iowa City.

Advances in the Theory and Application of Reaction Diffusion Models, **Jerome Goddard, II**, Auburn University, and **Ratnasingham Shivaji**, University of North Carolina, Greensboro.

Algebraic Theory of Differential and Functional Equations , **Taylor Dupuy**, Hebrew University of Jerusalem and University of Vermont, and **Alexey Ovchinnikov**, CUNY Queens College, New York.

Algebraic and Topological Methods in Combinatorics, **Andrew Berget**, Western Washington University, **Steven Klee**, Seattle University, and **Isabella Novik**, University of Washington, Seattle.

Analysis and Geometry in Nonsmooth Metric Measure Spaces, **Luca Capogna**, Worcester Polytechnic Institute, and **Jeremy Tyson**, University of Illinois at Urbana-Champaign.

Analysis, Geometry, and Data, **Kevin R. Vixie**, Washington State University, Pullman, and **Bala Krishnamoorthy**, Washington State University, Vancouver.

Analytic Function Spaces and Operators on Them, **Tim Ferguson** and **Hyun Kwon**, University of Alabama, Tuscaloosa.

Analytic Methods in Geometry, **Eric Bahuaud** and **Dylan Helliwell**, Seattle University.

Applications of Logic, Model Theory, and Theoretical Computer Science to Systems Biology, **James Lynch**, Clarkson University, and **Leo Marcus**, Santa Monica, CA (AMS-ASL).

Applied and Computational Topology, **Pawel Dlotko**, INRIA Saclay, France, **Nicholas Scoville**, Ursinus College, and **Matthew Wright**, IMA University of Minnesota.

Arithmetic Dynamics, **Matthew Baker**, Georgia Institute of Technology, and **Joseph Silverman**, Brown University.

Big Demand for Big Data: How Do We Create the Big Supply?, **Rick Cleary**, Babson College, and **Xiao-Li Meng**, Harvard University.

Classification Problems in Operator Algebras, **Marcel Bischoff** and **Ben Hayes**, Vanderbilt University.

Combinatorial Design Theory, **Esther R. Lamken**, California Institute of Technology.

Commutative Algebra, **Karen Smith**, University of Michigan, Ann Arbor, **Emily Witt**, University of Utah, and **Irena Swanson**, Reed College (AMS-AWM).

Commutative Algebra and Its Interactions with Algebraic Geometry, **Daniel Hernández**, University of Utah, **Jack Jeffries**, University of Michigan, Ann Arbor, and **Karl Schwede**, University of Utah (AMS-AWM).

Commutative Algebra, I (a Mathematics Research Communities Session), **Linquan Ma**, University of Utah, **Sarah**

Mayes-Tang, Quest University, and **Jonathan Moñtano**, University of Kansas.

Current Areas of Interest in the Mathematical Sciences of Medieval Islam, **Mohammad K. Azarian**, University of Evansville, and **Mohammad Javaheri** and **Emelie A. Kenney**, Siena College.

Data-Intensive Modeling in Ecology, **Nikolay Strigul**, Washington State University, Vancouver, and **Bala Krishnamoorthy**, Washington State University, Vancouver.

Difference Equations and Applications, **Michael A. Radin**, Rochester Institute of Technology.

Differential Equations, Probability and Sea Ice, I (a Mathematics Research Communities Session) , **B. Cael Barry**, MIT and Woods Hole Oceanographic Institution, **Kaitlin Hill**, Northwestern University, **Ross Lieb-Lappen**, Dartmouth College, **Christian Sampson**, University of Utah, and **Alexandria Volkening**, Brown University.

Distribution of Zeros of Entire Functions, **Matthew Chasse**, Rochester Institute of Technology, **Tamás Forgács**, California State University, Fresno, and **Andrzej Piotrowski**, University of Alaska Southeast, Juneau.

Early Career Female Mathematicians in Algebra and Topology, **Jocelyn Bell**, United States Military Academy, West Point, **Bethany Kubik**, University of Minnesota, Duluth, and **Candice Price**, Sam Houston State University.

Equations of Fluid Motion , **Elaine Cozzi** and **Radu Dascaliuc**, Oregon State University, and **James P. Kelliher**, University of California Riverside.

Essential Mathematical Structures and Practices in K–12 Mathematics, **William McCallum**, University of Arizona, Tucson, **Kristin Umland**, University of New Mexico, and **Ellen Whitsides**, University of Arizona, Tucson.

Financial Mathematics, I (a Mathematics Research Communities Session), **Triet Pham**, Rutgers University, **Wilber A. Ventura**, University of Texas at Arlington, and **Kim Weston**, Carnegie Mellon University.

Fractal Geometry and Dynamical Systems, **John Rock**, Cal Poly Pomona, **Machiel van Frankenhuijsen**, Utah Valley University, and **Michel L. Lapidus**, University of California, Riverside.

Geometric and Categorical Methods in Representation Theory, **Anthony Licata**, Australian National University, and **Julia Pevtsova**, University of Washington, Seattle.

Global Harmonic Analysis, **Steven Zelditch**, Northwestern University, **Hart Smith**, University of Washington, Seattle, and **Chris Sogge**, Johns Hopkins University.

Graduate Mathematics Courses and Programs for Secondary Mathematics Teachers, **James J. Madden**, Louisiana State University, Baton Rouge, and **James A. Mendoza Epperson**, University of Texas, Arlington.

Graph Products, **Richard Hammack** and **Dewey Taylor**, Virginia Commonwealth University.

Higher Genus Curves and Fibrations of Higher Genus Curves in Mathematical Physics and Arithmetic Geometry, **Andreas Malmendier**, Utah State University, Logan, and **Tony Shaska**, Oakland University, Rochester.

Innovative Ideas in Enhancing Success in Mathematics Classes, **Natali Hritonenko**, Prairie View A&M University, **Ellina Grigorieva**, Texas Woman's University, and **Michael A. Radin**, Rochester Institute of Technology (AMS-MAA).

Integrable Systems, Painlevé Equations, and Random Matrices, **Anton Dzhamay**, University of Northern Colorado, **Christopher M. Ormerod**, California Institute of Technology, and **Virgil U. Pierce**, University of Texas-Pan American.

Interactions between Noncommutative Algebra, Algebraic Geometry, and Representation Theory, **Ellen Kirkman**, Wake Forest University, and **James Zhang**, University of Washington.

Knots in Washington (State), **Allison Henrich**, Seattle University, **Sam Nelson**, Claremont McKenna College, **Jozef Przytycki**, George Washington University, and **Radmila Sazdanovic**, North Carolina State University, Raleigh.

Mathematical Information in the Digital Age of Science, **Patrick Ion**, University of Michigan, Ann Arbor, **Olaf Teschke**, zbMATH, Berlin, and **Stephen Watt**, University of Western Ontario.

Mathematical Programming on Integral Invexity, **Ram Verma**, Texas State University, San Marcos, and **Alexander Zaslavski**, Israel Institute of Technology.

Mathematics and Public Policy, **Paul Dreyer**, RAND Corporation.

Mathematics in Natural Resource Modeling, **Catherine A. Roberts**, College of the Holy Cross, and **Shandele M. Henson**, Andrews University.

Metrical and Topological Fixed Point Theory with Applications, **Clement Boateng Ampadu**, Boston, MA, **Talat Nazir**, Mälardalen University, Sweden, and **Hudson Akewe**, University of Lagos, Nigeria.

Modular Forms, q-Series, and Mathematics Inspired by Ramanujan, **Chris Jennings-Shaffer**, University of Florida, Gainesville, and Oregon State University, Corvallis, and **Holly Swisher**, Oregon State University, Corvallis.

Moduli Spaces in Algebraic Geometry, **Yaim Cooper**, Harvard University.

Moduli Spaces in Symplectic Geometry, **Nathaniel Bottman**, MIT, **Joel Fish**, IAS, Princeton, and the University of Massachusetts, Boston, **Sheel Ganatra**, Stanford University, and **Katrin Wehrheim**, University of California Berkeley.

Nonlinear Algebra, **Bernd Sturmfels**, University of California Berkeley, and **Rekha Thomas**, University of Washington, Seattle.

Nonlinear Waves and Coherent Structures, **Natalie Sheils** and **Chris Swierczewski**, University of Washington, Seattle.

Number Theory and Cryptography, **Matilde Lalin**, University of Montreal, **Michelle Manes**, University of Hawaii, Honolulu, and **Christelle Vincent**, University of Vermont.

Operators, Function Spaces, and Models, **Alberto Condori**, Florida Gulf Coast University, Fort Myers, and **William Ross**, University of Richmond.

Origami Methods and Applications, **Erik Demaine**, MIT, **Thomas C. Hull**, Western New England University, and **Robert J. Lang**, Lang Origami.

Parabolic Geometries, Twistor Theory, and the AdS/CFT Correspondence , **Jonathan Holland** and **George Sparling**, University of Pittsburgh, and **Daniela Mihai**, Carnegie Mellon University.

Partial Differential Equations in Complex Analysis, **Debraj Chakrabarti**, Central Michigan University, and **Yunus Zeytuncu**, University of Michigan, Dearborn.

Problems and Challenges in Financial Engineering and Risk Management, **Matthew Lorig**, University of Washington, Seattle, and **Haijun Li** and **Hong-Ming Yin**, Washington State University, Pullman.

Problems in Geometry and Design of Materials, **Marta Lewicka**, University of Pittsburgh, and **Petronela Radu**, University of Nebraska.

Pseudorandomness and Its Applications, **Timothy Gowers**, University of Cambridge, and **Jozsef Solymosi**, University of British Columbia.

Quantum Walks, Quantum Markov Chains, Quantum Computation and Related Topics, **Chaobin Liu**, Bowie State University, **Takyua Machida**, Japan Society for the Promotion of Science, **Salvador E. Venegas-Andraca**, Technológico de Monterrey, Mexico, and **Nelson Petulante**, Bowie State University.

Random and Complex Dynamics of Reaction-Diffusion Systems, **Michael Anton Hoegele**, Universidad de Los Andes, Bogota, Colombia, and **Yuncheng You**, University of South Florida, Tampa.

Recent Advances in Dynamical Systems and Mathematical Biology, **Guihong Fan**, Columbus State University, **Jing Li**, California State University Northridge, and **Hongying Shu**, Tongji University, China.

Recent Advances in Orthogonal Polynomials and Special Functions, **Xiang-Sheng Wang**, Southeast Missouri State University, Cape Girardeau.

Recent Developments in Dispersive Partial Differential Equations and Harmonic Analysis, **William Green**, Rose-Hulman Institute of Technology, Terre Haute, and **Jennifer Beichman**, University of Wisconsin, Madison.

Representation Theory of Algebraic Groups, **Daniel K. Nakano**, University of Georgia, and **Cornelius Pillen**, University of South Alabama.

Research by Postdocs of the Alliance for Diversity in Mathematics, **Aloysius Helminck**, North Carolina State University, Raleigh, and **Michael Young**, Iowa State University, Ames.

Research from the 2014 and 2015 Rocky Mountain-Great Plains Graduate Research Workshop in Combinatorics, **Michael Ferrera**, University of Colorado, Denver, Greeley, **Leslie Hogben**, Iowa State University, Ames, **Paul Horn**, University of Denver, and **Derrick Stolee**, Iowa State University, Ames.

Research in Mathematics by Undergraduates and Students in Post-Baccalaureate Programs, **Darren A. Narayan** and **Jobby Jacob**, Rochester Institute of Technology, **Tamas Forgacs**, California State University, Fresno, and **Ugur Abdulla**, Florida Institute of Technology (AMS-MAA-SIAM).

Set-Valued Optimization and Variational Problems with Applications, **Baasansuren Jadamba** and **Akhtar A. Kahn**, Rochester Institute of Technology, **Mau Nam Nguyen**, Portland State University, **Miguel Sama**, Universidad Nacional de Educacion a Distancia, Spain, and **Christiane Tammer**, Martin Luther University of Halle-Wittenberg.

Special Functions and q-Series, **Richard Askey**, University of Wisconsin, Madison, **Mourad E. H. Ismail**, University of Central Florida and King Saud University, Riyadh, and **Erik Koelink**, Radboud University, Nijmegen, The Netherlands.

Stochastic Effects in Models for Mathematical Biology and Ecology, **Olcay Akman**, Illinois State University, **Timothy D. Comar**, Benedictine University, and **Daniel Hrozencik**, Chicago State University.

Stochastic Models in Population Biology, **Brian Dennis**, University of Idaho, Moscow, and **Eddy Kwessi**, Trinity University.

Surreal Numbers, **Philip Ehrlich**, Ohio University, Athens, and **Ovidiu Costin**, Ohio State University, Columbus (AMS-ASL).

Tensor Decompositions and Secant Varieties, **Zach Teitler**, Boise State University.

The History of Mathematics, **Patti Hunter**, Westmont College, **Adrian Rice**, Randolph-Macon College, **Sloan Despeaux**, Western Carolina University, and **Deborah Kent**, Drake University (AMS-MAA).

The Mathematics of Computation, **Susanne C. Brenner**, Louisiana State University.

Topological Graph Theory: Structure and Symmetry, **Jonathan L. Gross**, Columbia University, and **Thomas W. Tucker**, Colgate University.

Topological Representation Theory, **Charles Frohman**, University of Iowa, Iowa City, and **Helen Wong**, Carleton College.

Water Waves, **John Carter**, Seattle University, **Bernard Deconinck**, University of Washington, Seattle, and **Katie Oliveras**, Seattle University.

What's New in Group Theory?, **Arturo Magidin**, University of Louisiana at Lafayette, and **Elizabeth Wilcox**, Oswego State University of New York.

AMS Sessions for Contributed Papers

There will be sessions of ten-minute contributed talks. Although an individual may present only one contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once on the program. Contributed papers will be grouped together by related subject classifications into sessions.

Submission of Abstracts for AMS Sessions

Authors must submit abstracts of talks through `joint mathematicsmeetings.org/meetings/abstracts/abstact.pl?type=jmm`. Indicate the number of authors for the paper, click on the "New Abstract" button, and you will be taken to the submission form. Simply follow the step-by-step instructions (read them carefully) until you receive your unique abstract receipt number. No submission is complete until you are given this number. **The deadline for all submissions is September 22, 2015**. Late papers cannot be accommodated. Please email `abscoord@ams.org` if you have questions. If you make an inquiry about your specific abstract, please include your abstract receipt number.

Other AMS Sessions

AMS Committee on the Profession Panel Discussion: Promoting mathematics to policy makers and the public, Wednesday, 4:30 pm–6:00 pm. Mathematicians are often dismayed at the difficulties encountered in trying to convince nonexperts of the value of mathematics.

How can we, as individuals and as a profession, explain to non-mathematicians what it is that we do? Is it possible to shape the perception of mathematics and convince others that math is important enough to be worthy of support? How can such messages be made effectively and to as wide and diverse an audience as possible? A panel of mathematicians who have dealt with these and related issues share their insights. Organizers are **Allan Greenleaf**, University of Rochester; **Hal Sadofsky**, University of Oregon; and **Suzanne L. Weekes**, Worcester Polytechnic Institute. Panelists are: **Sam Rankin**, AMS; **Jordan Ellenberg**, University of Wisconsin; **Kristin Lauter**, Microsoft Research; and **William Massey**, Princeton University.

Navajo Math Circles, Wednesday, 6:30 pm–7:50 pm. Hundreds of Navajo children in recent years have found themselves at the center of a lively collaboration with mathematicians from around the world. The children stay late after school and assemble over the summer to study mathematics, using a model called math circles, which originated in Eastern Europe and which has proliferated across the United States. This notion of student-centered learning puts children in charge of exploring mathematics to their own joy and satisfaction, with potentially long-lasting results.

Navajo Math Circles is a one-hour film that is documenting the meeting of two worlds: that of some of the country's most accomplished mathematicians and math educators, with the children and teachers in the underserved, largely rural Navajo educational system. An 8-minute trailer gives a taste of the film.

The project is supported by the Mathematical Sciences Research Institute (MSRI) in Berkeley, California with a generous grant from the Simons Foundation, and by Vision Maker Media (VMM), Lincoln, Nebraska, and by the Corporation for Public Broadcasting (CPB). Following this premiere screening at the 2016 Joint Mathematics Meeting (JMM), Vision Maker Media will work with the Corporation for Public Broadcasting to schedule a national broadcast.

This film was directed by **George Csicsery** and produced by MSRI. Co-sponsored by the AMS and MAA.

AMS-MAA-SIAM Panel Discussion: Computing Across the Curriculum: Opportunities and Challenges, organized by **Rachel Levy**, Harvey Mudd College; and **Lee Zia**, National Science Foundation; Thursday, 8:30 am–10:00 am. As data science, industrial mathematics, and mathematical modeling have gained attention as popular tools in the workforce, a new focus on computation has entered mathematical sciences courses. In this panel, faculty will share their experiences incorporating computing across the mathematics curriculum. Computing will be discussed as a major focus of a course or as new modules or assignments integrated into existing courses. Challenges and opportunities associated with these efforts will also be presented, along with potential NSF funding avenues. This panel is co-sponsored by the AMS, MAA, and SIAM.

Conversation on Nonacademic Employment, Thursday, 10:30 am–noon. This session will concentrate on how to find nonacademic positions, types of jobs, the interview process, work environments, and advancement opportunities. The discussion will be led by a panel of mathematical scientists working in government and industry.

AMS & AWM Committees on Education Panel Discussion: Work in Mathematics Education in Departments of Mathematical Sciences, organized by **Jacqueline Dewar**, and **Pao-sheng Hsu**, AWM Education Committee; Thursday, 10:30 am–12:00 pm. Many in the mathematics community in the US are now involved in mathematics education in various capacities. This panel is designed to illustrate the breadth and range of these activities. It will highlight examples of contributions to mathematics education by members in the mathematical sciences, and include the perspectives of mathematicians and mathematics educators who contribute in areas such as: teacher education (pre- and in-service); instructional materials development in K–16 mathematics; scholarship of teaching and learning; mathematics education research. Panelists will discuss their work and may reflect on how their work is received in their departments. The moderator for this panel will be **Elizabeth Burroughs**, Montana State University; panelists are: **Curtis Bennett,** Loyola Marymount University; **Brigitte Lahme,** Sonoma State University; **Kristin Umland**, University of New Mexico; and **Megan Wawro,** Virginia Polytechnic Institute and State University.

AMS Committee on Education Panel Discussion: What is a Mathematics PhD? Thursday, 1:00 pm–2:30 pm. The panel will discuss a variety of issues related to the training and mentoring of mathematics PhDs, including best practices for mentoring; expectations and responsibilities for mentors; TA preparation and graduate teaching responsibilities; special challenges for women; minorities and international students; what is the optimal size of a graduate program?; process of administration of oral, defense and exit exams and opportunities for professional development. Sponsored by the AMS Committee on Education.

Grad School Fair, Friday, 8:30 am–10:30 am. Here is the opportunity for undergrads to meet representatives from mathematical sciences graduate programs from universities all over the country. January is a great time for juniors to learn more, and college seniors may still be able to refine their search. This is your chance for one-stop shopping in the graduate school market. At last year's meeting about 300 students met with representatives from 50 graduate programs. If your school has a graduate program and you are interested in participating, a table will be provided for your posters and printed materials for US$75 (registration for this event must be made by a person already registered for the JMM), and you are welcome to personally speak to interested students. Complimentary coffee will be served. Co-sponsored by the the AMS and MAA.

Who Wants to Be a Mathematician—National Contest, organized by **Michael A. Breen**, AMS, and **William T.**

Butterworth, DePaul University; Friday, 9:30 am–11:00 am. See ten of the nation's best high school students compete for a US$5,000 first prize for themselves and US$5,000 for their school's math department. Semifinals are at 9:30 am and finals at 10:30 am. You are invited to come and match wits with the contestants.

Current Events Bulletin, organized by **David Eisenbud**, Mathematical Sciences Research Institute; Friday, 1:00 pm–5:00 pm. Speakers in this session follow the model of the Bourbaki Seminars in that mathematicians with strong expository skills speak on work not their own. Written versions of the talks will be distributed at the meeting and will also be available online at `www.ams.org/ams/current-events-bulletin.html` after the conclusion of the meeting.

Committee on Science Policy Panel Discussion*: *The Role of Research in Preserving the American Dream, Friday, 2:30 pm–4:00 pm.

Congressional Fellowship Session, organized by **Samuel M. Rankin III**, AMS; Friday, 4:30 pm–6:30 pm. This fellowship provides a public policy learning experience, demonstrates the value of science-government interaction and brings a technical background and external perspective to the decision-making process in Congress. Learn more about this program and speak with current and former AMS Fellows. Application deadline for the 2016–17 AMS Congressional Fellowship is **February 15, 2016.**

Other AMS Events

Council, Tuesday, 1:30 pm.

Business Meeting, Saturday, 11:45 am. The secretary notes the following resolution of the Council: Each person who attends a business meeting of the Society shall be willing and able to identify himself as a member of the Society. In further explanation, it is noted that each person who is to vote at a meeting is thereby identifying himself as and claiming to be a member of the American Mathematical Society. The Society has a Committee on the Agenda for Business Meetings. The purpose is to make business meetings orderly and effective. The committee does not have legal or administrative power. It is intended that the committee consider what may be called "quasipolitical" motions. The committee has several possible courses of action on a proposed motion, including but not restricted to:

(a) doing nothing,

(b) conferring with supporters and opponents to arrive at a mutually accepted amended version to be circulated in advance of the meeting,

(c) recommending and planning a format for debate to suggest to a business meeting,

(d) recommending referral to a committee, and

(e) recommending debate followed by referral to a committee.

There is no mechanism that requires automatic submission of a motion to the committee. However, if a motion has not been submitted through the committee, it may be thought reasonable by a business meeting to refer it rather than to act on it without benefit of the advice of the committee.

In order that a motion for this business meeting receive the service offered by the committee in the most effective manner, it should be in the hands of the AMS Secretary by **December 13, 2015**.

AMS Short Course on Rigorous Numerics in Dynamics

This two-day course will take place on Monday and Tuesday before the meeting actually begins. It is co-organized by **Jean-Philippe Lessard**, Université Laval, Quebec, Canada, and **Jan Bouwe van den Berg**, VU University Amsterdam, Netherlands, who will give talks on *Delay Differential Equations and Continuation*, and *Introduction: General Setup and An Example That Forces Chaos* (respectively). The 2016 Short Course also features these talks by **Sarah Day**, The College of William & Mary, *Dynamics and Chaos For Maps and The Conley Index*; **J. D. Mireles James**, Florida Atlantic University, *Rigorous Computation of (Un)Stable Manifolds and Connecting Orbits*; **Thomas Wanner**, George Mason University, *Bifurcations and An Application in Materials Science*; and **J. F. Williams**, Simon Frasier University, *Every Calculation An Existence Proof: Towards Automated Rigorous Computing.*

There are separate registration fees to participate in this course. Advance registration **(before December 22, 2015)**: Member, US$110; Non-member, US$165; Student, unemployed, or emeritus, US$58. On-site registration: Member, US$144; Non-member, US$195; Student, unemployed, or emeritus, US$79. Please see the complete article on page 1106 of this issue or at `www.ams.org/meetings/short-courses/short-course-general`.

NSF-EHR Grant Proposal Writing Workshop

Developing a Competitive Proposal for NSF-EHR, Monday (two days before the first day of the JMM), 3:00 pm–6:00 pm. Workshop goals are to familiarize participants with current direction/priorities in EHR, familiarize participants with key EHR education research and development programs, consider common issues of competitive proposals, and prepare participants to write a competitive proposal. There is no registration fee for this workshop, but participants must register separately in advance. Please contact the AMS Washington Office at 401-455-4116 or `amsdc@ams.org` for further information.

Department Chairs Workshop

This annual one-day workshop for department chairs and leaders is held on Tuesday, 8:00 am–6:30 pm, the day before the JMM actually begins, and is designed to stimulate discussion on a wide range of issues facing departments today, including personnel issues (staff and faculty), long-range planning, hiring, promotion and tenure, budget management, assessments, outreach, stewardship, junior faculty development, communication, and departmental leadership. There is a separate registration and fee to participate. Interested participants should also consider attending the NSF-EHR Grant Proposal Writing Workshop to be held on Monday, January 4. For further information, please contact

the AMS Washington Office at 401-455-4116 or amsdc@ams.org.

99th Meeting of the MAA

MAA Invited Addresses

Steven Brams, New York University, *Fair Division;* Thursday, 9:00 am.

Katherine D. Crowley, Washington and Lee University, *Mathematics and Policy: Strategies for Effective Advocacy;* Wednesday, 3:20 pm.

Charles R. Hadlock, Bentley University, *A Mathematical Tour Through a Collapsing World;* Friday, 9:00 am.

Alan Schoenfeld, University of California, Berkeley, *What Makes for Powerful Classrooms and What Can We Do, Now That We Know?,* Saturday, 10:05 am.

T. Christine Stevens, American Mathematical Society, *Singing Along with Math: The Mathematical Work of the Opera Singer Jerome Hines*; Wednesday, 2:15 pm.

Presentations by MAA Teaching Award Recipients

Friday, 2:30 pm–3:50 pm, organized by MAA Secretary **Barbara Faires**, Westminster College, and MAA President **Francis Su**, Harvey Mudd College. Winners of the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching will give presentations on the secrets of their success.

MAA Invited Paper Sessions

Current Trends in Mathematical and Computational Biology, organized by **Brian Walton**, James Madison University, and **Maeve McCarthy**, Murray State University; Thursday morning. Mathematical and computational biology encompasses a diverse range of biological phenomena and quantitative methods of exploring those phenomena. This session of current research topics will sample from this diversity. Biological application areas will address current research in growth and control of populations, spread and development of disease, evolution and bioinformatics, and molecular interactions in the cell. Mathematical approaches will include deterministic and stochastic dynamical models as well as combinatorial and algebraic models. This session is sponsored by BIO SIGMAA.

Fair Division, organized by **Michael Jones**, Mathematical Reviews, and **Jennifer Wilson**, The New School; Thursday 1:00 pm–4:15 pm. The goal of the session is to show how different types of mathematics can be used to address questions in both theoretical and applied aspects of fair division. Although a relatively new field, fair division now encompasses a wide variety of approaches (analytic, combinatoric, geometric, and axiomatic) to address both discrete and continuous problems. Fairness criteria can be applied to such diverse applications as cake cutting, the establishment of priority lists, and resource allocation.

Although the talks will be research oriented, speakers will include an expository overview to introduce fair division to a diverse audience including students.

This MAA Invited Paper Session accompanies Steven Brams' invited address on the same topic.

What Do We Know About University Mathematics Teaching, and How Can it Help Us?, presented by **Alan Schoenfeld**, University of California Berkeley; Friday 1:00 pm–5:00 pm. Research on university-level mathematics teaching and learning has grown over the past few decades from a cottage industry into a robust enterprise, both in general (with findings on problem solving, "powerful teaching," and understanding how and why teachers make the choices they do while teaching) and with regard to specific courses (e.g., developmental mathematics, linear algebra, proof). In turn, the research has led to applications to teaching. This too is in general (with professional development framed around the issues raised in research leading to changes in teaching) and in particular courses.

MAA Minicourses

MAA Minicourses are open only to persons who register for the Joint Meetings and pay the Joint Meetings registration fee in addition to the appropriate minicourse fee. The MAA reserves the right to cancel any minicourse that is undersubscribed. Participants should read the descriptions of each minicourse thoroughly as some require participants to bring their own laptops and special software; laptops will not be provided in any minicourse. The enrollment in each minicourse is limited to 50; the cost is US$85.

Minicourse #1. ***Introductory Proposal Writing for Grant Applications to the NSF EHR/Division of Undergraduate Education***, presented by **John Haddock**, **Teri Jo Murphy**, and **Lee Zia**, Division of Undergraduate Education, National Science Foundation; Part A, Tuesday, 9:00 am–11:00 am, and Part B, Tuesday, 2:00 pm–3:00 pm. The presenters will describe the general NSF grant proposal process and consider particular details relevant to programs in the Division of Undergraduate Education. This course is geared toward those who have not submitted a proposal to NSF and are unfamiliar with the organization. If you believe you have an idea, project or program worthy of Federal support that will positively impact undergraduate education in mathematics, you should attend this session. This two-part short course will provide information on the specific components of a NSF proposal, demonstrate the NSF peer review process, provide access to previously funded proposals and explicate the NSF merit review criteria by which proposals are reviewed. Participants should leave this minicourse with a draft of a project summary.

N.B. This course is offered on Tuesday, January 5, the day before the Joint Mathematics Meetings officially begin.

Minicourse #2. ***Visual Topics in Undergraduate Complex Analysis,*** presented by **Michael Brilleslyper,** US Air Force Academy**,** and **Michael Dorff,** Brigham Young University; Part A, Wednesday, 4:45 pm–6:45 pm, and Part B, Friday, 3:30 pm–5:30 pm. Complex analysis is a staple of the undergraduate mathematics curriculum. It is a beautiful mathematical subject that unifies and extends many topics from other courses. The course readily pulls together the theories of polynomial equations, differentiation, integration, and series, while also including geometry and function theory. Unfortunately, many undergraduate

courses end right where the cool stuff starts. In this minicourse, the proposers intend to expose the participants to two of the myriad of topics that are possible: (1) an introduction to minimal surfaces, and (2) the dynamics and locations of zeros of families of polynomials. Both of these topics are accessible to an audience having familiarity with the basics of complex analysis. The course is aimed at instructors of complex variables who are looking for some interesting topics for their courses, mathematicians who want to start learning something about the proposed areas, and instructors looking for potential undergraduate research projects to do with their students. Participants will need to bring their own computers with a current version of `Mathematica`, `Maple`™, or `MATLAB`. There will be limited support for `Sage`.

Minicourse #3. ***Designing and Implementing a Problem Based Mathematics Course***, presented by **Gail Burrill,** Michigan State University; **Bowen Kerins,** Educational Development Center; and **Darryl Yong,** Harvey Mudd College; Part A, Wednesday, 4:45 pm–6:45 pm, and Part B, Friday, 3:30 pm–5:30 pm. This is a problem based math course, where students spend most of the time in an interactive, collaborative environment, working on problems connecting various mathematical domains, which can simultaneously engage a broad range of students and enlarge their understanding of what it means to do math. The panelists will discuss the design of such a course, consider issues related to teaching the course, and describe how it might be implemented in a mathematics program. Such courses were originally developed for teachers at the Park City Mathematics Institute but are applicable for undergraduate majors, prospective teachers, or as part of continuing education programs for experienced teachers. Discussion will be framed by asking what the mathematical goals of such a course might be, how these goals could contribute to a better student understanding of what it means to do mathematics and how such courses might be part of the offerings in a typical math department.

Minicourse #4. ***Teaching Mathematics with Sports Applications***, presented by **Rick Cleary,** Babson College; Part A, Wednesday, 2:15 pm–4:15 pm, and Part B, Friday, 1:00 pm–3:00 pm. This minicourse is designed to help participants who wish to develop a course in mathematics and sports, or to incorporate sports applications into existing courses. The depth of the problems will range from those that require little mathematical background (elementary probability, statistics and combinatorics) that would be suitable in a first year seminar or general education course, to more sophisticated topics (linear algebra, operations research, mathematics of finance) that can make up an elective for mathematics majors or minors. Examples will come from many different sports including baseball, basketball, football, figure skating, distance running and others depending on the interest of participants. Application topics will include strategy, ranking and judging, efficient scheduling and optimization. Participants will find many of the issues are connected to essays in the MAA-published book *Mathematics and Sports* edited by Joe Gallian.

Minicourse #5. ***Teaching Introductory Statistics for Instructors New to Teaching Statistics***, presented by **Carolyn K. Cuff,** Westminster College; Part A, Wednesday, 9:00 am–11:00 am, and Part B, Friday, 9:00 am–11:00 am. This minicourse, intended for instructors new to teaching statistics, exposes participants to the big ideas of statistics and the ASA-endorsed Guidelines for Assessment and Instruction in Statistics Education (GAISE) report. It considers ways to engage students in statistical literacy and thinking, and contrast conceptual and procedural understanding in the first statistics course. Participants will engage in many of the classic activities that all statistics instructors should know. A set of approximately 6–8 hands-on classroom-ready activities will be given to participants. Parts of each activity will be done by the participants, other parts will be summarized by the presenter and the main statistical ideas of the activity will be explained to the participants. The activities have been chosen so that they require minimal adaptation for a wide variety of classrooms and are easy to implement. Each activity includes goals, key ideas, prerequisite skills and concepts, connection to other statistical concepts, objectives, known student difficulties and assessment questions. Internet sources of real data, activities, and best practices articles will be examined. Participants will find out how they can continue to learn about the best practices for the first course in Statistics by becoming involved in statistics education related conferences, newsletters, and groups.

Minicourse #6. ***Getting Started in the Scholarship of Teaching and Learning***, presented by **Jacqueline M. Dewar** and **Curtis D. Bennett,** Loyola Marymount University; Part A, Thursday, 8:30 am–10:30 am, and Part B, Saturday, 9:00 am–11:00 am. This course will introduce participants to the scholarship of teaching and learning (SoTL) in mathematics and help them begin projects of their own. We describe a taxonomy of SoTL questions, provide examples of SoTL projects in mathematics, and discuss methods for investigation. Participants will learn about collecting and analyzing different types of evidence, dealing with human subjects requirements, and selecting venues for presenting or publishing their work. With the presenters' guidance, participants interactively select and transform a teaching problem of their own into a question for scholarly investigation and identify several types of evidence to gather.

Minicourse #7. ***Making Sense of Calculus with Mapping Diagrams***, presented by **Martin Flashman**, Humboldt State University; Part A, Thursday, 1:00 pm–3:00 pm, and Part B, Saturday, 1:00 pm–3:00 pm. In this minicourse participants will learn how to use mapping diagrams (MD) to visualize functions for many calculus concepts. For a given function, f, a mapping diagram is basically a visualization of a function table that can be made dynamic with current technology. The MD represents x and $f(x)$ from the table as points on parallel axes, and arrows between the points indicate the function relation. The course will start with an overview of MD's and then connect MD's to key calculus definitions and theory including: linearity, limits, derivatives, integrals, and series. Participants will

learn how to use MD's to visualize concepts, results and proofs not easily realized with graphs for both single and multi-variable calculus. Participants are encouraged to bring a laptop with wireless capability.

Minicourse #8. ***Algebraic Geometry: A Problem Based Course***, presented by **Thomas Garrity**, Williams College, and **Ryan Brown**, Georgia College; Part A, Wednesday, 2:15 pm–4:15 pm, and Part B, Friday, 1:00 pm–3:00 pm. Participants will learn how to structure an introductory undergraduate course in algebraic geometry that is problem based (and hence an inquiry based learning course). As algebraic geometry is one of the core subjects of mathematics, such a course allows undergraduates to be introduced to a tremendous amount of material. Further, such a course can be and has been taught either with a linear algebra prerequisite or with an abstract algebra prerequisite. This type of course should be of interest to students who want to become secondary school teachers and also to those students who plan to pursue graduate work in mathematics. People who want to teach an IBL algebraic geometry course or who just want a brief introduction to algebraic geometry are encouraged to attend.

Minicourse #9. ***Increasing Student Engagement and Understanding through Active Learning Strategies in Calculus***; presented by **Debbie Gochenaur**, Shippensburg University; **Larissa Schroeder**, University of Hartford; **Matt Boelkins**, Grand Valley State University; **Angie Hodge**, University of Nebraska Omaha; **Carrie Diaz Eaton**, Unity College; and **Dana Ernst**, Northern Arizona University; Part A, Wednesday, 2:15 pm–4:15 pm, and Part B, Friday, 1:00 pm–3:00 pm. Participants will learn curricular and co-curricular evidence-based, active learning strategies to embed in a Calculus I course. Active learning is a process whereby students engage in activities, such as writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content; positively impacting student success can begin with an increase in student engagement within the classroom. This minicourse, intended for the novice user, will include small group discussion and hands-on development of active learning strategies. Participants should bring digital copies of their own curriculum material so that strategies can be embedded into personal material during the workshop. Bring a laptop with wireless capability.

Minicourse #10. ***Directing Undergraduate Research***, presented by **Aparna Higgins**, University of Dayton; Part A, Thursday, 1:00 pm–3:00 pm, and Part B, Saturday, 1:00 pm–3:00 pm. This minicourse will cover many aspects of facilitating research by undergraduates, such as getting students involved in research, finding appropriate problems, deciding how much help to provide, and presenting and publishing the results. Similarities and differences between research conducted during summer programs and research that can be conducted during the academic year will be discussed. The minicourse is designed for faculty who are new to directing undergraduate research. Although the examples used will be primarily in the area of discrete mathematics, the strategies discussed can be applied to any area of mathematics.

Minicourse #11. ***Implementing Inquiry-Oriented Curricula for Linear Algebra, Differential Equations, and Abstract Algebra***, presented by **Estrella Johnson**, Virginia Tech; **Karen Keene**, North Carolina State University; and **Christy Andrews-Larson**, Florida State University; Part A, Wednesday, 9:00 am–11:00 am, and Part B, Friday, 9:00 am–11:00 am. This session is designed to inform and support instructors interested in implementing inquiry-oriented curriculum. By inquiry-oriented we mean that the students are engaging in authentic mathematical inquiry and the teachers are actively involved in inquiring into students' mathematical thinking. This mini-course will have two components. In the first component participants will engage with mathematical tasks from three different research-based inquiry-oriented curricula that have been developed for Linear Algebra, Differential Equations, and Abstract Algebra. The goals of this component are to familiarize participants with the curricular tasks, the nature of the instruction, and common ways of student thinking. The second component will focus on high-leverage teaching practices that can be used in any inquiry-oriented setting. Examples of such practices include leading whole class discussions and launching instructional tasks. The goals of this component are to provide instructors with opportunities to develop some of the necessary teaching practices needed to implement inquiry-oriented curricula.

Minicourse #12. ***Humanistic Mathematics***, presented by **Gizem Karaali**, Pomona College, and **Eric Marland**, Appalachian State University; Part A, Wednesday, 9:00 am–11:00 am, and Part B, Friday, 9:00 am–11:00 am. The phrase humanistic mathematics is historical, going back about thirty years, and awakens many connotations in those who hear it. Indeed humanistic mathematics can include a broad range of topics; we use it in two distinct manners. First, as a scholarly perspective, humanistic mathematics describes an approach to mathematics that views it as a human endeavor and focuses on the paths of inquiry that study its aesthetic, cultural, historical, literary, pedagogical, philosophical, psychological, and sociological aspects. Second, as a pedagogical stance, humanistic mathematics explores and builds on the relationship of mathematics with its nontraditional partners in the humanities, the fine arts, and social sciences, providing additional perspective for the role of mathematics in a liberal arts education. This mini-course will introduce participating mathematics faculty to the ideas and scholarship of humanistic mathematics, a body of literature that eschews disciplinary jargon (e.g., edu-speak) in favor of reaching a more diverse audience. As concrete outcomes, participants will: develop a viable plan for a liberal arts course that they can offer at their own campuses to invite many new students into the fascinating world of mathematics; come up with ideas for possible scholarly projects in order to contribute to the ongoing conversations in the field; connect with like-minded colleagues; and get informed about possible venues of communication, collaboration, and dissemination of materials related to humanistic mathematics.

Minicourse #13. ***Introduction to Process Oriented Guided Inquiry Learning (POGIL) in Mathematics Courses***, presented by **Laurie Lenz**, Marymount University, and **Catherine Beneteau**, University of South Florida; Part A, Thursday, 1:00 pm–3:00 pm, and Part B, Saturday, 1:00 pm–3:00 pm. This minicourse will introduce faculty to the guided inquiry instructional method called POGIL (Process Oriented Guided Inquiry Learning). Participants will use hands-on activities to learn the crucial elements in a successful guided inquiry classroom. The workshop will provide participants with a basic introduction to facilitation techniques and an opportunity to reflect on how facilitation can enhance or interfere with student learning as well as how facilitation strategies can be critical in the development of student process skills. The participants will have the opportunity to examine a POGIL calculus activity and be introduced to the way the learning structure that is integrated into all POGIL activities is implemented in a mathematics specific activity. By the end of the workshop, participants will be trained to begin implementing guided inquiry activities in their own mathematics classrooms.

Minicourse #14. ***Teaching Quantitative Reasoning with Common Sense and Common Knowledge***, presented by **Maura B. Mast**, and **Ethan D. Bolker**, University of Massachusetts Boston; Part A, Thursday, 9:00 am–11:00 am, and Part B, Saturday, 9:00 am–11:00 am. Ten years from now, what do you want or expect your Quantitative Reasoning students to remember? Our answers to those questions profoundly shaped our approach to the course. We realized that in ten years, what matters will be how students approach a problem using the tools they carry with them–common sense and common knowledge–not the particular mathematics we chose for the curriculum. This has changed how and what we teach. In this minicourse we will provide hands-on experience with class activities using our approach and practice creating examples and exercises from current news.

Minicourse #15. ***Teaching Statistics using R and RStudio***, presented by **Randall Pruim**, Calvin College; Part A, Thursday, 10:00 am–12:00 noon, and Part B, Saturday, 10:00 am–12:00 noon. R is a freely available language and environment for statistical computing and graphics that has become popular in academia and in many industries. But can it be used with students? This mini-course will introduce participants to teaching applied statistics courses using computing in an integrated way. The presenter has been using R to teach statistics to undergraduates at all levels for the last decade and will share an approach and some favorite examples. Topics will include workflow in the RStudio environment, providing novices with a powerful but manageable set of tools, data visualization, basic statistical inference using R, and resampling. Much of this will be facilitated using the mosaic package. The minicourse is designed to be accessible to those with little or no experience teaching with R, and will provide participants with skills, examples, and resources that they can use in their own teaching. Participants should bring a laptop to the session.

Minicourse #16. ***Mobile Mathematics—Interactive Apps for Teaching and Learning***, presented by **Lila Roberts**, Clayton State University, and **Andrew G. Bennett**, Kansas State University; Part A, Wednesday, 4:45 pm–6:45 pm, and Part B, Friday, 3:30 pm–5:30 pm. Mobile devices have made their way into our lives and our classrooms. In this minicourse, participants will learn about various ways to integrate tablets and other mobile devices into mathematics courses. The presenters will demonstrate interactive resources that they have developed as well as other applications/materials that are ready-made and easily available. In addition, participants will learn how to use various ways to develop new and/or adapt existing resources for their face-to-face and online classrooms. Bring your own mobile device and/or a wireless capable laptop computer.

MAA Contributed Papers

The MAA Committee on Contributed Paper Sessions solicits papers pertinent to the sessions listed below. Contributed Paper Session presentations are limited to fifteen minutes, except in the general session where they are limited to ten minutes. Each session room is equipped with a computer projector and a screen. Please note that the days and times scheduled for these sessions remain tentative. Several of these sessions have specific suggestions for the appropriateness of submissions. Potential submitters are advised to read the full descriptions of these sessions at `jointmathematicsmeetings.org/meeting/national/jmm2016/2181_maacall`.

The deadline for submission of abstracts is Tuesday, September 22, 2015.

MAA Contributed Paper Sessions with Themes

Addressing the Needs of Mathematics and Computer Science Majors in Discrete Mathematics Courses, organized by **Ksenija Simic-Muller**, Pacific Lutheran University; and **Tom J. Edgar**, Pacific Lutheran University; Saturday afternoon.

Assessing Student Learning: Alternative Approaches, organized by **David Clark**, Grand Valley State University; **Jane Butterfield**, University of Victoria; **Robert Campbell**, College of St. Benedict/St. John's University; and **Cassie Williams**, James Madison University; Wednesday morning.

Bringing the Community into the College Mathematics Classroom, organized by **Ksenija Simic-Muller**, Pacific Lutheran University; Thursday afternoon.

The Broad Impact of Math Circles, organized by **Katherine Morrison**, University of Northern Colorado; **Amanda Matson**, Clarke University, and **Philip Yasskin**, Texas A&M University; Thursday afternoon. Sponsored by the SIGMAA on Math Circles for Students and Teachers.

Common Core State Standards (CCSS) for Mathematics Practices and Content: The Role of Math Departments in Preparing Math Education Candidates for New Assessments, organized by **William Martin**, North Dakota State University; **Karen Morgan**, New Jersey City University; **Gulden Karakok**, University of Northern Colorado; and **James A. Mendoza Epperson**, University of Texas-Arlington; Thursday afternoon. Sponsored by the MAA Committee on the Mathematical Education of Teachers (COMET) and the MAA Committee on Assessment.

Contemplative Pedagogy and Mathematics, organized by **Luke Wolcott**, Lawrence University; and ***Justin Brody***, Goucher College; Friday afternoon.

The Contributions of Minorities to Mathematics Throughout History, organized by **Amy Shell-Gellasch**, Montgomery College; and **Lloyd Douglas**, University of North Carolina; Friday morning. Sponsored by the SIGMAA on the History of Mathematics.

Conversations with the Partner Disciplines: Collaborations to Improve the Mathematics Curriculum, organized by **Victor Piercey**, Ferris State University; **Suzanne I. Doree**, Augsburg College; **Jason Douma**, University of Sioux Falls; and **Susan Ganter**, East Carolina University; Saturday afternoon. Sponsored by the Curriculum Renewal Across the First Two Years (CRAFTY) and Mathematics Across the Disciplines (MAD) subcommittees of CUPM and the journal PRIMUS: Problems, Resources, and Issues in Undergraduate Mathematics Studies.

The Development and Adoption of Open Educational Resources for Teaching and Learning, organized by **Benjamin Atchison**, Framingham State University; and **Jeremy Russell**, The College of New Jersey; Friday afternoon.

Experiences and Innovations in Teaching Probability Theory, organized by **Jonathon Peterson**, Purdue University; and **Nathaniel Eldredge**, University of Northern Colorado; Wednesday morning.

Graduate Students Teach Too: Ideas and Best Practices, organized by **Samuel L. Tunstall**, Appalachian State University; Saturday morning.

Helping Students See Beyond Calculus, organized by **David Strong**, Pepperdine University; **James Tanton**, MAA; **Courtney Davis**, Pepperdine University; and **Angela Spalsbury**, Youngstown State University; Saturday afternoon. Sponsored by the SIGMAA Teaching Advanced High School Mathematics.

Incorporating the History of Mathematics into Developmental Math Courses, organized by **Van Herd**, University of Texas Austin; and **Amy Shell-Gellasch**, Montgomery College; Saturday morning. Sponsored by the SIGMAA on the History of Mathematics.

Innovative Approaches to One-Semester Calculus Courses, organized by **Joel Kilty** and **Alex M. McAllister**, Centre College; Thursday morning.

Innovative and Effective Ways to Teach Linear Algebra, organized by **David Strong**, Pepperdine University; **Gil Strang**, MIT; and **Megan Wawro**, Virginia Tech; Friday afternoon.

Innovative Targeted Solutions in Teaching Introductory Statistics, organized by **Patti Frazer Lock**, St. Lawrence University; **Randall Pruim**, Calvin College; and **Sue Schou**, Idaho State University; Thursday afternoon. Sponsored by the SIGMAA on Statistics Education.

Integrating Research into the Undergraduate Classroom, organized by **Shannon R. Lockard**, Bridgewater State University; and **Timothy B. Flowers**, Indiana University of Pennsylvania; Saturday afternoon.

Inquiry-Based Teaching and Learning, organized by **Brian Katz**, Augustana College; and **Victor Piercey**, Ferris State University; Friday morning.

Mathematical Modeling in the Undergraduate Curriculum, organized by **Jason Douma**, University of Sioux Falls; and **Rachel Levy**, Harvey Mudd College; Saturday morning. Sponsored by the MAA CUPM Mathematics Across the Disciplines Subcommittee and the SIAM Education Committee.

Mathematics and the Arts, organized by **Douglas Norton**, Villanova University; Wednesday morning and afternoon. Sponsored by the SIGMAA on Mathematics and the Arts.

Mathematics Experiences and Projects in Business, Industry, and Government, organized by **Carla D. Martin**, Dept. of Defense; and **Allen Butler**, Wagner Associates; Friday afternoon. Sponsored by the SIGMAA on Business, Industry, and Government.

Mathematics and Sports, organized by **Drew Pasteur**, College of Wooster; and **John David**, Virginia Military Institute; Saturday morning.

New Ideas in Teaching Upper-Level Statistics Courses, organized by **Patti Frazer Lock**, St. Lawrence University; **Randall Pruim**, Calvin College; and **Sue Schou**, Idaho State University; Friday afternoon. Sponsored by the SIGMAA on Statistics Education.

Origami in the Mathematics K–12 Classroom, organized by **Roger Alperin**, San Jose State University; and **Perla Myers**; University of San Diego; Saturday afternoon.

Preparation, Placement and Support of Elementary Mathematics Specialists, organized by **Laurie J. Burton**, Western Oregon University; **Cheryl Beaver**, Western Oregon University; and **Klay Kruczek**, Southern Connecticut State University; Thursday morning. Sponsored by the MAA Committee on the Mathematical Education of Teachers.

Professional Development for Mathematicians: A Session for MAA PREP Organizers and Participants, organized by **Jon Scott**, Montgomery College; **Barbara Edwards**, Oregon State University; **Nancy Hastings**, Dickinson College; and **Stan Yoshinobu**, Cal Poly San Luis Obispo; Wednesday afternoon. Sponsored by the MAA Committee on Professional Development.

Proofs and Mathematical Reasoning in the First Two Years of College, organized by **Joanne Peeples**, El Paso Community College; **Chris Oehrlein**, Oklahoma City Community College; and **Dean Gooch**, Santa Rosa Junior College; Wednesday morning. Sponsored by the MAA Committee on Two Year Colleges.

Quantitative Literacy in the K–16 Curriculum, organized by **Aaron Montgomery**, Central Washington University; **Gary Franchy**, Southwestern Michigan College; **Gizem Karaali**, Pomona College; **Andrew Miller**, Belmont University; and **Victor Piercey**, Ferris State University; Wednesday afternoon. Sponsored by the SIGMAA on Quantitative Literacy.

Recreational Mathematics: Puzzles, Card Tricks, Games, Game Shows, and Gambling, organized by **Paul R. Coe**, **Sara B. Quinn**, and **Marion Weedermann**, Dominican University; Thursday morning.

Research in Undergraduate Mathematics Education, organized by **Karen A. Keene**, North Carolina State University; Thursday morning and afternoon. Sponsored by

the SIGMAA on Research in Undergraduate Mathematics Education.

Revitalizing Complex Analysis, organized by **Russell Howell**, Westmont College; **Paul Zorn**, St. Olaf College; and **Alan Noellni**, Oklahoma State University; Saturday morning.

The Scholarship of Teaching and Learning in Collegiate Mathematics, organized by **Jacqueline Dewar**, Loyola Marymount University; **Thomas Banchoff**, Brown University; **Curtis Bennett**, Loyola Marymount University; **Pam Crawford**, Jacksonville University; and **Edwin Herman**, University of Wisconsin-Stevens Point; Wednesday morning and afternoon.

The Teaching and Learning of Undergraduate Ordinary Differential Equations, organized by **Christopher S. Goodrich**, Creighton Preparatory School; and **Beverly H. West**, Cornell University; Friday morning. Sponsored by the Community of Ordinary Differential Equations Educators (CODEE).

Topics and Techniques for Teaching Real Analysis, organized by **Erik Talvila**, University of the Fraser Valley; **Paul Musial**, Chicago State University; **Robert Vallin**, Lamar University; and **James Peterson**, Alma College; Wednesday afternoon.

Trends in Undergraduate Mathematical Biology Education, organized by **Timothy Comar**, Benedictine University; and **Daniel Hrozencik**, Chicago State University; Friday morning. Sponsored by the SIGMAA on Mathematical and Computational Biology.

Using Philosophy to Teach Mathematics Analysis, organized by **Carl Behrens**, Alexandria, VA; and **Dan Sloughter**, Furman University; Thursday morning. Sponsored by the SIGMAA on the Philosophy of Mathematics.

General Contributed Paper Sessions, organized by **Bem Cayco**, San Jose State University; **Timothy Comar**, Benedictine University, and **T. James Reid**, University of Mississippi; Wednesday, Thursday, Friday, and Saturday, mornings and afternoons. These sessions accept contributions in all areas of mathematics, curriculum, and pedagogy. When you submit your abstract you will be asked to classify it according to the following scheme: *Algebra*; *Analysis*; *Applied Mathematics*; *Assessment*; *Geometry*; *Graph Theory*; *History or Philosophy of Mathematics*; *Interdisciplinary Topics in Mathematics*; *Linear Algebra*; *Logic and Foundations*; *Mathematics and Technology*; *Mentoring*; *Modeling and Applications*; *Number Theory*; *Outreach*; *Probability and Statistics*; *Teaching and Learning Introductory Mathematics*; *Teaching and Learning Calculus*; *Teaching and Learning Advanced Mathematics*; *Teaching and Learning Developmental Mathematics*; *Topology*; or *Other*.

Submission Procedures for MAA Contributed Paper Abstracts

Abstracts may be submitted electronically at `jointmathematicsmeetings.org/meetings/abstracts/abstract.pl?type=jmm`. Simply fill in the number of authors, click "New Abstract," and then follow the step-by-step instructions. **The deadline for abstracts submission is Tuesday, September 22, 2015**.

Each participant may give at most one talk in the MAA contributed paper sessions. If your paper cannot be accommodated in the session to which it was submitted, it will automatically be considered for the general session.

The organizer(s) of your session will automatically receive a copy of the abstract, so it is not necessary for you to send it directly to the organizer. All accepted abstracts are published in a book that is available to registered participants at the meeting. Questions concerning the submission of abstracts should be addressed to `abs-coord@ams.org`.

MAA Panels, Posters, Workshops, and Other Sessions

Creating a Meaningful Calculus I Experience for Students Entering with High School Calculus, organized by **Alison Reddy**, University of Illinois; Wednesday, 8:00 am–9:20 am. Jim McClure of Purdue once said, "Once a student has been exposed to calculus it is hard to treat them." With the sharp increase in the number of students enrolling in Calculus I who have had some calculus experience in high school (as high as 70 percent at some research universities*), programs are struggling with the question of how to best serve these students in their introductory Calculus courses. In this session we will explore and discuss approaches used at different universities to address this concern. [*Bressoud, CBMS talk on "Building for Success in Calculus", Oct. 2014] Panelists are: **Michael Boardman**, Pacific University; **Randy McCarthy**, University of Illinois; **Robin Permantle**, University of Pennsylvania; and **Uri Treisman**, University of Texas. Co-sponsored by MAA/NCTM Joint Committee on Mutual Concerns, and College Board/MAA Joint Committee on Mutual Concerns.

NSF Funding Opportunities for the Learning and Teaching of the Mathematical Sciences, organized by **John Haddock** and **Lee Zia**, Division of Undergraduate Education, NSF; **Karen King**, Division of Research on Learning, NSF; **Tasha Inniss**, Division of Human Resource Development, NSF; and **Jennifer Slimowitz Pearl**, Division of Mathematical Sciences, NSF. A number of NSF divisions offer a variety of grant programs that support innovations in learning and teaching in the mathematical sciences. These programs will be discussed along with examples of successful projects in two sessions. Anticipated budget highlights and other new initiatives for the next fiscal year, as appropriate, will also be presented. Sponsored by the MAA Committee on Professional Development.

Part I: Undergraduate/Graduate Education, Department of Mathematics Infrastructure, and Human Resource Development (DUE/DGE/DMS/HRD) Wednesday, 8:00 am–9:15 am, and

Part II: The K–16 Continuum: Learning Science & Research and Pre- and In-Service Teachers (DUE/DRL) Wednesday, 9:30 am–10:30 am.

Advanced Placement Calculus Today: Opportunities and Challenges, organized by **Ben Hedrick**, College Board; Wednesday, 9:35 am–10:55 am. There is a growing debate as to whether more students should take calculus in high school. The data suggest that the public believes they should, as more and more students enroll in Honors

and Advanced Placement Calculus classes. This increased enrollment dramatically affects the AP Calculus Program and university course offerings. The panelists will discuss the AP Calculus Program, how it aligns to post-secondary calculus courses, recent changes in the course content and examination, the development of assessment items, and the exam scoring process. The discussion will also focus on mathematical practices for AP Calculus that engage students in developing conceptual understanding of core concepts, those ideas that are necessary to apply important techniques and procedures. As a consequence of expanding enrollment in high school calculus, participants will be asked to consider the prerequisite skills and knowledge for an AP Calculus course. Panelists are: **Don King**, Northeastern University; **Dan Teague**, North Carolina School of Science and Mathematics; **Gail Burrill**, Michigan State University; and **Stephen Davis**, Davidson University

Developing the MAA Pedagogy Guide, organized by **Martha Abell,** Georgia Southern University; Wednesday, 2:15 pm–3:35 pm. In the process of revising the Curriculum Guide, the MAA Committee on the Undergraduate Program in Mathematics (CUPM) encountered questions related to "how we teach" instead of "what we teach". As a result in September 2014, the MAA Committee on the Teaching of Undergraduate Mathematics (CTUM) was charged with developing a Pedagogy Guide to help faculty become more aware of research-based pedagogical approaches, course design, and assessment of student learning. Panel members will discuss various aspects of the Pedagogy Guide, including successful approaches for teaching various mathematics content areas, instructional techniques such as inquiry-based learning and "flipped classrooms," approaches to addressing student skills such as writing and other forms of communication, course design, classroom climate and student motivation. The panel discussion also provides an opportunity for members of the mathematics community to provide input to the Pedagogy Guide as it is being developed. Panelists are: **Jacqueline Dewar**, Loyola Marymount University; **Gavin LaRose**, University of Michigan; **Carol Schumacher**, Kenyon College; **Lew Ludwig**, Denison University; and **Diana White**, University of Colorado Denver.

The Enjoyment of Employment: Finding the Right Organizational Culture, organized by **Douglas Kalish**, University of California Berkeley; Wednesday, 2:15 pm–3:35 pm. This workshop is targeted to graduate students and postdocs who are considering nonacademic careers. Are you considering a nonacademic career after graduate school or your postdoc? Are you aware of the different kinds of workplace cultures you'll encounter? People look for different things in a job: one person might want to change the world, while another just wants a paycheck. Matching your work personality to the culture of the organization is one of the prime factors in workplace happiness. In this workshop you'll assess your workplace personality, which we will then match against different work environments to see what kinds of organizations are compatible with your work style. We'll end with a checklist and timeline for starting your job search so that you'll be fully prepared when the time comes. Before the workshop, go to `www.dougsguides.com/personality`, take the personality assessment and bring the results with you.

Project NExT–YMN Poster Session, organized by **Jonathan Needleman**, Le Moyne College, and **Thomas Wakefield,** Youngstown State University, Wednesday, 2:15 pm–4:15 pm. This session is intended to highlight the research activities, both mathematical and pedagogical, of recent or future Master's/ PhD's in mathematics and related fields. The organizers seek to provide an open venue for people who are near completion, or have finished their graduate studies in the last five years, to present their work and make connections with other same-stage professionals, in much the same spirit as YMN and Project NExT. The poster size will be 48" wide by 36" high. Poster boards and materials for posting pages on the posters will be provided on site. We expect to accept about forty posters from different areas within the mathematical sciences. To apply, send a poster abstract, when and where you have or will receive your PhD or master's degree, and your current college or university affiliation to the organizers. Potential applicants should send a poster abstract to one of the organizers, Thomas Wakefield, `tpwakefield@ysu.edu`, or Jonathan Needleman, `needlejs@lemoyne.edu`, to apply for the session. The deadline for submissions is **December 15, 2015.** Sponsored by the Young Mathematicians' Network and Project NExT.

Finding a Thesis Topic and Advisor, organized by **Nicholas Scoville**, Ursinus College**,** and **Emily Cilli-Turner**, Salve Regina University***;*** Wednesday, 3:50 pm–5:10 pm. Your choice of graduate school is an important career decision, but equally important is your choice of thesis advisor and topic. An advisor and topic that is right for you can give you the jumpstart you need for your career, while a poorly chosen one can be detrimental. In this panel, our experts will offer advice and tips on choosing both a thesis advisor and a topic, addressing such questions as: Do I have to come up with my own research problem? Does it matter if I "like" or get along well with my advisor? How much does my advisor's reputation in the mathematical community matter? What if I need to change my advisor or my advisor retires or changes schools? How much guidance should I expect from my advisor? Should I choose a graduate school based on a potential advisor? This panel is not only for graduate students, but also undergraduates who are planning on attending graduate school. Panelists are: **Allison Henrich**, Seattle University, and **Brooke Shipley**, University of Illinois at Chicago. This panel is sponsored by the Young Mathematicians Network.

Improving the Preparation of Graduate Students to Teach Mathematics: An NSF-Funded Project, organized by **Jessica Deshler**, West Virginia University; Wednesday, January 6, 3:50 pm–5:10 pm. The mathematics community's responsibility for preparing graduate students to teach is an issue of increasing concern. While there are many departments and faculty who would like to provide teaching-related professional development (PD) for their graduate students (Austin, 2002; Blair, Kirkman, Maxwell, 2013), there is no central clearinghouse that makes the resources broadly visible and easily accessible to the

mathematics community. A second barrier to the development of PD programs for TAs is the limited interaction and collaboration between researchers of undergraduate mathematics teaching and those who prepare graduate students to teach, all of whom share a common interest in improving the teaching of undergraduate mathematics. A recently funded NSF IUSE project aims to develop stronger connections and support networks between three groups: (1) those who conduct research on teaching assistant professional development, (2) those who create professional development materials for TAs and (3) those who deliver the professional development in their departments. Panelists will discuss background work that led to the development of the project as well as project components, including an on-line Resources Suite, workshops for those who wish to provide TA PD, networks for those involved in all aspects of TA PD and distance delivery of PD for mathematics TAs. Panelists are: **Jack Bookman**, Duke University; **Robin Gottlieb,** Harvard University; **Shandy Hauk**, WestEd; **Sarah Schott**, Duke University; and **Natasha Speer**, University of Maine. Sponsored by the MAA Committee on Professional Development.

Navajo Math Circles, Wednesday, 6:30 pm–7:50 pm. Hundreds of Navajo children in recent years have found themselves at the center of a lively collaboration with mathematicians from around the world. The children stay late after school and assemble over the summer to study mathematics, using a model called math circles, which originated in Eastern Europe and which has proliferated across the United States. This notion of student-centered learning puts children in charge of exploring mathematics to their own joy and satisfaction, with potentially long-lasting results.

Navajo Math Circles is a one-hour film that is documenting the meeting of two worlds: that of some of the country's most accomplished mathematicians and math educators, with the children and teachers in the underserved, largely rural Navajo educational system. An 8-minute trailer gives a taste of the film.

The project is supported by the Mathematical Sciences Research Institute (MSRI) in Berkeley, California with a generous grant from the Simons Foundation, and by Vision Maker Media (VMM), Lincoln, Nebraska, and by the Corporation for Public Broadcasting (CPB). Following this premiere screening 2016 Joint Mathematics Meeting (JMM), Vision Maker Media will work with the Corporation for Public Broadcasting to schedule a national broadcast.

This film was directed by **George Csicsery**, and produced by MSRI. Co-sponsored by the AMS and MAA.

Guiding Your PhDs to Nonacademic Careers, organized by **Douglas Kalish**, University of California Berkeley; Thursday, 8:00 am–9:20 am. According to the NSF, in 2010 nearly 50 percent of mathematics and statistics PhDs held nonacademic positions. More faculty are accepting and promoting nonacademic career alternatives for their graduate students and postdocs. But for some faculty without extensive industry experience or contacts, it's difficult to offer advice and counsel to these students. This workshop provides information and tools for faculty who want to mentor their PhDs as to the opportunities available and additional skills required for a successful nonacademic job search. Some of the topics we will cover will include: the nonacademic job market for quantitative PhDs; skills required of PhDs for nonacademic jobs; making industry internships work for the PhD and advisor; counseling and networking resources for nonacademically-bound PhDs; supporting nonacademic career PhDs emotionally and behaviorally; managing academic and nonacademic career PhDs in the same department; and sharing experiences and challenges in mentoring nonacademic career PhDs. The tools and topics of this workshop are targeted to mathematical sciences faculty who embrace (or at least accept) nonacademic career choices for their graduate students and postdocs. This workshop is not a discussion of the appropriateness of a graduate education for nonacademic career candidates

Applications of Gapminder for Undergraduate Mathematics and Statistics Courses, organized by **Samuel L. Tunstall**, **Sarah Greenwald**, and **Bill Bauldry**, Appalachian State University; Thursday, 8:00 am–9:20 am. Do a nation's GDP and its youth's math ability go hand-in-hand? Are geriatric car crashes on the decline? Which nations are the most "developed"? These are all captivating questions, and the commonality among them is that they were tackled by students using data from `Gapminder.org`. While such questions are nontrivial for a mathematician or sociologist to approach, it is worthwhile for students to approach them–doing the work could change their mind about the utility of mathematics. Created in 2005, `Gapminder` is a nonprofit site with the goal of enhancing sustainable global development through an increased use of information regarding social, economic, and environmental development at local and international levels. With more than 520 data sets to peruse, the site is a powerhouse for applications in the classroom; one might use it for demonstrations, short-term assignments, or semester-long research projects. Notwithstanding, deciding how to use the tools so that neither you nor your students becomes overwhelmed can be a challenge. As such, the first component of this interactive workshop is to familiarize instructors with the site and its visualization tools. Next, we will move on to discuss the applications of it in classes such as college algebra, first-year seminar, introductory and upper-level statistics, differential equations, and other modeling courses. Finally, participants will work in teams to create new assignments for immediate use in their classrooms. Whether one has used the site before or not, each participant should expect to take away meaningful, tangible strategies for its use. Participants should come prepared to learn more about the world and how to bring it into your classroom!

AMS-MAA-SIAM Panel Discussion: Computing across the curriculum: Opportunities and challenges, organized by **Rachel Levy**, Harvey Mudd College; and **Lee Zia**, National Science Foundation; Thursday, 8:30 am–10:00 am. As data science, industrial mathematics, and mathematical modeling have gained attention as popular tools in the workforce, a new focus on computation has entered mathematical sciences courses. In this panel, faculty will share their experiences incorporating computing across

the mathematics curriculum. Computing will be discussed as a major focus of a course or as new modules or assignments integrated into existing courses. Challenges and opportunities associated with these efforts will also be presented, along with potential NSF funding avenues. This panel is co-sponsored by the AMS, MAA, and SIAM.

MAA Session for Chairs: What Department Chairs Should Know About Teaching with Technology, organized by **Catherine M. Murphy**, Purdue University Calumet, and **Daniel Maki,** Indiana University; Thursday, 9:00 am–10:20 am. Based on their experience as developers and users of technology to support teaching, the panelists will address the following: the goals for learning outcomes and pedagogy, infrastructure and other resources needed for a new initiative, institutionalizing the results of successful pilot programs, ADA requirements. During the discussion following the panelists' presentations, attendees are invited to share their experiences as well as ask questions of the panelists. Panelists for this session are: **Michael Gage,** University of Rochester; **Gavin LaRose**, University of Michigan; and **Peter Turbek**, Purdue University Calumet.

Mathematical Outreach Programs, organized by **Elizabeth Yanik**, Emporia State University; Thursday, 10:00 am–12:00 noon. This poster session is designed to highlight special programs which have been developed to encourage students to maintain an interest in and commitment to succeeding in mathematics. These programs might include such activities as after school clubs, weekend activities, one-day conferences, mentoring opportunities, summer camps, etc. This poster session encompasses a wide variety of outreach efforts for a variety of age groups. For example, programs might be designed to reach out to underrepresented groups. The projects supported by MAA Tensor and Summa grants will find this an ideal venue in which to share the progress of their funded projects. Another possible type of outreach might involve mathematical enrichment programs. For example recipients of Dolciani Mathematics Enrichment Grants might wish to highlight their programs. Other examples might include innovative programs to motivate undergraduates to study mathematics. We encourage everyone involved with offering mathematical outreach activities to consider submitting an abstract to the session organizer, Betsy Yanik, `eyanik@emporia.edu`. This poster session is sponsored by the MAA Committee on the Participation of Women.

Career Options for Undergraduates, organized by **Thomas P. Wakefield**, Youngstown State University, and **Kristine Roinestad**, US Census Bureau; Thursday, 10:35 am–11:55 am. A common question for math majors to ask is, "What options are available for someone with a math degree?" In today's global marketplace, employers are increasingly seeking candidates with a degree in mathematics, applied mathematics, or statistics. Panelists **Dr. Thomas A. Grandine**, technical fellow with Boeing; **Dr. Katie Oliveras**, assistant professor, Seattle University; and a representative of the Society of Actuaries will showcase options for career paths in academia as well as settings such as industry, government, and nonprofits. They also will speak on their own career experiences. Panelists are: **Thomas Grandine**, Boeing Corporation; **Katie Oliveras**, Seattle University; and **Marcia A. Ciol**, University of Washington. This panel is sponsored by the Young Mathematicians Network.

Developing Mathematical Concepts with Technology, organized by **Gail Burrill**, Michigan State University; Thursday, 10:35 am–11:55 am. Although technology is often used as a tool for doing mathematics–creating graphs and crunching numbers–it can also be a powerful tool for developing understanding of mathematical concepts. Interactive dynamic technology can play a central role in helping students grapple with and come to understand ideas in mathematics. CAS technology, in particular, offers the potential for students to explore sophisticated and subtle mathematical concepts helping them develop some of the fundamentals that are necessary for moving fluently among the ideas and making connections among concepts. The panelists will share examples from calculus, geometry, introductory statistics, linear algebra and differential equations; discuss the affordances and limitations of technology; offer suggestions from research about how technology can be used effectively; and engage the audience in a discussion about the effective use of the technology. The discussion will focus on interactive dynamic technology but will also include a broader perspective on technologies available for use in teaching. Panelists will include **Wade Ellis**, West Valley Community College; **Tom Dick**, Oregon State University; **Andrew Bennett**, University of Kansas; and **Gail Burrill**, Michigan State University.

Interdisciplinary Modeling Experiences for Undergraduates, organized by **Amanda Beecher**, Ramapo College of New Jersey, and **Chris Arney**, United States Military Academy; Thursday, 1:00 pm–2:20 pm. This panel will feature faculty discussing the opportunities and challenges of developing interdisciplinary modeling experiences for undergraduates. Ideas for how to develop these experiences inside (courses or projects) or outside (contests, learning communities, community service experiences) the classroom will be presented. Each of the panelists will focus on advantages and disadvantages faced while developing interdisciplinary modeling opportunities, including time, resources, and institutional support. This panel is designed for faculty teaching or leading any form of modeling or problem solving. Significant time will be reserved for questions from the audience and between the panelists. Panelists are **Heidi Berger**, Simpson College; **Jessica Libertini**, Virginia Military Institute; **Gary Olson**, University of Colorado Denver; and **Robert Wooster**, Wooster College.

Mid-Career Faculty: Charting the Next Half of Your Career, organized by **Jenna P. Carpenter**, Louisiana Tech University; Thursday, 1:00 pm–2:20 pm. Mentoring programs often focus on new faculty but mid-career faculty can benefit from mentoring, too. While they have issues and interests that differ from faculty just starting their career, they also have a wider spectrum of opportunities open to them. This panel session features several successful mid-career faculty who have taken different paths post-tenure. They will share some of their wisdom for charting

an interesting second half of one's career. Panelists are: **Jonathan K. Hodge**, Grand Valley State University; **Judith Covington**, Louisiana State University at Shreveport; **Annalisa Crannell**, Franklin and Marshall College; **Brigitte Lahme**, Sonoma State University; and **Ronald Taylor,** Berry College. Sponsor for this panel is the MAA Committee on Professional Development.

Projects Supported by the NSF Division of Undergraduate Education, organized by **Jon Scott**, Montgomery College; Thursday, 2:00 pm–4:00 pm. This session will feature principal investigators (PIs) presenting progress and outcomes from various NSF funded projects in the Division of Undergraduate Education. The poster session format will permit ample opportunity for attendees to engage in small group discussions with the PIs and to network with each other. Information about presenters and their projects will appear in the program.

Is Online Inquiry-Based Learning (IBL) Possible? organized by **Padraig McLoughlin** and **Perry Y. C. Lee**, both of Kutztown University of Pennsylvania; Thursday, 2:35 pm–3:55 pm. Inquiry-Based Learning (IBL) is insistent on having students do mathematics: the pedagogy is based on challenging students to create, discover, produce solutions to problems, conjecture, experiment, explore, interact, opine, and prove or disprove claims. IBL encourages students to engage so students cannot simply sit and "absorb." Faculty cannot figuratively open heads and "pour in the knowledge." Students are to conjecture, experiment, explore, and solve problems. Socratic inquiry via IBL is not a 'process' where there is 'information' exchanged. IBL is not a unary philosophy of mathematics teaching insofar as there are a number of types of IBL methods across the full range of schooling and ranges from active learning to discovery learning through to the Moore method. A fundamental part of IBL is that students are guided through well-crafted notes in mathematical discovery. This panel discussion will focus on whether IBL can be achieved in an online course. Panelists will discuss their successes, or lack thereof, with IBL for online courses or a hybrid (a way that augments face-to-face classes) manner which do not sacrifice depth for breadth, that do foster discussion, and that do support authentic inquiry. We also shall include panelists who will justify why they opine that such goals cannot be achieved within the framework of IBL. Panelists to be determined.

Summer Research Programs, organized by **Lloyd E. Douglas**, Independent Consultant; **William A. Hawkins Jr.**, MAA and University of the District of Columbia; and **Robert Megginson**, University of Michigan; Thursday, 2:35 pm–3:55 pm. The MAA has sponsored Summer Research Programs with funding from NSF and NSA since 2003. Each program consists of a small research group of at least four minority undergraduates mentored by a faculty member. About one hundred thirty sites have been funded as of summer 2015. **Yunus Zeytuncu**, University of Michigan-Dearborn; **Brett Sims**, Borough of Manhattan Community College; and **Min-Lin Lo**, California State University, San Bernardino, will discuss their programs. There will be ample time for questions and discussion. It is expected that funding will be available for summer 2016. Additional information can be found on the NREUP website at `www.maa.org/programs/faculty-and-departments/underrepresented-groups/nreup`. Sponsor for this panel is the MAA Committee on Minority Participation and the MAA Office of Minority Participation.

Find a Research Collaborator Social Hour, organized by **Jacob White**, Texas A&M University, and **Timothy Goldberg**, Lenoir-Rhyne University; Thursday, 3:15 pm–4:15 pm. As freshly graduated PhD's will start their research career at a new institution, two of the most common obstacles observed are (1) finding collaborators in other departments or institutions, and (2) finding topics to work on. This event will consist of small group discussions based on research interests, with the goal of sharing ideas of how to find collaborators and topics, as well as possibly finding a collaborator during the event. Sponsored by the Young Mathematicians' Network.

Poetry + Art + Math, organized by **Gizem Karaali**, Pomona College; **Lawrence M. Lesser**, University of Texas at El Paso; and **Douglas Norton**, Villanova University; Thursday, 5:30 pm–7:00 pm. In the last few years, JMM attendees have enjoyed eclectic poetry readings. This year's poetry reading will be augmented by a guest lecture by Seattle mathematical artist / poet Michael Schultheis. Schultheis's art will also be displayed during the session. All who are interested in mathematical poetry and/or mathematical art are invited. Come to share your poetry or simply enjoy the poetry-art-math! Though we do not discourage last-minute decisions to participate, we invite and encourage poets to submit poetry (no more than three poems, no longer than five minutes) and a bio in advance—and, as a result, be listed on our printed program. Inquiries and submissions (by December 1, 2015) may be made to Gizem Karaali (`gizem.karaali@pomona.edu`). Sponsors for this event include the Journal of Humanistic Mathematics and SIGMAA ARTS.

College Calculus and the Preparation Gap: Identified Problems and Models for Improvement, organized by **Michael Boardman**, Pacific University; **Gail Burrill**, Michigan State University; and **David Bressoud**, Macalester College; Friday, 8:00 am–9:20 am. Mathematics departments and their faculty face the difficult task of providing effective Introductory Calculus courses for students with significantly different backgrounds in mathematics. Some students have completed high school calculus, in courses of varied quality, and others have never seen calculus before. Some have strong preparation for college calculus, while others have significant deficits in their backgrounds. Panelists will share results of recent research about the nature and impact of these challenges and will describe some models for success in dealing with this issue. Panelists to include **David Bressoud**, Macalester College; **Deborah Hughes Hallett**, Harvard University; **Robin Cruz**, College of Idaho; **Dave Dwyer**, University of Evansville; and **Chad Topaz**, Macalester College. Sponsors for this panel are MAA/NCTM Joint Committee on Mutual Concerns, and the College Board/MAA Joint Committee on Mutual Concerns.

Guidelines for Statistics Education: MAA Curriculum Guide, ASA Guidelines, GAISE II, and SET. Organizers include **Patti Frazer Lock**, St. Lawrence University; **Sue**

Schou, Idaho State University; and **Randall Pruim**, Calvin College; Friday, 8:00 am–9:20 am. In recognition of the increasing importance of statistics and statistics education, there have been four major new reports on statistics education in the last year and a half. This panel focuses on these reports:

• The MAA 2015 Curriculum Guide recommends that "every mathematical sciences major should have, at a minimum, … a command of data analysis and statistical inference at a level equivalent to that obtained in an applied data analysis course." The Curriculum Guide links to a report giving recommendations for this course, as well as a report giving recommendations for statistics programs.

• The American Statistical Association published its Curriculum Guidelines for Undergraduate Programs in Statistical Science in November 2014. These Guidelines update previous guidelines published in 2000.

• The original GAISE (Guidelines for Assessment and Instruction in Statistics Education) College Report was written in 2005 and endorsed by the ASA and AMATYC. These guidelines are being updated this year and the GAISE 2016 report is expected in early 2016.

• The Statistics Education of Teachers (SET) report came out in early 2015 and gives specific recommendations for the statistics education of pre-service K–12 teachers. The Conference Board of the Mathematical Sciences (CBMS) identified the statistical preparation of teachers as an area of concern in their document, Mathematics Education of Teachers 2 (MET2). The SET report addresses this concern.

We will have four panelists, each an author on one of these four reports. The panelists will share the results of the different reports and will discuss implications of the reports for programs in mathematics, statistics, and mathematics education. Panelists present will be **Patti Frazer Lock**, St. Lawrence University; **Michelle Everson**, Ohio State University; **Chris Franklin**, University of Georgia; and **Beth Chance**, Cal Poly–San Luis Obispo. Sponsored by SIGMAA STAT ED.

Pure and Applied Talks by Women Math Warriors presented by EDGE (Enhancing Diversity in Graduate Education), organized by **Candice R. Price**, Sam Houston State University, and **Amy L. Buchmann**, Tulane University; Friday, 8:00 am–10:55 am. Since its beginning in 1998, nearly two hundred women have participated in the EDGE program. Approximately seventy are currently working toward a PhD, over one hundred have earned Masters and fifty-seven have gone on to successfully complete PhDs. This session will be comprised of research talks in a variety of different sub-disciplines given by women involved with the EDGE program. For more information on the EDGE program see `www.edgeforwomen.org`.

Instructional Strategies That Can Make a Difference, organized by **Gail Burrill**, Michigan State University; Friday, 9:35 am–10:55 am. Research has suggested some ways of supporting learning can make a difference in what students learn and what they remember. The NCTM's recent publication, Principles to Action, describes what these could look like in K–12 classrooms, for example, facilitating productive discussion, posing meaningful questions, using and connecting mathematical representations. Are there counterparts for instruction at the post-secondary level? Panelists will talk about what these might be and how they can look in post secondary classrooms. Panelists are: **Tom Dick**, Oregon State University; **Diane Briars**, National Council of Teachers of Mathematics; **Brian Hopkins**, St. Peters University; and **Darryl Yong**, Harvey Mudd College. Sponsored by the MAA/NCTM Joint Committee on Mutual Concerns.

Perspectives on IBL Teaching: Novice, Experienced, and Master, organized by **Judith Covington**, LSU Shreveport, and **Theron Hitchman**, University of Northern Iowa; Friday, 9:35 am–10:55 am. Panelists will share their experiences in getting started with Inquiry Based Learning (IBL) and perspectives on maintaining these techniques over time. They will share a quick thought on the opportunities and challenges of IBL courses, but a large fraction of the time will be reserved for questions from the audience. Our panelists include someone new to IBL teaching, someone with enough experience to feel comfortable designing a new course, and an acknowledged master teacher who has mentored others in IBL teaching. Panelists are: **Angie Hodge**, University of Nebraska Omaha; **Mitchel T. Keller**, Washington and Lee University; and **Carol Schumacher**, Kenyon College.

Learning from Each Other: International Perspectives on the Mathematical Education of Teachers, organized by **Bonnie Gold**, Monmouth University, and **David C. Carothers**, James Madison University; Friday, 1:00 pm–2:20 pm. Every country has its own ways of educating its teachers, due to a combination of historical factors and the way the country is organized. So we cannot simply look at another country and say, "Wow, they do so much better than us on the TIMSS (or PISA)–let's do what they do." For example, some countries are less concerned about including students with disabilities than we are. However, there is still value in looking at what other countries do and considering whether some aspects of their approaches might be worthwhile for us to modify and adopt. There have been several studies of what is being done in other countries: China, Korea, and Germany, among others. Panelists will speak on aspects of mathematical education of teachers in other countries that perhaps are worth discussing in the US. Panelists are: **Tad Watanabe**, Kennesaw State University; **Catherine B. Kessel**, Mathematics Education Consultant, Berkeley, CA; and **William Schmidt**, Michigan State University. This panel is sponsored by the MAA Committee on the Mathematical Education of Teachers (COMET).

Undergraduate Research as a Capstone Course, organized by **Aklilu Zeleke**, Michigan State University; **James Solazzo**, Coastal Carolina University; and **Michael Karls**, Ball State University; Friday, 1:00 pm–2:20 pm. Undergraduate research in the mathematical sciences has flourished over the past decade. The number of undergraduates engaging in mathematical sciences research has increased dramatically over the past few years. Indicators of this growth include the size of the undergraduate poster session at the Joint Mathematics Meetings (e.g., over 300 posters at the 2014 meeting), the number of mathematics

Research Experience for Undergraduates programs (now close to 70), and the recent creation of journals devoted to mathematics undergraduate research (e.g., Involve at UC Berkeley). Undergraduate research is now a major factor in preparing students for graduate school and industrial careers. There are many models of undergraduate research in the mathematical sciences, such as semester–long projects that are completed for honors or thesis credit, nationally funded summer REUs, and research projects that engage students over a longer period, usually two to four semesters. All these models have one thing in common: the research experience is not targeting all students in a class or institution. At many institutions, mathematics majors fulfill a capstone course. Usually such courses are nonstandard and/or interdisciplinary and are not normally offered as part of the undergraduate curriculum. Students are expected to read research articles, write expository reports and make presentations. In this panel we seek examples of models that have incorporated undergraduate research as a component of a capstone course. The panel will discuss strategies for selecting appropriate projects, mentoring students for successful outcomes and assessment of students' work. Panelists are: **Anant Godbole**, East Tennessee State University; **Keshav Jagannathan**, Coastal Carolina University; **Rebecca Garcia**, Sam Houston State University; and **Sergio Loch**, Grand View University. Sponsored by the MAA Subcommittee on Research by Undergraduates.

Renewing the First Two Years Curriculum: Calculus, Quantitative Reasoning, Statistics, Pre-calculus, and Developmental Mathematics, organized by **Suzanne I. Dorée**, Augsburg College; Friday, 2:35 pm–3:55 pm. This broad array of mathematics courses taught in the first two years is key to student success in college, both for prospective majors in STEM and as part of the general education for all majors. National efforts to renew the first two years' curriculum are underway with the goal that introductory courses be interesting and engaging for students, reflect modern workforce use of mathematics, and prepare students for subsequent coursework and their lives as citizens. To accomplish these lofty goals, we all need to revise our curriculum—updating standard courses and reconsidering courses that no longer work. Where is your department in this effort? A great place to start is to learn more about successful programs that you might easily adapt to your needs. Whether you are just getting started or already renewing your curriculum, come learn more about what's happening on the national scene. Panelists will describe innovative trends and resources for renewing calculus, building quantitative reasoning courses, modernizing introductory statistics, improving courses that prepare students for calculus, and restructuring developmental mathematics. Department chairs, academic leaders, and faculty engaged in curriculum renewal of mathematics courses in the first two years are especially encouraged to attend. Panelists are: **Michael Axtell**, University of St. Thomas; **Caren Diefenderfer**, Hollins University; **Patti Frazer Lock**, St. Lawrence University; **Rebecca Hartzler**, Seattle Central College; and **Bruce Yoshiwara**, Pierce College. Sponsored by MAA Committee on Curriculum Renewal Across the First Two Years (CRAFTY)

A Common Vision for the Undergraduate Mathematics Program in 2025, organized by **Karen Saxe**, Macalester College; Friday, 2:35 pm–3:55 pm. Each year approximately 50 percent of students fail to pass college algebra with a grade of 'C' or better. Failure rates under traditional lecturing are 55 percent higher than the rates observed under active learning. Challenges like these are highlighted in reports such as "The Mathematical Sciences in 2025" (NRC) and "Engage to Excel" (PCAST), and have led to differentiated responses from different groups in the mathematical sciences. The Common Vision project [NSF DUE-1446000] has brought together leaders from five professional associations in the mathematical sciences—AMATYC, AMS, ASA, MAA, and SIAM—to provide a snapshot of the current thinking about undergraduate mathematics. The Common Vision report reflects a consensus that failure rates in traditional entry-level courses at two- and four-year institutions are unacceptably high, and that other pathways to college-credit-bearing courses are needed. The five associations are working closely together for the first time and work growing out of this project should guide future progress to incrementally improve education in the mathematical sciences. Panelists will update the community on the project. Panelists are: **Tara Holm**, Cornell University; **Helen Burn**, Highline College; **Rachel Levy**, Harvey Mudd College; and **Matthew Ando**, University of Illinois Urbana-Champaign.

Change Is the Norm!, organized by **Patrick Brewer**, Lebanon Valley College; **Robert Buck**, Slippery Rock University; **Bettye Case**, Florida State University; **Kevin Charlwood**, Washburn University; **Michelle Guan**, Indiana University Northwest; **Steve Paris**, Florida State University; and **Sue Staples**, Texas Christian University; Friday, 5:00 pm–7:00 pm. To meet expectations of students intending actuarial careers, changes are needed faster than the usual deliberative academic pace. There is constant need for curriculum modification. Possibly the most important discussions for this, the 24th in this series of JMM actuarial sessions, will center on changes and initiatives not yet announced as it is planned. The outside-class activity of a strong program can stress both students and actuarial advisors. Sessions seek to support faculty involved with actuarial science offerings; they are organized by faculty from a variety of such programs. Presentations feature Seattle area actuaries and include representatives from professional and publishing organizations. Comments from actuaries at differing career stages and paths will touch on "what I wish I had known before I began working". One of the career demands these actuaries mention is certain to be about credentialing. This major commitment is sometimes undertaken by faculty and the resulting demands will be described by recently credentialed faculty members. Panelists are: **Steve Armstrong**, Casualty Actuarial Society; **Robert Buck**, Slippery Rock University; **Robert Fisette**, Milliman; **Michelle Guan**, Indiana University Northwest; **Stuart Klugman**, Society of Actuaries; **John Leo**, Regence Group; and **Steve Paris**, Florida State University.

Managing Your Own Course Social Hour, organized by **Jacob A. White**, Texas A&M University, and **Timothy Goldberg**, Lenoir-Rhyne University, Hood College; Friday, 4:00 pm–5:00 pm. One of the many challenges facing new faculty members (and sometimes advanced teaching assistants) is managing their own courses. This event will consist of small group discussions based on types of courses and perhaps types of institutions, with the goal of sharing ideas and experiences about managing one's own course. This may also include discussions on creating a new course. Sponsored by the Young Mathematicians' Network.

Mathematically Bent Theater, featuring **Colin Adams** and the **Mobiusbandaid Players**; Friday, 6:00 pm–7:00 pm. Is laughter the body's attempt to eject excess phlegm? Why did Plato write dialogues instead of monologues? Who walked off with my copy of "Quasi-Linear Perturbations of Hamiltonian Klein-Gordon Equations on Spheres" at the AMS Fellows Reception at the San Antonio Joint Meetings? These are just a few of the questions we will not answer in this theatrical presentation of several short mathematically inclined humorous pieces.

Backgammon! organized by **Arthur Benjamin**, Harvey Mudd College; Friday, 8:00 pm–10:00 pm. Learn to play backgammon from expert players. It's a fun and exciting game where players with a good mathematics background have a decisive advantage. Boards and free lessons will be provided by members of the US Backgammon Federation. Stop by anytime!

How to Think Brilliantly and Creatively in Mathematics: A Guide for K–12 Educators and Their Students, organized by **Deanna Haunsperger**, Carleton College; Saturday, 8:00 am–8:50 am. This lecture is a guide for thinking brilliantly and creatively in mathematics for K–12 educators, their students, and all seeking joyful doing in mathematics. How do we model and practice uncluttered thinking and joyous doing in the classroom? Pursue deep understanding over rote practice and memorization? Develop the art of successful flailing? Our complex society demands of its next generation not only mastery of quantitative skills, but also the confidence to ask new questions, explore, wonder, flail, persevere, innovate, and succeed. Let's not only send humans to Mars, let's teach our next generation to solve problems and get those humans back if something goes wrong! In this talk, **James Tanton**, MAA, will explore five natural principles of mathematical thinking. We will all have fun seeing how school mathematical content is the vehicle for ingenuity and joy. All are so welcome to attend! The sponsor for this lecture is the MAA Council on Outreach.

Starting a New Track: Actuarial Science, Biomathematics, Environmental Science, Climate Studies, organized by **Julie Barnes**, Western Carolina University; **Martha Siegel**, Towson University; and **Linda McGuire**, Muhlenberg College; Saturday, 9:00 am–10:20 am. Mathematicians that have successfully implemented either a track within the mathematics major, a double major, or a fully integrated major in Actuarial Science, Biomathematics, or Environmental Science and Climate Studies will briefly describe the necessary components of such a program, including the opportunities and the obstacles to implementation in a mathematics department. For each such program, there will be ample time to consult with the experts so as to determine how one's own department might encourage the professional development of its mathematics faculty and/or the cooperation within an institution to allow for implementation of some level of interdisciplinary tracks in these three areas. Panelists are: **Jim Daniel**, University of Texas at Austin; **Tim Comar**, Benedictine University; and **Ben Galluzzo**, Shippensburg University. This panel is sponsored by the MAA Committee on the Undergraduate Program in Mathematics (CUPM) and MAA Committee on Professional Development.

High School Quadratics: How to Think About and Do Everything About Them Brilliantly and Creatively, organized by **Deanna Haunsperger**, Carleton College; Saturday, 9:15 am–10:45 am. Presenter, **James Tanton**, MAA, will now put brilliant and creative thinking practices into an actual high-school topic: the study of quadratics in algebra II. Let's see how to bring the light of ease and joyful doing into this standard classroom unit. By letting go of a focus on jargon and memorization we can effectively help our students develop the confidence to "power their way" through questions and challenges, to engage in problem solving, and to develop the confidence to persevere. We can teach our students to be confident and agile thinkers and still master the curriculum content they are required to know. This workshop will model the presentation of the entire standard quadratics content, illustrating how doing less leads to more! Sponsored by the MAA Council on Outreach.

What's Beyond the Curriculum? organized by **Martha Siegel**, Towson University; Saturday, 10:35 am–11:55 am. The 2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences has been available for about one year. CUPM presents some important ways to use the Guide to craft some or all of a mathematics major program and expands on its recommendations for managing the elements beyond the curriculum that will contribute to success. Sponsored by the MAA Committee on the Undergraduate Program in Mathematics.

Math Circle Demonstration, organized by **Zvezdelina Stankova**, Mills College; **Tatiana Shubin**, San Jose State University; and **Paul Zeitz**, University of San Francisco; Saturday, 11:00 am–11:50 am. A math circle is an enrichment experience that brings mathematics professionals in direct contact with pre-college students and/or their teachers. Circles foster passion and excitement for deep mathematics. This demonstration session offers the opportunity for conference attendees to observe and then discuss a math circle experience designed for local students. While students are engaged in a mathematical investigation, mathematicians will have a discussion focused on appreciating and better understanding the organic and creative process of learning that circles offer, and on the logistics and dynamics of running an effective circle. Presenting at this demonstration will be **Zvezdelina Stankova**, Mills College, Berkeley Math Circle Director. The sponsor for this demonstration is SIGMAA MCST.

International Engagement in Research and Education in the Mathematical Sciences, organized by **Overtoun Jenda**, Auburn University; Saturday, 1:00 pm–2:20 pm. This session will showcase international programs involving research and education. Speakers will discuss unique features and goals of their programs and will give examples of their activities including specific collaborative research projects. Activities and research collaborations can involve faculty, graduate students and/or undergraduate students. Programs where US faculty and students visit other countries and vice versa will be discussed. Speakers will also share opportunities, challenges, and lessons learned in developing, implementing, and sustaining such programs. The Southern Africa Mathematical Sciences Association's Masamu Program is one example that will be presented. Panelists are: **Neal Koblitz**, University of Washington; **Overtoun Jenda**, Auburn University; **Suzanne Lenhart**, University of Tennessee; **Yuan Lou**, Ohio State University; and **Fred Roberts**, Rutgers University.

Math Wrangle, organized by **Mark Saul**, American Math Competitions, and **Ed Keppelmann**, University of Nevada Reno; Saturday, 1:00 pm–2:30 pm. Math Wrangle will pit teams of students against each other, the clock, and a slate of great math problems. The format of a Math Wrangle is designed to engage students in mathematical problem solving, promote effective teamwork, provide a venue for oral presentations, and develop critical listening skills. A Math Wrangle incorporates elements of team sports and debate, with a dose of strategy tossed in for good measure. The intention of the Math Wrangle demonstration at the Joint Math Meetings is to show how teachers, schools, circles, and clubs can get students started in this exciting combination of mathematical problem solving with careful argumentation via public speaking, strategy and rebuttal. Sponsors for this event are SIGMAA-MCST and American Mathematics Competitions.

Special Interest Groups of the MAA (SIGMAAs)

SIGMAAs will be hosting a number of activities, sessions, and guest lectures. There are currently twelve such focus groups in the MAA offering members opportunities to interact, not only at meetings, but throughout the year, via newsletters and email-based communications. For more information visit `www.maa.org/community/sigmaas`.

SIGMAA Officers Meeting, Thursday, 10:30 am to noon.

SIGMAA on Mathematics and the Arts (SIGMAA ARTS)

Mathematics and the Arts, Wednesday morning and afternoon (see MAA Contributed Paper Sessions).

Poetry+Art+Math, Thursday, 5:30 pm–7:00 pm.

SIGMAA on Business, Industry, and Government (BIG SIGMAA)

Mathematics Experiences and Projects in Business, Industry, and Government, Friday afternoon (see MAA Contributed Paper Sessions).

SIGMAA on Mathematical and Computational Biology (BIO SIGMAA)

Current Trends in Mathematical and Computational Biology, Thursday, 9:00 am–11:20 am (see MAA Invited Paper Sessions).

Trends in Undergraduate Mathematical Biology Education, *Friday morning* (see MAA Contributed Papers Section).

SIGMAA on the History of Mathematics (HOM SIGMAA)

Business Meeting and Reception, Wednesday, 5:30 pm–6:20 pm.

Guest Lecture, Wednesday, 6:30 pm–7:20 pm, **James Evans**.

The Contributions of Minorities to Mathematics Throughout History, Friday morning (Contributed Paper Session).

Incorporating the History of Mathematics into Developmental Math Courses, Saturday morning (Contributed Paper Session).

SIGMAA on Math Circles for Students and Teachers (SIGMAA MCST)

The Broad Impact of Math Circles, Thursday afternoon (Contributed Paper Session).

Math Circle Demonstration, Saturday, 11:00 am–11:50 am.

Math Wrangle, Saturday, 1:00 pm–2:30 pm.

SIGMAA on the Philosophy of Mathematics (POM SIGMAA)

Using Philosophy to Teach Mathematics, Thursday morning (see MAA Contributed Paper Sessions).

Reception, Thursday, 5:30 pm–5:50 pm.

Business Meeting, Thursday, 6:00 pm–6:20 pm.

Guest Lecture, Thursday, 6:30 pm–7:20 pm, **Bonnie Gold**, Monmouth University.

SIGMAA on Quantitative Literacy (SIGMAA QL)

Quantitative Literacy in the K-16 Curriculum, Wednesday afternoon (see MAA Contributed Paper Sessions).

Reception (joint with SIGMAA STAT-ED), Thursday, 5:30 pm–5:50 pm.

Business Meeting, Thursday, 6:00 pm–6:45 pm.

SIGMAA on Research in Undergraduate Mathematics Education (SIGMAA RUME)

Research in Undergraduate Mathematics Education, Thursday morning and afternoon (see MAA Contributed Paper Sessions).

SIGMAA on Statistics Education (SIGMAA Stat Ed)

Reception (with SIGMAA QL), Thursday, 5:30 pm–6:00 pm.

Business Meeting, Thursday, 6:00 pm–6:45 pm.

Guest Lecture, Thursday, 6:50 pm–7:40 pm, **Hadley Wickham**, **Tim Hesterburg**, Google.

Panel Session: ***Guidelines for Statistics Education***, Friday, 8:00 am–9:20 am.

Innovative Targeted Solutions in Teaching Introductory Statistics, Thursday afternoon (Contributed Paper Session).

New Ideas in Teaching Upper-Level Statistics Courses Friday afternoon (Contributed Paper Session).

SIGMAA on the Teaching of Advanced High School Mathematics (SIGMAA TAHSM)

Helping Students See Beyond Calculus, Saturday afternoon (see MAA Contributed Paper Sessions).

SIGMAA on Undergraduate Research (UR SIGMAA)

Business Meeting: Thursday, 5:30 pm–6:30 pm.

All are invited to the first meeting of the MAA's newest SIGMAA! Members and friends of the SIGMAA on Undergraduate Research (UR SIGMAA) will gather to meet each other, discuss our first elections, and plan our first year as a SIGMAA. Those who are considering joining are especially welcome!

SIGMAA on Mathematics Instruction Using the Web (WEB SIGMAA)

Business Meeting and Reception, Friday, 5:30 pm–5:50 pm.

Guest Lecture, Friday, 6:00 pm–6:50 pm, **Matthew Leingang**, New York University, *Streamlining assessment, feedback, and archival with auto-multiple-choice.*

Poster Session: *Me and My Gadgets–Teaching with Technology.*

MAA Sessions for Students

How to Think Brilliantly and Creatively in Mathematics: A Guide for K–12 Educators and Their Students, organized by **Deanna Haunsperger**, Carleton College; Saturday, 8:00 am–8:50 am. This lecture is a guide for thinking brilliantly and creatively in mathematics for K–12 educators, their students, and all seeking joyful doing in mathematics. How do we model and practice uncluttered thinking and joyous doing in the classroom? Pursue deep understanding over rote practice and memorization? Develop the art of successful flailing? Our complex society demands of its next generation not only mastery of quantitative skills, but also the confidence to ask new questions, explore, wonder, flail, persevere, innovate, and succeed. Let's not only send humans to Mars, let's teach our next generation to solve problems and get those humans back if something goes wrong! In this talk, James Tanton, MAA, will explore five natural principles of mathematical thinking. We will all have fun seeing how school mathematical content is the vehicle for ingenuity and joy. All are so welcome to attend! The sponsor for this lecture is the MAA Council on Outreach.

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Grad School Fair, Friday, 8:30 am–10:30 am. Here is the opportunity for undergrads to meet representatives from mathematical sciences graduate programs from universities all over the country. January is a great time for juniors to learn more, and college seniors may still be able to refine their search. This is your chance for one-stop shopping in the graduate school market. At last year's meeting about 300 students met with representatives from 50 graduate programs. If your school has a graduate program and you are interested in participating, a table will be provided for your posters and printed materials for US$75 (registration for this event must be made by a person already registered for the JMM), and you are welcome to personally speak to interested students. Complimentary coffee will be served. Co-sponsored by the the AMS and MAA.

MAA Lecture for Students, Friday, 1:00 pm–1:50 pm, will be given by **Robert Devaney**, Boston University, on *The Fractal Geometry of the Mandelbrot Set.*

MAA Student Poster Session, organized by **Joyati Debnath**, Winona State University; Friday, 4:30 pm–6:00 pm. This session features research done by undergraduate students. First-year graduate students are eligible to present if their research was completed while they were still undergraduates. Research by high school students can be accepted if the research was conducted under the supervision of a faculty member at a post-secondary institution.

Appropriate content for a poster includes, but is not limited to, a new result, a new proof of a known result, a new mathematical model, an innovative solution to a Putnam problem, or a method of solution to an applied problem. Purely expository material is not appropriate for this session.

Participants should submit an abstract describing their research in 250 words or less by midnight, Friday, October 9, 2015. Notification of acceptance or rejection will be sent by November 2, 2015. See `www.maa.org/programs/students/undergraduate-research/jmm-student-poster-session` for further information on what should be included in the abstract and a link to the abstract submission form.

Posters will be judged during the session and award certificates will be mailed to presenters with the highest scores. Trifold, self-standing 48" by 36" tabletop poster boards will be provided. Additional materials and equipment are the responsibility of the presenters. Participants must set up posters between 2:30 pm and 3:30 pm and must be available at their posters from 3:30 pm to 6:00 pm. Judging will begin at 3:30 pm, and general viewing will begin at

4:30 pm. Judges results will be available at the MAA Pavilion in the Exhibit Hall the following day until the exhibits close.

Questions regarding this session should be directed to Joyati Debnath jdebnath@winona.edu.

More advanced students might be interested in these sessions listed elsewhere in this announcement: ***The Enjoyment of Employment: Finding the Right Organizational Culture***, Wednesday, 2:15 pm–3:35 pm; ***YMN/Project NExT Poster Session***, Wednesday at 2:15 pm; ***Finding a Thesis Topic and Advisor***, Wednesday, 3:50 pm–5:10 pm; ***Career Options for Undergraduates***, Thursday, 10:35 am–11:55 am; ***Summer Research Programs***, Thursday, 2:35 pm–3:55 pm. See the full descriptions in the "MAA Panels..." section. You may also be interested in the ***CBMS–TPSE Math Panel Discussion: Recent Graduates, What we Wish we had Learned***, Thursday, 9:00 am–10:30 am; see the listing under Other AMS Sessions.

Other MAA Events

Board of Governors, Tuesday, 9:00 am–5:00 pm.

Department Liaisons Meeting, Wednesday, 9:30 am–11:00 am.

MAA Section Officers Meeting, Wednesday, 4:00 pm–5:00 pm, chaired by **Betty Mayfield**, Hood College. Section officers will meet with members of the Committee on Sections and MAA staff to share information and discuss current initiatives.

SIGMAA Officers Meeting, Thursday, 10:30 am–12:00 noon, chaired by **Karen A Marrongelle**, Portland State University.

MAA Business Meeting, Saturday, 11:10 am–11:40 am, chaired by MAA President **Francis Su**, Boston University.

MAA Ancillary Workshops (these take place on Monday and Tuesday, January 4 and 5, before the JMM actually begins)

National Research Experiences for Undergraduates Workshop, organized by **Dennis Davenport**, Howard University; Tuesday, 9:00 am–4:30 pm. This workshop will teach participants how to write a competitive grant proposal. This workshop is a hands-on experience where participants write a summary of a proposal and rate an NSF-awarded proposal in a mock panel review. Participants will also learn many helpful hints and fatal flaws to proposal writing. This workshop is appropriate for current PIs of MAA's NREUP grants and for those who were denied funding for an MAA grant. Advanced registration is required. Send an email to the organizer at dennis.davenport@howard.edu to register for the workshop.

Bringing Passion to your Introductory Statistics Classroom: a supportive, multidisciplinary project-based approach. The presenter for this workshop will be **Lisa Dierker,** Wesleyan University; organized by **Lorey Burghard**, Pennsylvania State University; **Lisa Dierker**, Wesleyan University; and **Dennis Pearl**, Pennsylvania State University; Monday, 9:00 am–4:30 pm. This workshop will support instructors who teach an introductory statistics or quantitative research course in designing or redesigning any or all portions of their course to engage students in the rich, complicated, decision-making process of real statistical inquiry. Core features of this passion-driven, flipped classroom approach include providing opportunities for students to flexibly apply their statistical knowledge in the context of real data, the use of computing as a window to core statistical concepts, supporting students with varying levels of preparation, and attracting and inspiring students from underrepresented groups. The workshop will include very brief presentations focused on the nuts and bolts of supporting project-based experiences, followed by ample hands-on opportunities that will be supported by experienced faculty and students. Similar to the approach that will be presented; your experience in the workshop will be individualized to your own interests, background and needs. Sponsored by the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE).

Teaching the Statistical Investigation Process with Randomization-Based Inference. Presenters for this workshop are **Lorey Burghard**, Pennsylvania State University; **Dennis Pearl**, Pennsylvania State University, and **Nathan Tintle**, Dordt College; organized by **Lorey Burghard**, Pennsylvania State University, and **Dennis Pearl**, Pennsylvania State University; Tuesday, 9:00 am–4:30 pm. The goals of this workshop are to help participants to revise their introductory statistics course in two ways: 1. Using randomization-based methods, as opposed to methods based on the normal distribution, to introduce concepts of statistical inference, and 2. Emphasizing the overarching process of conducting statistical investigations, from formulating a question and collecting data through exploring data and drawing inferences to communicating results, throughout the course. The workshop will provide direct experience with hands-on activities designed to introduce students to fundamental concepts of inference using randomization-based methods. The learning activities involve using freely available applets to explore concepts and analyze real data from genuine research studies. The presenters will also offer implementation and assessment suggestions during these activity-based sessions and discussion sessions based on the experiences of the presenters with randomization-based curricula in their own classrooms. More information about the project on which this workshop is based can be found at: www.math.hope.edu/isi. Sponsored by the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE).

Activities of Other Organizations

This section includes scientific sessions. Several organizations or special groups are having receptions or other social events. Please see the "Social Events" section of this announcement for those details.

Association for Symbolic Logic (ASL)

This two-day program on Friday and Saturday will include sessions of contributed papers as well as Invited Addresses by **Dana Bartosova**, Universidade de Sao Paulo; **Natasha Dobrinen**, University of Denver; **James**

Freitag, University of California Berkeley; **Carl Jockusch**, University of Illinois at Urbana-Champaign; **Bakhadyr Khoussainov**, University of Auckland; **Lou van den Dries**, University of Illinois at Urbana-Champaign; and **Jindrich Zapletal**, University of Florida.

See also the session co-sponsored by the ASL on *Applications of Logic, Model Theory, and Theoretical Computer Science to Systems* on Saturday in the "AMS Special Sessions" listings.

Association for Women in Mathematics (AWM)

Thirty-Seventh Annual Noether Lecture, Thursday, 10:05 am, will be given by **Karen E. Smith**, University of Michigan, title to be announced.

Also see the sessions on Commutative Algebra and Its Interactions with Algebraic Geometry, jointly sponsored by the AWM, in the "AMS Special Sessions" listings.

Research Collaboration Conferences for Women: Who, What, Where, When, Why, and How? organized by **Michelle Manes**, University of Hawaii at Manoa; Wednesday, 2:15 pm–3:40 pm. Research Collaboration Conferences for Women are a new model of working research conference designed to build networks of female researchers in different areas of mathematics. Several conferences have been held at math institutes over the past few years, each focused on building collaboration groups consisting of senior and junior women in a given area. These include: Women in Numbers (WIN) and the three follow-up conferences at Banff and Lunimy; Algebraic Combinatorixx and Women in Topology (WIT) at Banff; Women in Shape (WiSh) at IPAM; and two Women in Applied Math conferences at IMA, Dynamical Systems with Applications to Biology and Medicine (WhAM!) and Numerical PDEs and Scientific Computer (WhAM2!). Each of these conferences has resulted in new, high-quality mathematics research as well as lasting collaborations among attendees. Hear from organizers and participants about why they attended a Research Collaboration Conference, what their experience was like, how these networks are spreading through other AWM events, and how you or your students can get involved. This session is open to all JMM attendees. Panelists include **Maria Basterra**, University of New Hampshire (WIT); **Susanne Brenner**, Louisiana State University (WhAM2!); **Ellen Eischen**, University of Oregon (WIN); **Kristin Lauter**, Microsoft Research (WIN), **Kathryn Leonard**, California State University, Channel Islands (WiSh); and **Ami Radunskaya**, Pomona College (WhAM!). `https://sites.google.com/site/awmpanel2016/`

Business Meeting, Wednesday, 3:45 pm–4:15 pm. **Chair, Kristen Lauter**, AWM President.

AMS–AWM Committee on Education Panel Discussion: Work in mathematics education in departments of mathematical sciences, organized by **Jacqueline Dewar**, and **Pao-sheng Hsu**, AWM Education Committee; Thursday, 10:30 am–12:00 pm. Many in the mathematics community in the US are now involved in mathematics education in various capacities. This panel is designed to illustrate the breadth and range of these activities. It will highlight examples of contributions to mathematics education by members in the mathematical sciences, and include the perspectives of mathematicians and mathematics educators who contribute in areas such as: teacher education (pre- and in-service); instructional materials development in K–16 mathematics; scholarship of teaching and learning; and mathematics education research. Panelists will discuss their work and may reflect on how their work is received in their departments. The moderator for this panel will be **Elizabeth Burroughs**, Montana State University; panelists are: **Curtis Bennett**, Loyola Marymount University; **Brigitte Lahme**, Sonoma State University; **Kristin Umland**, University of New Mexico; and **Megan Wawro,** Virginia Polytechnic Institute and State University.

Workshop Poster Presentations and Reception, Friday, 6:00 pm–7:15 pm. AWM will conduct its workshop poster presentations by women graduate students. AWM seeks volunteers to serve as mentors for workshop participants. If you are interested, please contact the AWM office at `awm@awm-math.org`. This session is open to all JMM attendees. Organizers for these presentations are **Brenda Johnson**, Union College and **Catherine Searle**, Wichita State University.

AWM Workshop: Special Session on Algebraic Combinatorics, Saturday, 8:00 am–5:00 pm. AWM will conduct its workshop with presentations by senior and junior women researchers. Updated information about the workshop is available at `www.awm-math.org/workshops.html`. AWM seeks volunteers to serve as mentors for workshop participants. If you are interested, please contact the AWM office at `awm@awm-math.org`. All JMM attendees are invited to attend the program. Organizers for this workshop are **Gizem Karaali**, Pomona College and **Rosa Orellana**, Dartmouth College.

Reception, Wednesday, 9:30 pm–11:00 pm. See the listing in the "Social Events," section of the announcement. See also the sessions co-sponsored by the AWM on ***Commutative Algebra I and II*** on Friday and Saturday in the "AMS Special Sessions" listings. Organizers for these sessions are **Karen Smith**, University of Michigan, Ann Arbor, **Emily Witt**, University of Utah and **Irena Swanson**, Reed College.

National Association of Mathematicians (NAM)

Granville-Brown-Hayes Session of Presentations by Recent Doctoral Recipients in the Mathematical Sciences, Friday, 1:00 pm–4:00 pm.

Cox-Talbot Address, to be given Friday after the banquet by **Tanya Moore**, Building Diversity in Science / City of Berkeley, title to be announced.

Panel Discussion; ***Work Hard, Play Hard: Balancing Career, Hobbies, and Family***, Saturday, 9:00 am–9:50 am. Moderator: **Duane Cooper**, Morehouse; Panelists to include: **Ron Buckmire**, Occidental College; **Emille Davie Lawrence**, University of San Francisco, **Robin Wilson**, California State Polytechnic University.

Business Meeting, Saturday, 10:00 am–10:50 am.

Claytor-Woodward Lecture, Saturday, 1:00 pm, **Tatiana Toro**, University of Washington, title to be announced.

See details about the banquet on Friday in the "Social Events" section.

National Science Foundation (NSF)

The NSF will be represented at a booth in the exhibit area. NSF staff members will be available to provide counsel and information on NSF programs of interest to mathematicians. The booth is open the same days as the exhibit is. Times that staff will be available will be posted at the booth.

Pi Mu Epsilon (PME)

Council Meeting, Thursday, 8:00 am–11:00 am.

Project NExT

Project NExT Workshop, Wednesday–Saturday, 8:00 am–6:00 pm.

Project NExT Lecture, Thursday, 2:00 pm–2:50 pm.

Poster Session: ***Young Mathematicians Network–Project NExT Poster Session***, Organized by **Jonathan Needleman**, Le Moyne College, and **Thomas Wakefield**, Youngstown State University, Wednesday, 2:15 pm–4:15 pm.

See details about the reception on Friday in Social Events.

Society for Industrial and Applied Mathematics (SIAM)

This program consists of an Invited Address, ***Stochastic facilitation and sensitivities in discontinuous dynamics*** at 11:10 am on Thursday given by **Rachel Kuske**, University of British Columbia, and a series of Mini-symposia to include ***Probability Meets Dynamics in Biology***, **Rachel Kuske**, University of British Columbia; ***Graphical Models for High Dimensional Data***, **Andrea Bertozzi**, University of California, Los Angeles; ***Trends in the Mathematics of Signal Processing and Imaging***, **Zuhair Nashed**, University of Central Florida; ***Inverse Problems and Applications***, **Gunther Ullmann**, University of Seattle; ***Optimization***, **Juan Meza**, University of California, Merced; and one other to be announced.

The program also includes a co-sponsored panel discussion, ***AMS-MAA-SIAM Panel Discussion: Computing across the curriculum: Opportunities and challenges***, organized by **Rachel Levy**, Harvey Mudd College and **Lee Zia**, National Science Foundation; Thursday, 8:30 am–10:00 am. As data science, industrial mathematics, and mathematical modeling have gained attention as popular tools in the workforce, a new focus on computation has entered mathematical sciences courses. In this panel, faculty will share their experiences incorporating computing across the mathematics curriculum. Computing will be discussed as a major focus of a course or as new modules or assignments integrated into existing courses. Challenges and opportunities associated with these efforts will also be presented, along with potential NSF funding avenues. This panel is co-sponsored by the AMS, MAA, and SIAM.

Others

CBMS–TPSE Math Panel Discussion: Recent Graduates, What we Wish we had Learned, organized by **Tara Holm**, Cornell University, and **Charles Steinhorn**, Vassar College; Thursday, 9:00 am–10:30 am. The undergraduate mathematical sciences curriculum, particularly the first two years of the post-secondary curriculum, is a topic of substantial current interest. Efforts including TPSE Math, the MAA Common Vision project, and the Fall 2014 CBMS Forum on The First Two Years of College Math: Building Student Success all put a spotlight on this subject. The recent National Research Council publication, The Mathematical Sciences in 2025, informs the discussion as well. Recent graduates in the workforce can provide powerful insights to contribute to this conversation. At the fall 2014 CBMS forum and a recent TPSE Math meeting, a recent Vassar mathematics graduate spoke forcefully about those topics in the mathematical sciences to which, in hindsight, she would have liked to have been exposed during her undergraduate studies.

The proposed panel will bring together recent graduates with varied mathematical backgrounds who work in a wide range of fields to discuss what they would have like to have learned prior to beginning their careers.

The Moderator for this panel will be **Don Saari**, Conference Board of Mathematical Sciences.

Mathematical Art Exhibition, organized by **Robert Fathauer**, Tessellations Company; **Nathaniel A. Friedman**, ISAMA and SUNY Albany, **Anne Burns**, Long Island University C. W. Post Campus, **Reza Sarhangi**, Towson University, and **Nathan Selikoff**, Digital Awakening Studios. A popular feature at the Joint Mathematics Meetings, this exhibition provides a break in your day. On display are works in various media by artists who are inspired by mathematics and by mathematicians who use visual art to express their findings. Topology, fractals, polyhedra, and tiling are some of the ideas at play here. Don't miss this unique opportunity for a different perspective on mathematics. The exhibition will be located inside the Joint Mathematics Exhibits and open during the same exhibit hours.

Summer Program for Women in Mathematics (SPWM) Reunion, organized by **Murli M. Gupta**, George Washington University; Saturday, 1:00 pm–3:00 pm. This is a reunion of the summer program participants from the past 20 years (1995–2015) who are in various states of their mathematical careers: some are students (undergraduate or graduate), others are in various jobs, both in academia as well as government and industry. The participants will describe their experiences relating to all aspects of their careers. There will also be a presentation on the increasing participation of women in mathematics over the past two decades and the impact of SPWM and similar programs.

See `www.gwu.edu/~spwm`.

Success in Graduate School (and the Rest of Your Life), organized by **Patricia Hale**, California State Polytechnic University, Pomona; **Magnhild Lien**, California State University, Northridge; and **Bernd Sturmfels**, University of California at Berkeley; Thursday, 1:00 pm–2:30 pm. There is anecdotal evidence that the rate of female participation in PhD programs in mathematics has been decreasing in recent years. This panel will explore a wide range of issues that may be relevant to the personal choices behind this trend. We focus on choosing a graduate program, and

on life during and after graduate school. Specific topics, relevant for both women and men, include work/life balance, family planning, and career options. We especially welcome the participation of undergraduate students, who may be thinking about the pros and cons of going to graduate school: the panelists will be delighted to address your questions. Sponsored by the Joint Committee on Women in the Mathematical Sciences.

Social Events

All events listed are open to all registered participants. It is strongly recommended that for any event requiring a ticket, tickets should be purchased through advance registration. Only a very limited number of tickets, if any, will be available for sale on site. If you must cancel your participation in a ticketed event, you may request a 50 percent refund by returning your tickets to the Mathematics Meetings Service Bureau (MMSB) by **January 2, 2015**. After that date no refunds can be made. Special meals are available at banquets upon advance request, but this must be indicated on the Advanced Registration/Housing Form.

2016 AMS Dinner Celebration: Join your colleagues on this special occasion in celebration of service and volunteerism in the mathematical community. The AMS will recognize long-term members as well as honor the recipients of Programs That Make a Difference Award and the Exemplary Programs Award. Enjoy delicious meals from gourmet food stations, special entertainment, and enter to win fun prizes at the raffle table! This evening of celebration will be held on Saturday, January 9th with a reception at 6:30 pm and doors opening at 7:30 pm. Tickets are US$69 including tax and gratuity. The student ticket price is US$29.

Association of Christians in the Mathematical Sciences (ACMS) Reception and Lecture, Thursday, 5:30 pm–7:30 pm. The reception will take place between 5:30 pm and 6:30 pm, followed by a talk at 6:30 pm titled "Math. Love. Danger." given by **John Roe**, Penn State University, at 6:30 pm. See `www.acmsonline.org`.

Association of Lesbian, Gay, Bisexual, and Transgendered Mathematicians Reception, Thursday, 6:00 pm–8:00 pm. This annual reception is for lesbian, gay, bisexual, and transgender mathematicians, as well as their allies. We are affiliated with NOGLSTP, the National Organization of Gay and Lesbian Scientists and Technical Professionals, Inc. `www.noglstp.net/qmath.`

Association for Women in Mathematics Reception and Awards Presentation. The AWM Reception, which is open to all JMM attendees, will be held on Wednesday at 9:30 pm after the AMS Gibbs Lecture. The AWM President at 10:00 pm will recognize all of the honorees of the AWM Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman, the recipients of the AWM-Microsoft Research Prize in Algebra and Number Theory, the AWM-Sadosky Research Prize in Analysis, and the AWM Service Awards.

Backgammon! organized by **Arthur Benjamin**, Harvey Mudd College; Friday, 8:00 pm–10:00 pm. Learn to play backgammon from expert players. It's a fun and exciting game where players with a good mathematics background have a decisive advantage. Boards and free lessons will be provided by members of the US Backgammon Federation. Stop by anytime on Friday evening.

Budapest Semesters in Mathematics Annual Alumni Reunion, Friday, 6:00 pm–7:30 pm.

Budapest Semesters in Mathematics Education Informational Session, Friday, 12:00 pm–1:00 pm. BSME is a semester-long program in Budapest, Hungary, designed for American and Canadian undergraduates (and recent graduates) interested in teaching middle school or high school mathematics. Participants will study the *Hungarian approach* to learning and teaching, in which a strong and explicit emphasis is placed on problem solving, mathematical creativity, and communication. Come learn more about this exciting new program.

University of Chicago, Mathematics Alumni Reception, Thursday, 6:00 pm–7:00 pm.

Reception for Graduate Students and First-Time Participants, Wednesday, 5:30 pm–6:30 pm. The AMS and MAA co-sponsor this social hour. Graduate students and first-timers are especially encouraged to come and meet some old-timers to pick up a few tips on how to survive the environment of a large meeting. Light refreshments will be served.

Knitting Circle, Thursday, 8:00 pm–9:30 pm. Bring your needlework and come knit (crochet, cross-stitch, etc.) with us while talking about math or other relaxing subjects. Catch up with your friends and meet new ones during this fun social event.

MAA/Project NExT Reception, Friday, 8:00 pm–10:00 pm, organized by **Julia Barnes**, Western Carolina University; **Alissa Crans**, Loyola Marymount University; **Matt DeLong**, Taylor University; **Dave Kung**, St. Mary's College of Maryland; and **Anthony Tongen**, James Madison University. All Project NExT Fellows, consultants, and other friends of Project NExT are invited.

MAA Two-Year College Reception, Thursday, 5:45 pm–7:00 pm, is open to all meeting participants, particularly two-year faculty members. This is a great opportunity to meet old friends and make some new ones. There will be hot and cold refreshments and a cash bar.

Mathematical Reviews Reception, Friday, 6:00 pm–7:00 pm. All friends of the Mathematical Reviews (MathSciNet) are invited to join reviewers and MR editors and staff (past and present) for a special reception in honor of all of the efforts that go into the creation and publication of the Mathematical Reviews database. Refreshments will be served.

Mathematical Institutes Open House, Wednesday, 5:30 pm–8:00 pm. Members of the AMS and MAA who are attending the Joint Mathematics Meetings are warmly invited to come to the Mathematical Institutes Open House reception, co-sponsored by several of the mathematical sciences institutes in North America. This reception precedes the Gibbs Lecture. We hope to see you there! `https://icerm.brown.edu/events/mioh/2016.`

MSRI Reception for New and Prospective MSRI Donors, Thursday, 6:30 pm–8:00 pm. Why private support matters–MSRI thanks its supporters who are ensuring MSRI's well being today and in the future. MSRI is thankful for the many mathematicians who support MSRI's programs and workshops through their membership in the Archimedes Society or the Gauss Society. Not a member yet? Come and learn about why your support matters. Archimedes Society members support MSRI with annual gifts. Gauss Society members support MSRI with a planned gift through arrangements in their will and estates. David Eisenbud, MSRI's Director, and Hélenè Barcelo, MSRI's Deputy Director, will speak about current events at MSRI. For more information, please contact: Heike Friedman, Director of Development, `hfriedman@msri.org`; 510-643-5056.

National Association of Mathematicians Banquet, Friday, 6:00 pm–8:40 pm. A cash bar reception will be held at 6:00 pm, and dinner will be served at 6:30 pm. Tickets are US$63 each, including tax and gratuity. The Cox-Talbot Invited Address will be given after the dinner.

NSA Women in Mathematics Society Networking Session, Thursday, 6:00 pm–8:00 pm. All participants are welcome to this annual event. Please stop by the NSA booth in the exhibit hall for information and the location of the event.

Pennsylvania State University Mathematics Alumni Reception, Thursday, 5:30 pm–7:30 pm. Please join us for hors d'oeuvres, beverages, and mingling, with math alumni, faculty, and College of Science representatives.

SIMIODE Reception–Free Refreshments and Door Prizes–Open to All, Friday, January 8, 2016, 7:00 pm–9:00 pm. SIMIODE-Systemic Initiative for Modeling Investigations and Opportunities with Differential Equations at `www.simiode.org`, a free and open community for using modeling to motivate the study of differential equations, sponsors this mixer. All are encouraged to meet colleagues interested in using SIMIODE to bring motivational modeling to their differential equations classroom and learn how the SIMIODE community can provide support. Engage in conversations while enjoying light refreshments and door prizes.

Student Hospitality Center, Wednesday–Friday, 9:00 am–5:00 pm, and Saturday, 9:00 am–3:00 pm, sponsored by the MAA Committee for Undergraduate Student Activities.

Reception for Undergraduates, Wednesday, 4:00 pm–5:00 pm.

Registering in Advance

The importance of registering for the meeting cannot be overemphasized. Advanced registration fees are considerably lower than on-site registration fees. The AMS and the MAA encourage all participants to register for the meeting. When a participant pays the registration fee, he or she is helping to support a wide range of activities associated with planning, organizing, and execution of the meetings.

All participants who wish to attend sessions are expected to register and should be prepared to show their badges if so requested. Badges are required to enter the Joint Mathematics Meetings (JMM) Exhibits, the Employment Center, or to obtain discounts at the AMS and MAA Book Sales and cash a check with the Joint Meetings cashier.

All JMM registrations are processed by the Mathematics Meetings Service Bureau (MMSB). Participants who register by November 17, 2015, may receive their badges, programs, and tickets (where applicable) in advance by US mail approximately three weeks before the meetings. Those who do not want their materials mailed should check the appropriate box on the Registration and Housing Form. Materials cannot be mailed to Canada, Mexico, or other countries outside of the US. Participants from these countries must pick up their materials at the Joint Meetings Registration Desk, which will be located on the fourth floor of the Washington State Convention Center. Please note that a replacement fee of US$5 will be charged for programs and badges that were mailed but not brought to the meeting.

Online Registration: The form to register for the meeting and to reserve a hotel room online is located at `www.jointmathematicsmeetings.org/meetreg?meetnum=2181`. VISA, MasterCard, Discover, and American Express are the only methods of payment accepted for online registrations, and charges to credit cards will be made in US funds. All registration acknowledgments will be sent by email to all email addresses provided.

Paper Form Registration: The form to register for the meeting and to reserve a hotel room by paper is located at `www.jointmathematicsmeetings.org/meetings/national/jmm2016/jmm16_regform.pdf`. Forms must be mailed or faxed to the MMSB at MMSB, P.O. Box 6887, Providence, RI 02940 or 401-455-4004. For security reasons, credit card numbers by email or fax cannot be accepted. If a participant is registering by paper form and would like to pay for the registration or guarantee your hotel reservation by credit card, he or she should indicate this on the form and someone from the MMSB will call that person.

Participant Lists and Mailing Lists: If any participant would like to opt-out of any mailing lists or participant lists that are generated for the meeting, he or she should check the appropriate box on the Registration and Housing Form. All participants who do not opt-out will be included in all mailing lists and participant lists that are generated and distributed for the meeting.

Cancellation Policy: Participants who cancel their registration for the meetings, minicourses, or short course by **December 31, 2015** will be eligible to receive a 50 percent refund of fees paid. Participants who cancel their banquet tickets by **January 2, 2016** will be eligible to receive a 50 percent refund of monies paid. No refunds will be issued after these deadlines.

Joint Mathematics Meetings Registration Fees

	Advanced (by Dec. 22)	At Meeting
Member of AMS, ASL, CMS, MAA, SIAM	US$282	US$371
Non-member	448	571
Graduate Student Member of AMS, ASL, CMS, MAA, SIAM	63	74
Graduate Student Non-member	101	112
Undergraduate Student Member of AMS, ASL, CMS, MAA, PME, KME, SIAM	63	74
Undergraduate Student Non-member	101	112
Temporarily Employed	230	263
Emeritus Member of AMS, MAA; Unemployed; High School Teacher; Developing Countries; Librarian	63	74
High School Student	6	12
One-Day Member of AMS, ASL, CMS, MAA, SIAM	N/A	202
One-Day Non-member	N/A	315
Non-mathematician Guest	18	18
Commercial Exhibitor	0	0
MAA Minicourses	85	85
Grad School Fair Table	75	75
AMS Short Course:		
Member of AMS	110	144
Non-member	165	195
Student/Unemployed/Emeritus	58	79

Registration Category Definitions

Full-Time Students: Any person who is currently working toward a degree or diploma is eligible. Students are asked to determine whether their status can be described as a graduate (working toward a degree beyond the bachelor's), an undergraduate (working toward a bachelor's degree), or high school (working toward a high school diploma) and to mark the Registration and Housing Form accordingly. See membership distinctions below.

Graduate Student Member: Any graduate student who is a member of the AMS, ASL, CMS, MAA, or SIAM is eligible. Students should check with their department administrator to check their membership status.

Undergraduate Student Member: Any undergraduate student who is a member of the AMS, ASL, CMS, MAA, SIAM, PME, or KME is eligible. Students should check with their department administrator to check their membership status.

Emeritus: Any person who has been a member of the AMS for twenty years or more and who retired because of age or long-term disability from his or her latest position is eligible. Anyone person who has been a member of the MAA for 25 years and who is 70+ years of age is eligible.

Librarian: Any librarian who is not a professional mathematician is eligible.

Unemployed: Any person who is currently unemployed, actively seeking employment, and is not a student is eligible. This category is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

Developing Country Participant: Any person employed in developing countries where salary levels are radically not commensurate with those in the US is eligible.

Temporarily Employed: Any person currently employed but who will become unemployed by June 1, 2016, and who is actively seeking employment is eligible.

Non-mathematician Guest: Any family member or friend, who is not a mathematician, and who is accompanied by a participant in the meetings is eligible. Guests will receive a badge and may accompany a mathematician to a session or talk and may also enter the exhibit area.

Commercial Exhibitor: Any person exhibiting in the Joint Mathematics Meetings Exhibits and in the Mathematical Art Exhibition is eligible for this category. This does not include anyone participating in any poster sessions. Any exhibitor who is a mathematician and wants to attend sessions, talks, etc. is expected to register separately for the meeting.

Registration Deadlines

There are three separate registration deadlines, each with its own benefits:

EARLY meetings registration (free room drawing) is **November 2.**

ORDINARY meeting registration (hotel reservations, materials mailed) is **November 17.**

FINAL meeting registration (advanced registration, short course, minicourses, and banquets) is **December 22.**

Early Registration: Participants who **register by the early deadline of November 2** will be included in a random drawing to select winners of complimentary hotel room nights during the meeting. Rooms with multiple occupants will be included in the drawing. The location of these rooms will be based on the number of complimentary room nights earned in the various hotels; a free room will not necessarily be in winner's first-choice hotel. All winners will be notified by phone and email prior to December 22, so register early!

Ordinary Registration: Participants who register **after November 2 and by the ordinary deadline of November 17** may use the housing services offered by the MMSB but are not eligible for the free room drawing. They may also elect to receive their badges and programs by mail in advance of the meeting (US participants only).

Final Registration: Participants who register **after November 17 and by the final deadline of December 22** must pick up their badges, programs, and any tickets for social events at the meeting. Unfortunately it is sometimes not possible to provide final participants with housing, so everyone is strongly urged to make their hotel reservations by November 17. Please note that the final deadline of December 22 is firm. Any forms received after that date will be returned with full refunds. Registration materials may be picked up at the Meetings Registration Desk located on the fourth floor of the Washington State Convention Center.

Miscellaneous Information

Audio-Visual Equipment: A projection screen is included as standard equipment in all session rooms. Invited 50-minute speakers are automatically provided with an ELMO visual presenter (document camera/projector), and a laptop projector; AMS Special Sessions and Contributed Papers, and MAA Invited and Contributed Paper Sessions, are provided with a screen and a laptop projector. Blackboards are not available, nor are Internet connections in session rooms. Any request for additional equipment should be sent to `meet@ams.org` and received by November 1.

Equipment requests made at the meetings most likely will not be granted because of budgetary restrictions. Unfortunately no audiovisual equipment can be provided for committee meetings or other meetings or gatherings not on the scientific program.

Child Care: The AMS and the MAA will provide reimbursement grants of US$250 per family to help with the cost of child care for a number of registered participants at JMM2016. The funds may be used for child care that frees a parent to participate more fully in JMM.

Information about child care grants and deadlines for requesting support will be available prior to the opening of advance registration in September; watch the website at `jointmathematicsmeetings.org/meetings/national/jmm2016/2181_childcare`.

Email Services: Limited email access for all Joint Meetings participants will be available in an email center located near the JMM Registration Desk, Atrium Lobby, on the fourth level in the Washington State Convention Center. The hours of operation will be published in the program. Participants should be aware that **complimentary Internet access** will be available in the networking center located in Skybridge (Hall 4D), fourth level of the convention center.

Information Distribution: Tables are set up in the exhibit area for dissemination of general information of possible interest to the members and for the dissemination of information of a mathematical nature not promoting a product or program for sale. Information must be approved by the AMS Director of Meetings and Conferences prior to being placed on these tables.

If a person or group wishes to display information of a mathematical nature promoting a product or program for sale, they may do so in the exhibit area at the Joint Books, Journals, and Promotional Materials exhibit for a fee of US$50 (posters are slightly higher) per item. Please contact the exhibits coordinator, MMSB, P.O. Box 6887, Providence, RI 02940, or by email at `cpd@ams.org` for further details.

The administration of these tables is in the hands of the AMS-MAA Joint Meetings Committee, as are all arrangements for Joint Mathematics Meetings.

Local Information: For information about the city, see `visitseattle.org`.

Photograph and Video Policy: The videotaping of any AMS or joint sponsored events, talks, and sessions is strictly forbidden without the explicit written permission of the AMS Director of Meetings and Conferences. The policy for videotaping of any MAA events, talks, and sessions is posted at `www.maa.org/about-maa/policies-and-procedures/recording-or-broadcasting-of-maa-events`. Photographs and videos of meeting interactions will be taken by professional photographers hired by the Joint Mathematics Meetings or by AMS and MAA staff. These photographs and videos may occasionally be used for publicity purposes. By participating in the Joint Mathematics Meetings, attendees acknowledge that their photograph or a video that includes them may be published in material produced by the Joint Meetings, AMS or MAA. AMS and MAA are not responsible for unauthorized photographs or other images not taken by professional photographers hired by the Joint Mathematics Meetings or AMS and MAA staff.

Telephone Messages: It will be possible to leave a message for any registered participant at the meetings registration desk from January 6 through 9 during the hours that the desk is open. These messages will be posted on the Mathematics Meetings Message Board in the networking center; however, staff at the desk will try to locate a participant in the event of a bona fide emergency. The telephone number will be published in the program and daily newsletter.

Travel/Transportation

Seattle is on Pacific Time. The principal airport is the Seattle-Tacoma International Aiport (SEA, frequently referred to as Sea-Tac) which is served by all major airlines. The website for Seattle-Tacoma International airport is `www.portseattle.org/Sea-Tac/Pages/default.aspx` and the street address is 17801 International Boulevard, Seatac, WA, 98158. It is located approximately twelve miles from downtown Seattle.

The 2016 Joint Mathematics Meetings will be held in the Washington State Convention Center in downtown Seattle, 800 Convention Place, Seattle, WA, 98101. The main entrance is on Eighth Avenue between Pike and Seneca.

Airline

The official airline for this meeting is Delta. Participants are encouraged to book their flights for the meeting, if possible, with Delta and receive special pricing (in most cases, a 5 percent discount) on scheduled service to Seattle. Discounts are applicable to US and Canada originating passengers. This discount is not valid with other discounts, certificates, coupons, or promotional offers.

To make a reservation, go to `www.delta.com`, and click on the box that says "Book a Trip". At the bottom of the drop-down, click on "Advanced Search" (includes Flexible Airport and Meeting Event Code). On the reservation screen, please enter the Meeting Event Code NMLNH. It is located to the right of "Number of Passengers." Reservations can also be made by calling Delta Meeting Network Reservations at 1-800-328-1111 and citing the meeting event code. A direct ticketing charge will apply for booking by phone.

Ground Transportation

Car Rental: All major rental car companies have offices at the Sea-Tac airport. There is a separate rental car facility with dedicated shuttle buses operating on a 24-hour-a-day

schedule. Two passenger pick-up areas are located outside baggage claim at the north and south ends of the main terminal. Proceed to the baggage claim level and pick up your checked bags. Exit the sliding glass doors near either carousel #1 or #15 and walk to one of the two designated shuttle bus pick-up areas for transportation to the rental car facility.

Hertz is the official car rental company for the meeting. A brochure with the information for this meeting is located at `jointmathematicsmeetings.org/Hertz-info-Seattle.pdf`. To access the JMM special meeting rates at www.hertz.com, enter the standard information (pickup location, dates, etc.) and then click the box that says "Enter a discount or promo code" and enter 04N30006 as the convention number (CV#). Reservations can also be made by calling Hertz directly at 800-654-2240 (US and Canada) or 405-749-4434.

Meeting rates include unlimited mileage and are subject to availability. Advance reservations are recommended and blackout dates may apply. Government surcharges, taxes, tax reimbursement, airport-related fees, vehicle licensing fees and optional items are extra. Standard rental conditions and qualifications apply. Vehicles must be returned to the renting location. Minimum rental age is 20 (age differential charge for 20–24 applies).

Weekend rentals are available in the continental US and Canada for pickup between noon Thursday and noon Sunday and must be returned no later than Monday at 11:59 pm. Thursday pick-up requires a minimum three-day keep. Friday pick-up requires a minimum two-day keep, and Saturday and Sunday pick-up require a one-day keep. Weekly rentals are from five to seven days. Extra day rate for weekly rentals will be one-fifth the Weekly Rate.

Driving Directions from the Airport to the Center: The Washington State Convention Center (WSCC) is located at 800 Convention Place, Seattle, WA 98101-2350. Take a slight left onto Airport Expressway. Merge onto WA-518 E toward I-5/I-405 Seattle/Tacoma. Merge onto I-5 N via the exit on the left toward Seattle. Take Exit 164A, Madison Street, from I-5 N. At the underpass, stay to the left and then merge into the right lane. Follow the exit toward Madison Street/Convention Center. Move to the right lane. This lane becomes 7th Avenue. Turn right onto Madison Street. Immediately move to the left turn lane. Turn left at the end of the block onto Eighth Avenue. Follow Eighth Avenue a short distance over the bridge. Turn right into the WSCC parking garage. The trip takes approximately 25 minutes, depending on traffic.

Driving Directions from the Airport to the Sheraton: The Sheraton Seattle Hotel is located at 1400 Sixth Avenue, Seattle, WA, 98101. Take a slight left onto Airport Expressway. Merge onto WA-518 E toward I-5/I-405 Seattle/Tacoma. Merge onto I-5 N via the exit on the left toward Seattle. Take Exit 165, Seneca Street, on the left. Turn right onto Sixth Avenue. The trip takes approximately 25 minutes, depending on traffic.

Taxi: The taxi stand is located on the third floor of the airport garage. The phone number for Seattle Yellow Cab is 206-622-6500, and the website is `www.seattleyellowcab.com/seatac-taxi-rides/`. One-way fare to the downtown area is approximately US$45.

Seattle Sound Transit Link Light Rail: The SeaTac/Airport Station is connected to the fourth floor of the airport parking garage by a covered walkway. Wheelchair service is available. Take the train at SeaTac/Airport station and go to the end of the line at Westlake Center. Westlake Center is located at 4th Avenue and Pine Street. To go to the Sheraton Seattle from Westlake Center, go 1/2 block east on Pine Street, and 2 blocks south on Sixth Avenue. Trains run every 8–15 minutes from 5:00 am to 1:00 am on weekdays, and every 15 minutes on Saturday. On Sunday, the trains run from 6:00 am to midnight. One way fare is currently US$2.75. The trip takes approximately 35 minutes. The schedule and more information is located at `www.soundtransit.org/Schedules/Link-light-rail`.

Downtown Airporter Shuttle: The Downtown Airporter/Shuttle Express picks up and drops off at the inner drive curb on the third floor of the airport garage. It departs twice an hour from 6:30 am to 9:00 pm, with service to and from many downtown Seattle hotels, including the Crowne Plaza, Fairmont Olympic, Grand Hyatt, Renaissance Seattle, Seattle Sheraton, and the Westin Hotel. Online reservations are required. The fare is approximately US$19 one way, and the trip can take up to an hour, depending on traffic. Share ride and private service is also available. Call 425-981-7000 or go to `shuttle-express.com/seattle/airport/downtown-airporter` for more detail.

Parking: The Washington State Convention Center operates two parking garages, the WSCC Garage and the Freeway Park Garage. The WSCC Garage entrance is located on Eighth Avenue between Pike and Seneca, and it is open daily between 5:30 am and midnight. The entrance to the Freeway Park Garage is located on Hubbell Place between Pike and Seneca. It is open Monday-Friday, 5:30 am to 8:00 pm. Directions to the parking garages and rates are located at `www.wscc.com/parking-directions`. The parking map is located at `www.wscc.com/sites/default/files/find-it/files/2014.09.09_FIND_IT_Parking_map.pdf`.

See hotel page for details on parking at the hotels.

Welcoming Environment Policy

The AMS and MAA strive to ensure that participants in the Joint Mathematics Meetings (JMM) enjoy a welcoming environment. In all JMM activities, the two organizations seek to foster an atmosphere that encourages the free expression and exchange of ideas. The AMS and MAA support equality of opportunity and treatment for all participants, regardless of gender, gender identity or expression, race, color, national or ethnic origin, religion or religious belief, age, marital status, sexual orientation, disabilities, or veteran status.

Harassment is a form of misconduct that undermines the integrity of JMM activities as well as the AMS and MAA missions.The AMS and MAA will make every effort to maintain an environment that is free of harassment, even though they do not control the behavior of third parties. A

commitment to a welcoming environment is expected of all attendees at JMM activities, including mathematicians, students, guests,staff, contractors and exhibitors, and participants in scientific sessions and social events. To this end, the AMS and MAA will include a statement concerning their expectations toward maintaining a welcoming envi-ronment in registration materials, and have put in place a mechanism for reporting violations. Violations may be reported confidentially and anonymously to 855-282-5703 or at www.mathsociety.ethicspoint.com. The reporting mechanism ensures the respect of privacy while alerting the AMS and MAA to the situation.