Sponsored by the SIAM Activity Group on Analysis of Partial Differential Equations

The Activity Group on Analysis of Partial Differential Equations fosters activity in the analysis of partial differential equations (PDE) and enhances communication between analysts, computational scientists and the broad PDE community. Its goals are to provide a forum where theoretical and applied researchers in the area can meet, to be an intellectual home for researchers in the analysis of PDE, to increase conference activity in PDE, and to enhance connections between SIAM and the mathematics community.

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McMaster University, Canada
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Université de Bordeaux, France

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SIAM Registration Desk

The SIAM registration desk is located in the Grand Ballroom Foyer - Main Level. It is open during the following hours:

**Sunday, December 6**
4:00 PM – 8:00 PM

**Monday, December 7**
7:30 AM – 5:30 PM

**Tuesday, December 8**
8:00 AM – 5:30 PM

**Wednesday, December 9**
8:00 AM – 5:30 PM

**Thursday, December 10**
8:00 AM – 3:00 PM

Hotel Address
DoubleTree Resort by Hilton Paradise Valley - Scottsdale
5401 N. Scottsdale Road
Scottsdale, Arizona 85250 USA

Hotel Telephone Number
To reach an attendee or leave a message, call +1-480-947-5400. If the attendee is a hotel guest, the hotel operator can connect you with the attendee’s room.

Hotel Check-in and Check-out Times
Check-in time is 4:00 PM.
Check-out time is 12:00 PM.

Child Care
The DoubleTree Resort by Hilton Paradise Valley-Scottsdale recommends the following two local child care options.
* The Child’s Garden 480-354-2122
* Arizona Lullaby Guild 602-852-0459

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SIAM corporate members provide their employees with knowledge about, access to, and contacts in the applied mathematics and computational sciences community through their membership benefits. Corporate membership is more than just a bundle of tangible products and services; it is an expression of support for SIAM and its programs. SIAM is pleased to acknowledge its corporate members and sponsors. In recognition of their support, non-member attendees who are employed by the following organizations are entitled to the SIAM member registration rate.

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List current October 2015.

Funding Agencies
SIAM and the conference organizing committee wish to extend their thanks and appreciation to U.S. National Science Foundation and U.S. Department of Energy for their support of this conference.

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If you are not a SIAM member and paid the Non-Member or Non-Member Mini Speaker/Organizer rate to attend the conference, you can apply the difference between what you paid and what a member would have paid ($130 for a Non-Member and $65 for a Non-Member Mini Speaker/Organizer) towards a SIAM membership. Contact SIAM Customer Service for details or join at the conference registration desk.

If you are a SIAM member, it only costs $10 to join the SIAM Activity Group on the Analysis of Partial Differential Equations (SIAG/APDE). As a SIAG/APDE member, you are eligible for an additional $10 discount on this conference, so if you paid the SIAM member rate to attend the conference, you might be eligible for a free SIAG/APDE membership. Check at the registration desk.

Free Student Memberships are available to students who attend an institution that is an Academic Member of SIAM, are members of Student Chapters of SIAM, or are nominated by a Regular Member of SIAM.

Join onsite at the registration desk, go to www.siam.org/joinsiam to join online or download an application form, or contact SIAM Customer Service:
Telephone: +1-215-382-9800 (worldwide); or 800-447-7426 (U.S. and Canada only)
Fax: +1-215-386-7999
E-mail: membership@siam.org
Postal mail: Society for Industrial and Applied Mathematics, 3600 Market Street, 6th floor, Philadelphia, PA 19104-2688 USA

Standard Audio/Visual Set-Up in Meeting Rooms
SIAM does not provide computers for any speaker. When giving an electronic presentation, speakers must provide their own computers. SIAM is not responsible for the safety and security of speakers’ computers.

The Plenary Session Room will have two (2) screens, one (1) data projector and one (1) overhead projector. The data projectors support VGA connections only. Presenters requiring an HDMI or alternate connection must provide their own adaptor.

All other concurrent/breakout rooms will have one (1) screen and one (1) data projector. The data projectors support VGA connections only. Presenters requiring an HDMI or alternate connection must provide their own adaptor.

If you have questions regarding availability of equipment in the meeting room of your presentation, please see a SIAM staff member at the registration desk.

Internet Access
The DoubleTree Resort by Hilton Paradise Valley offers wireless Internet access to guestrooms in the SIAM block and in public areas of the hotel at no additional charge.

Complimentary wireless Internet access in the meeting space is also available to SIAM attendees.

In addition, a limited number of computers with Internet access will be available during registration hours.

Registration Fee Includes
- Admission to all technical sessions
- Business Meeting (open to SIAG/APDE members)
- Coffee breaks daily
- Poster Session
- Room set-ups and audio/visual equipment
- Welcome Reception and Poster Session

Job Postings
Please check with the SIAM registration desk regarding the availability of job postings or visit http://jobs.siam.org.
Important Notice to Poster Presenters
The poster session is scheduled for Sunday, December 6, from 6:00 PM – 8:00 PM. Poster presenters are requested to set up their poster material no later than 6:00 PM on Sunday, the official start time of the session. Posters will remain on display through Thursday, December 10 and must be removed by 11:00 AM. Posters remaining after this time will be discarded. SIAM is not responsible for discarded posters.

SIAM Books and Journals
Display copies of books and complimentary copies of journals are available on site. SIAM books are available at a discounted price during the conference. If a SIAM books representative is not available, completed order forms and payment (credit cards are preferred) may be taken to the SIAM registration desk. The books table will close at 12:00 PM on Thursday, December 10.

Name Badges
A space for emergency contact information is provided on the back of your name badge. Help us help you in the event of an emergency!

Comments?
Comments about SIAM meetings are encouraged! Please send to:
Cynthia Phillips, SIAM Vice President for Programs (vpp@siam.org).

Get-togethers
Welcome Reception and Poster Session
Sunday, December 6
6:00 PM – 8:00 PM

Business Meeting
(open to SIAG/APDE members)
Tuesday, December 8
7:15 PM – 8:00 PM
Complimentary beer and wine will be served.

Please Note
SIAM is not responsible for the safety and security of attendees’ computers. Do not leave your laptop computers unattended. Please remember to turn off your cell phones, pagers, etc. during sessions.

Recording of Presentations
Audio and video recording of presentations at SIAM meetings is prohibited without the written permission of the presenter and SIAM.

Social Media
SIAM is promoting the use of social media, such as Facebook and Twitter, in order to enhance scientific discussion at its meetings and enable attendees to connect with each other prior to, during and after conferences. If you are tweeting about a conference, please use the designated hashtag to enable other attendees to keep up with the Twitter conversation and to allow better archiving of our conference discussions. The hashtag for this meeting is #SIAMPD15.

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Minitutorials

Tuesday, December 8  
5:00 PM – 7:00 PM  
**MT1** PDE Aspects of Mean Field Games  
Room: Forum – Lower Level  
Organizer: **Pierre Cardaliaguet**, *Université Paris Dauphine, France*

Wednesday, December 9  
5:15 PM – 7:15 PM  
**MT2** Simulating Stochastic Systems  
Room: Forum – Lower Level  
Organizer: **Jonathan Weare**, *University of Chicago, USA*
Prize Lecture

Wednesday, December 9
2:00 PM – 2:45 PM

SP1
SIAG/Analysis of Partial Differential Equations
Prize Lecture

Slow Modulation and Large-time Dynamics Near Periodic Waves

Room: Forum – Lower Level

Miguel Rodrigues, Université de Rennes 1, France
Invited Plenary Speakers

** All Invited Plenary Presentations will take place in Forum - Lower Level**

Monday, December 7
11:00 AM – 11:45 AM
IP1 Tracing Genealogy Within an Invasion Wave
Kerry A. Landman, University of Melbourne, Australia

11:45 AM – 12:30 PM
IP2 Regularity Properties of the Euler Equations in Lagrangian Variables
Vlad C. Vicol, Princeton University, USA

Tuesday, December 8
11:00 AM – 11:45 AM
IP3 Hypersurfaces with Almost Constant Mean Curvature and Capillarity Theory
Francesco Maggi, University of Texas at Austin, USA

11:45 AM – 12:30 PM
IP4 Long Time Dynamics for Two Dimensional Water Wave Models
Daniel Tataru, University of California, Berkeley, USA

Wednesday, December 9
11:00 AM – 11:45 AM
IP5 Optimal Shape and Location of Sensors or Actuators in PDE Models
Emmanuel Trélat, Université Pierre et Marie Curie, France

11:45 AM – 12:30 PM
IP6 The Abelian Sandpile and Circle Packings
Charles Smart, Cornell University, USA
**Invited Prenary Speakers**

**All Invited Plenary Presentations will take place in Forum - Lower Level**

**Thursday, December 10**

**11:00 AM – 11:45 AM**

**IP7** Scientific Computing in the Movies and Virtual Surgery  
**Joseph Teran**, *University of California, Los Angeles, USA*

**11:45 AM – 12:30 PM**

**IP8** Customising Image Analysis Using Nonlinear Partial Differential Equations  
**Carola-Bibiane Schönlieb**, *University of Cambridge, United Kingdom*
SIAM Activity Group on Analysis of Partial Differential Equations (SIAG/PDE)
www.siam.org/activity/pde

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Collaborate and interact with mathematicians and applied scientists whose work involves analysis of partial differential equations

ACTIVITIES INCLUDE:
• Special sessions at SIAM meetings
• Biennial conference
• SIAG/PDE newsletter
• SIAG/PDE Prize
• PDE website

BENEFITS OF SIAG/PDE MEMBERSHIP:
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• Additional $10 discount on registration for the SIAM Conference on Analysis of Partial Differential Equations (excludes students)
• Electronic communications about recent developments in your specialty
• Eligibility for candidacy for SIAG/PDE office
• Participation in the selection of SIAG/PDE officers

ELIGIBILITY:
• Be a current SIAM member.

COST:
• $10 per year
• Student members can join two activity groups for free!

2014—2016 SIAG/PDE OFFICERS:
• Chair: Helena Nussenzveig Lopes
• Vice-Chair: Dejan Slepcev
• Program Director: Lia Bronsard
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SIAM Presents

An audio-visual archive, comprised of more than 1800 presentations posted in 28 searchable topics, including:
- algebraic geometry
- atmospheric and oceanographic science
- computational science
- data mining
- geophysical science
- optimization
- uncertainty quantification
and more...

The collection, *Featured Lectures from our Archives*, includes audio and slides from 25 conferences since 2008, including talks by invited and prize speakers, select minisymposia, and minitutorials from the 2014 Annual Meeting and four 2014 SIAM meetings.

In addition, you can view brief video clips of speaker interviews and topic overviews from sessions at Annual Meetings starting in 2010, as well as the 2013 SIAM Conference on Computational Science and Engineering and the 2014 SIAM Conference on the Life Sciences.

Plans for adding more content from SIAM meetings abound, including presentations from six meetings in 2015.

New presentations are posted every few months as the program expands with sessions from additional SIAM meetings. Users can search for presentations by category, speaker name, and/or keywords.

The audio, slide, and video presentations are part of SIAM’s outreach activities to increase the public’s awareness of mathematics and computational science in the real world, and to bring attention to exciting and valuable work being done in the field. Funding from SIAM, the National Science Foundation, and the Department of Energy was used to support this project.

www.siam.org/meetings/presents.php
PD15 Program

SIAM Conference on Analysis of Partial Differential Equations

December 7-10, 2015
DoubleTree Resort by Hilton
Paradise Valley-Scottsdale
Scottsdale, Arizona USA
Sunday, December 6

Registration
4:00 PM-8:00 PM
Room: Grand Ballroom Foyer - Main Level

PP1
Welcome Reception and Poster Session
6:00 PM-8:00 PM
Room: Forum - Lower Level

Four-Step Hybrid Type Method with Vanished Phase-Lag and Its First Derivatives for Each Level for the Approximate Integration of the Schrodinger Equation
Ibraheem Alolyan, King Saud University, Saudia Arabia

Phase Slip Solutions in Magnetically Modulated Taylor-Couette Flow
Farzana Khan, Quaid-i-Azam University, Islamabad, Pakistan; Rainer Hollerbach, Leeds University, United Kingdom

Charged Boundary-Layer Domain Walls in Thin Ferromagnetic Films
Ross Lund and Cyrili B. Muratov, New Jersey Institute of Technology, USA; Valeriy Slastikov, University of Bristol, United Kingdom

Frechet Differentiability in the Optimal Control of Parabolic Free Boundary Problems
Jessica Pillow, Rhodes College, USA; Ugur G. Abdulla, Florida Institute of Technology, USA; Dylanger Pittman, Williams College, USA; Jonathan Goldfarb, Florida Institute of Technology, USA

Monday, December 7

Registration
7:30 AM-5:30 PM
Room: Grand Ballroom Foyer - Main Level

Monday, December 7

MS1
Partial Differential Equations in Image Analysis and Processing - Part I of II
8:30 AM-10:30 AM
Room: Forum - Lower Level

For Part 2 see MS17
Nonlinear partial differential equations and non-smooth variational methods constitute one of the main analytical tools for modelling, analyzing and processing images. Apart from them being powerful computational tools for processing images, they are interesting mathematical objects whose analysis often requires very sophisticated tools from nonlinear PDE analysis, variational calculus, geometric measure theory and functional analysis. In this minisymposium we showcase some recent approaches that include transport equations for image restoration, PDEs on graphs for data clustering, free discontinuity approaches for image segmentation and non-smooth variational approaches for multi-channel image processing.

Organizer: Carola B. Schoenlieb
University of Cambridge, United Kingdom

Organizer: Laird Robert Hocking
University of Cambridge, United Kingdom

8:30-8:55 Reverse Engineering a Pde from An Image Inpainting Algorithm
Laird Robert Hocking, University of Cambridge, United Kingdom

9:00-9:25 Geometric Graph Based Algorithms
Andrea L. Bertozzi, University of California, Los Angeles, USA

9:30-9:55 A Chromaticity-Brightness Model for Color Images Denoising
Irene Fonseca, Carnegie Mellon University, USA

10:00-10:25 Variational Approach to Image Segmentation and Inpainting
Franco Tomarelli, Politecnico di Milano, Italy
Monday, December 7

**MS2**

**Nonlocal Interaction Models: Dynamics, Asymptotics and Applications - Part I of II**

8:30 AM-10:30 AM

Room: Rio Verde - Main Level

For Part 2 see MS15

A range of physical and biological systems — from biological swarms and granular media to crystallization and self-assembly of nano particles — can be described by mathematical models of nonlocal interactions. The purely nonlocal nature of these models presents a variety of mathematical challenges that require techniques from diverse areas applied mathematics to be combined in new ways. With this minisymposium, we aim to bring together young researchers and leading scholars who study nonlocal interaction models and their applications via variational, dynamical and asymptotic analysis.

Organizer: Katy Craig
University of California, Santa Barbara, USA

Organizer: Ihsan A. Topaloglu
McMaster University, Canada

8:30-8:55 **Attractive-Repulsive Interaction of Sets and Height Constrained Densities**
Ihsan A. Topaloglu, McMaster University, Canada

9:00-9:25 **Existence and Geometry of Minimisers for the Interaction Energy**
Francesco Patacchini, Imperial College London, United Kingdom

9:30-9:55 **A New Method for Finding Approximate Global Minimizers to Pairwise Interaction Problems**
David Shirokoff, New Jersey Institute of Technology, USA

10:00-10:25 **Nonlocal Functionals and Dimensionality Reduction**
Xin Yang Lu and Dejan Slepcev, Carnegie Mellon University, USA

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Monday, December 7

**MS3**

**Convex Integration and Degenerate Solutions to Nonlinear PDEs in Geometry and Physics - Part I of II**

8:30 AM-10:30 AM

Room: Sonora - Main Level

For Part 2 see MS30

This minisymposium concerns questions of flexibility and rigidity of solutions to nonlinear pdes, with a focus on degenerate (flexible) weak solutions which can be obtained through methods of convex integration. Recent advances regarding Holder continuous dissipative solutions to Euler equations have renewed the interest in applying these methods to a wider range of problems, including the Monge-Ampere and transport equations. Similar efforts have also lead to progress regarding isometric immersions. Our objective is to bring together scientists involved with flexibility vs. rigidity in fluid dynamics and in geometric pdes, in order to investigate discuss advances and challenges from different perspectives

Organizer: Marta Lewicka
University of Pittsburgh, USA

Organizer: Reza Pakzad
University of Pittsburgh, USA

8:30-8:55 **Convex Integration and Infinitely Many Weak Solutions to the Perona-Malik Equation in All Dimensions**
Baisheng Yan, Michigan State University, USA; Seonghak Kim, Renmin University of China, China

9:00-9:25 **Convex Integration for Active Scalar Equations**
Philip Isett, Massachusetts Institute of Technology, USA

9:30-9:55 **A Nash-Kuiper Theorem for C^{1,1/5-} Embeddings of Surfaces in 3 Dimensions**
Dominik Inauen and Camillo De Lellis, University of Zurich, Switzerland; László Jr. Székelyhidi, University of Leipzig, Germany

10:00-10:25 **Convex Integration for the Monge-Ampere Equation**
Marta Lewicka and Reza Pakzad, University of Pittsburgh, USA

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Monday, December 7

**MS4**

**Fluid Models, Turbulence and Data Assimilation - Part I of II**

8:30 AM-10:30 AM

Room: Sedona - Main Level

For Part 2 see MS18

Many dissipative dynamical systems of practical interest arise in the context of geophysical flows related to the atmosphere and ocean. The dynamics of such models are generically chaotic and “turbulent,” calling for a probabilistic framework to properly analyze the underlying phenomena. Moreover, due to the imprecise knowledge of the initial condition for the governing equations, it can be helpful to dynamically update the solution with data collected continuously-in-time to improve prediction. This symposium will therefore focus on the interplay of topics such as regularity, data assimilation, asymptotic dynamics and statistical/stochastic solutions in analyzing turbulence in dissipative dynamical systems.

Organizer: Vincent R. Martinez
Tulane University, USA

Organizer: Michael S. Jolly
Indiana University, USA

Organizer: Animikh Biswas
University of Maryland, Baltimore County, USA

8:30-8:55 **A Data Assimilation Algorithm for the Hyperdissipative Sqg Equation**
Vincent R. Martinez, Tulane University, USA; Michael S. Jolly, Indiana University, USA; Edriss Titi, Texas A&M University, USA

9:00-9:25 **Backward in Time Behavior of Nonlinear Dissipative Equations – The Effect of Energy Spectra**
Yanqiu Guo, Weizmann Institute of Science, Israel; Edriss S. Titi, Texas A&M University, USA and Weizmann Institute of Science, Israel

continued on next page
Monday, December 7

**MS4**

**Fluid Models, Turbulence and Data Assimilation - Part I of II**

8:30 AM-10:30 AM

Room:Sedona - Main Level

9:30-9:55 The Regularized 3D Boussinesq Equations with Fractional Laplacian and No Diffusion

Hakima Bessaih, University of Wyoming, USA

10:00-10:25 Analyticity Properties of the Navier-Stokes and Euler Equations

Igor Kukavica, University of Southern California, USA

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**MS5**

**Analysis and Control of Fluid Models and Flow-coupled Systems - Part I of IV**

8:30 AM-10:30 AM

Room:Palomas - Main Level

For Part 2 see MS19

This minisymposium will serve to promote and disseminate recent developments on evolution PDEs, especially those describing fluid or gas flows and their interaction with other types of dynamics such as plates or elastic solids, with fixed or moving interfaces. Questions on modeling, well-posedness, control, stability, optimization and numerical simulations will be of primary interest.

Organizer: Marcelo Disconzi

Vanderbilt University, USA

Organizer: Irena M. Lasiecka

University of Memphis, USA

Organizer: Daniel Toundykov

University of Nebraska-Lincoln, USA

Organizer: Justin T. Webster

North Carolina State University, USA

8:30-8:55 An Energy-Conserving One-Dimensional Model of 3D Euler

Stephen Preston, University of Colorado Boulder, USA

9:00-9:25 Long Time Solutions for Two Dimensional Water Waves

Mihaela Ifrim, McMaster University, Canada; Daniel Tataru, University of California, Berkeley, USA; John Hunter, University of California, Davis, USA

9:30-9:55 Stabilization of a Boussinesq System for Surface Water Waves

Ademir Pazoto, Federal University of Rio de Janeiro, Brazil; Sorin Micu, University of Craiova, Romania

10:00-10:25 On Nonlocal Differential Operators and Applications

Andrei Tarfulea, Princeton University, USA

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**MS6**

**Coherent Structures in Hamiltonian PDE - Part I of III**

8:30 AM-10:30 AM

Room:Coronado - Main Level

For Part 2 see MS20

Hamiltonian partial differential equations appear in many fields including plasma physics, optics and fluid mechanics, where they can characterize wave phenomenon such as solitons, wave collapse and turbulence. Hamiltonian partial differential equations provide a variety of challenges, ranging from well-posedness to numerical methods. This session will survey recent advances in Hamiltonian Partial Differential Equations, including progress on blow-ups of nonlinear Schrodinger equations, rigorous derivation of focusing NLS from quantum many-body systems, and well-posedness of wave maps.

Organizer: Magdalena Czubak

Binghamton University, USA

Organizer: Gideon Simpson

Drexel University, USA

Organizer: Daniel Spirn

University of Minnesota, USA

Organizer: Catherine Sulem

University of Toronto, Canada

8:30-8:55 Effective Dynamics of Charged Interfaces

Kyle Thompson, University of Toronto, Canada

9:00-9:25 Canonical Transformations on Null Forms

Amanda French, Walter Craig, and Chi-Ru Yang, McMaster University, Canada

9:30-9:55 Wave Maps on Hyperbolic Space

Andrew Lawrie, University of California, Berkeley, USA

10:00-10:25 Recent Progress on the Wave Maps Equation on Hyperbolic Spaces

Sohrab Shahshahani, University of Michigan, USA
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<td><strong>Ginzburg-Landau Theory and Related Topics - Part I of III</strong></td>
<td><strong>Multiscale Analysis, Modeling and Simulation for Applications in Material Science - Part I of III</strong></td>
<td><strong>Transport Theory in Complex Particle Systems - Part I of II</strong></td>
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<td><strong>8:30 AM-10:30 AM</strong></td>
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<td><strong>For Part 2 see MS22</strong></td>
<td><strong>For Part 2 see MS23</strong></td>
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<td>The mathematical tools developed to study variational models for superconducting systems are often successfully used in other areas of materials science, to examine phenomena such as topological defects in liquid crystals and solids. The minisymposium will feature speakers with an interest and background in the analysis and modeling of superconducting materials. Research on both dynamic and stationary problems will be presented. Topics will include behavior of minimizers, vortex filaments, vortex scattering and traveling waves in Ginzburg-Landau and related models.</td>
<td>In recent years we have witnessed a tremendous growth of activity on developing methods for materials-related phenomena whose essential role extends over multiple scales in time and space. The proposed minisymposium will focus on multiscale modeling, analysis and simulation of the problems arising in composite and other heterogeneous media. In particular, topics that will be discussed include but not limited to are asymptotic analysis, homogenization, inverse problems, and computational tools for complex inhomogeneous media. The purpose of this section is to enable contact between researchers working on multiscale methods with an update on recent progress in this field.</td>
<td>This minisymposium will focus on common issues associated with analytical methods for dispersive and dissipative nonlinear partial or integral transport equations arising in many areas of mathematical and statistical physics in the study of quantum and kinetic theories. These models arise in the study of microscopic dynamics of complex interacting systems derived into nonlinear and nonlocal quantum and kinetic systems and their macroscopic approximations into PDEs for classical dynamics. Discussions will focus on analytical properties of particle interacting transport models such as non-linear Schroedinger, Vlasov or Boltzmann type, by means of classical, probabilistic and stochastic analysis methods.</td>
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| **Organizer:** Tiziana Giorgi  
New Mexico State University, USA | **Organizer:** Silvia Jimenez  
Colgate University, USA | **Organizer:** Maja Taskovic  
University of Texas at Austin, USA |
| **Organizer:** Dmitry Golovaty  
University of Akron, USA | **Organizer:** Yuliya Gorb  
University of Houston, USA | **Organizer:** Irene M. Gamba  
University of Texas at Austin, USA |
| **8:30-8:55 Some Geometric Ginzburg-Landau Problems**  
Robert Jerrard, University of Toronto, Canada | **8:30-8:55 Homogenization of a Transmission Problem**  
Shari Moskow, Drexel University, USA | **8:30-8:55 Random Versus Probabilistic Approach in the Study of Wave and Dispersive Equations**  
Gigliola Staffilani, Massachusetts Institute of Technology, USA |
| **9:00-9:25 Defect Solutions in Vector-Valued Singular Problems**  
Andres A. Contreras, New Mexico State University, USA | **9:00-9:25 On Mathematical Modeling of Charged Laminate Materials**  
Bart S. Tilley, Worcester Polytechnic Institute, USA; Daniel Gendin, Boston University, USA | **9:00-9:25 Many Body Dynamics, Nonlinear Dispersive PDE and Quantum De Finetti Theorems**  
Thomas Chen, University of Texas at Austin, USA; Christian Haizl, University of Tuebingen, Germany; Natasa Pavlovic, University of Texas at Austin, USA; Robert Seiringer, Princeton University, USA |
| **9:30-9:55 Analysis of Minimizers of the Lawrence-Doniach Model for Layered Superconductors in Magnetic Fields**  
Guanying Peng, University of Cincinnati, USA; Patricia Bauman, Purdue University, USA | **9:30-9:55 Equations for Poroelastic Materials**  
Miao-Jung Y. Ou, University of Delaware, USA | **9:30-9:55 Dynamics of Fermions Near Thermal Equilibrium Interacting with Power Nonlinearities**  
Thomas Chen, Younghung Hong, and Natasa Pavlovic, University of Texas at Austin, USA |
| **10:00-10:25 Vortex Scattering and the Gross-Pitaevskii Equation**  
Matthias Kurzke, University of Nottingham, United Kingdom; Jeremy L. Marzoula, University of North Carolina at Chapel Hill, USA; Daniel Spirn, University of Minnesota, USA | **10:00-10:25 On Well Productivity Index for Compressible Fluid, and Applications**  
 Lidia Bloshanskaya, State University of New York, New Paltz, USA; Eugenio Aulisa and Akif Ibragimov, Texas Tech University, USA | **10:00-10:25 Global Behavior and Non-squeezing for the NLKG**  
Dana Mendelson, Massachusetts Institute of Technology, USA |
Monday, December 7

**MS10**

Large-Time Dynamics of the Navier-Stokes Equations and Related Models

8:30 AM-10:30 AM

Room: Chambers Lecture Hall - Main Level

The accurate, reliable prediction of the long-time dynamical evolution of hydrodynamic systems has become increasingly important in the climatological, astrophysical, and geophysical sciences. Mathematically quantifying this behaviour allows for more accurate and cost-effective reduced models, and helps validate existing models, leading to more realistic real-time predictions for the long-time dynamics of such systems. This minisymposium will address the long-time dynamics of hydrodynamic models such as the Navier-Stokes equations and related models. Of particular interest are the study of the global attracting set, techniques in data assimilation, asymptotically reduced models, and the global well-posedness in time of these models.

Organizer: Adam Larios

*University of Nebraska, Lincoln, USA*

8:30-8:55 Determining Modes for 3D Navier-Stokes

Landon Kavlie, University of Illinois, Chicago, USA

9:00-9:25 Ergodicity Results for Stochastic Boussinesq Equations

Geordie Richards, University of Rochester, USA; Juraj Foldes, Université Libre de Bruxelles, Belgium; Nathan Glatt-Holtz, Virginia Tech, USA; Enrique A. Thomann, Oregon State University, USA

9:30-9:55 Statistical Solutions and the Asymptotic Behaviour of Evolutionary Systems

Ricardo Rosa, Universidade Federal do Rio De Janeiro, Brazil

10:00-10:25 Global Attractors for Discrete Dynamical Systems Which Approximate the Two-Dimensional Navier Stokes Equations and the Model Error in the Ns-Alpha Model.

Eric Olson, University of Nevada, Reno, USA

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Monday, December 7

**MS11**

Advances in Theoretical and Numerical Analysis of Parametrized PDEs in High Dimension - Part I of II

8:30 AM-10:30 AM

Room: Four Peaks - Upper Level

For Part 2 see MS25

This minisymposium focuses on advances in numerical analysis of parametrized PDEs. Predicting the behavior of the solution map relies on constructing solutions in terms of high-dimensional spaces, particularly in the case when the input data depend on a large number of parameters. For higher accuracy, simulations must increase the number of dimensions, and expend more effort resolving smooth or even discontinuous behavior within each dimension. The resulting explosion in computational effort is a symptom of the curse of dimensionality. This mini-symposium aims at exploring recent breakthroughs in analysis of sparse sampling and representations, least squares projection, compressed sensing, low-rank approximations.

Organizer: Abdellah Chkifa

*Oak Ridge National Laboratory, USA*

Organizer: Hoang A. Tran

*Oak Ridge National Laboratory, USA*

Organizer: Clayton G. Webster

*Oak Ridge National Laboratory, USA*

Organizer: Guannan Zhang

*Oak Ridge National Laboratory, USA*

8:30-8:55 Multi-Level Monte Carlo with Control Variate for Elliptic Pdes with Log-Normal Coefficients.

Fabio Nobile, EPFL, Switzerland

9:00-9:25 High-Dimensional Approximation Using Equilibrium Measures

Akil Narayan, University of Massachusetts, Dartmouth, USA; John D. Jakeman, Sandia National Laboratories, USA; Tao Zhou, Chinese Academy of Sciences, China

9:30-9:55 A Multi-Level Compressed Sensing Petrov-Galerkin Method for the Approximation of Parametric PDEs

Jean-Luc Bouchot, Drexel University, USA; Benjamin Bykowski and Holger Rauhut, RWTH Aachen University, Germany; Christoph Schwab, ETH Zürich, Switzerland

10:00-10:25 Compressed Sensing Approaches for Polynomial Approximation of Hilbert-Valued Functions on Lower Sets

Clayton G. Webster, Abdellah Chkifa, and Hoang A. Tran, Oak Ridge National Laboratory, USA

continued in next column
Monday, December 7

MS12
Challenges in the Mechanics of Thin Elastic Structures - Part I of III
8:30 AM-10:30 AM
Room: Flagstaff A - Upper Level
For Part 2 see MS14

The mechanics of thin structures is a field where geometry and mechanics interact, leading to deep questions in PDE and the calculus of variations. Current issues include (i) understanding the patterns and defects produced by compressive loads in flat or cylindrical structures; (ii) understanding how growth, misfit, or crystalline defects influence the preferred shape of a thin structure; and (iii) understanding the emergence of localized structures such as folds and conical singularities. The talks in this 3-part minisymposium will address these and related problems, drawing on tools from geometry, mechanics, the calculus of variations, and PDE.

Organizer: Robert V. Kohn
Courant Institute of Mathematical Sciences, New York University, USA

8:30-8:55 Folding Patterns in Partially Delaminated Thin Films
Sergio Conti, Universität Bonn, Germany

9:00-9:25 Unstretchable Two-Dimensional Elastic Bodies: Kinematics and Energetics
Eliot Fried, Okinawa Institute of Science and Technology, Japan

9:30-9:55 Isometric Immersions and Self Similar Buckling in Non-Euclidean Elastic Sheets
John A. Gemmer, Brown University, USA; Shankar C. Venkataramani, University of Arizona, USA; Eran Sharon, The Hebrew University, Israel

10:00-10:25 Understanding Mechanisms of High Sensitivity of Buckling Loads to Imperfections.
Yury Grabovsky, Temple University, USA; Davit Harutyunyan, University of Utah, USA

Monday, December 7

MS13
Complex Systems Arising in Biology and Economics - Part I of II
8:30 AM-10:00 AM
Room: Flagstaff B - Upper Level
For Part 2 see MS26

Partial differential equation systems have become ubiquitous in modern science. Applications arising in Biology and Economics provide complex systems which are challenging from a modeling, numerical, and analytical perspective. In this minisymposium, we will discuss several such complex systems and their relationship with current PDE research.

Organizer: Daniel Brinkman
Arizona State University, USA

Organizer: Sebastien Motsch
Arizona State University, USA

8:30-8:55 Mathematics of Insurance: Continuous Time Approximations
Daniel Brinkman, Arizona State University, USA

9:00-9:25 Agent Based Simulations for Chip Sales to High-End Gamers
Andee Thatcher, Arizona State University, USA

9:30-9:55 Model Predictive Control for Many Agent Systems
Michael Herty, RWTH Aachen University, Germany

Monday, December 7

CP1
Elliptic Problems
8:30 AM-10:30 AM
Room: San Carlos - Main Level
Chair: Giles Auchmuty, University of Houston, USA

8:30-8:45 The Laplace Equation and The Numerical Analysis For Streamline Around a Circle
Jacobs Andreas Atohema Somnic, Bandung Institute of Technology, Indonesia

8:50-9:05 Steklov Eigenproblems and Representations of Solutions of Laplace’s Equation
Giles Auchmuty, University of Houston, USA

9:10-9:25 Steklov Representations of Harmonic Functions and Applications
Giles Auchmuty and Manki Cho, University of Houston, USA

9:30-9:45 Computing the Thermal Properties of Ground Heat Exchangers
Paul Christodoulides and Georgios Florides, Cyprus University of Technology, Cyprus

9:50-10:05 Asymptotics for the Best Sobolev Constants and Their Extremal Functions
Grey Ercole and Gilberto Pereira, Universidade Federal de Minas Gerais, Brazil

10:10-10:25 Radial Eigenpairs of P-Laplacian Via Inverse Iterations
Julio Cesar Espirito Santo, Universidade Federal de Ouro Preto, Brazil; Grey Ercole, Universidade Federal de Minas Gerais, Brazil; Eder Marinho Martins, Universidade Federal de Ouro Preto, Brazil

Coffee Break
10:30 AM-10:55 AM
Room: Forum - Lower Level

Welcome Remarks
10:55 AM-11:00 AM
Room: Forum - Lower Level
Cell invasion, whereby cells move and undergo cell division, occurs in tumor growth, wound healing and during embryonic development. Continuum models of cell invasion typically employ the well-known Fisher equation. This PDE supports travelling wave solutions, making the population-level behavior highly predictable. However, recent individual cell lineage experiments (within a predictable cell invasion wave) revealed a surprising result: the contribution of individual cells is highly unequal. This paradoxical behavior is examined using various tools, including PDEs to track the number of divisions that cells undergo within an invasion wave. The method provides a potentially useful technique for deducing cell lineage data when imaging every cell is not feasible.

Kerry A. Landman
University of Melbourne, Australia
Monday, December 7

**MS15**

**Nonlocal Interaction Models: Dynamics, Asymptotics and Applications - Part II of II**

2:30 PM-4:30 PM

**Room:** Rio Verde - Main Level

For Part 1 see MS2

A range of physical and biological systems — from biological swarms and granular media to crystallization and self-assembly of nano particles — can be described by mathematical models of nonlocal interactions. The purely nonlocal nature of these models presents a variety of mathematical challenges that require techniques from diverse areas applied mathematics to be combined in new ways. With this minisymposium, we aim to bring together young researchers and leading scholars who study nonlocal interaction models and their applications via variational, dynamical and asymptotic analysis.

**Organizer:** Katy Craig

*University of California, Santa Barbara, USA*

**Organizer:** Ihsan A. Topaloglu

*McMaster University, Canada*

**2:30-2:55 Energy Driven Pattern Formation in Planar Dipole-Dipole Systems in the Presence of Weak Noise**

*Andrew J. Bernoff, Harvey Mudd College, USA; Jaron Kent-Dobias, Cornell University, USA*

**3:00-3:25 Stationary Solution and Long-time Behavior of 2D Keller-Segel Model with Degenerate Diffusion**

*José Carrillo, Imperial College London, United Kingdom; Sabine Hittmeir, Johann Radon Institute for Computational and Applied Mathematics, Austria; Bruno Volzone, Parthenope University, Napoli, Italy; Yao Yao, University of Wisconsin, Madison, USA*

**3:30-3:55 Analysis of a Particle Method for the Aggregation Equation**

*Martin Campos Pinto, CNRS, France; José A. Carrillo, Imperial College London, United Kingdom; Frédérique Charles, Laboratoire Jacques-Louis Lions, France; Young-Pil Choi, Imperial College London, United Kingdom*

**4:00-4:25 Interaction Models with Nonlinear Diffusion**

*Razvan Fethceau, Simon Fraser University, Canada; Martin Burger, University of Muenster, Germany; Yanghong Huang, Imperial College London, United Kingdom*

continued in next column
Monday, December 7

**MS17**

**Partial Differential Equations in Image Analysis and Processing - Part II of II**

2:30 PM-4:30 PM

*Room: San Carlos - Main Level*

*For Part I see MS1*

Nonlinear partial differential equations and non-smooth variational methods constitute one of the main analytical tools for modelling, analyzing and processing images. Apart from them being powerful computational tools for processing images, they are interesting mathematical objects whose analysis often requires very sophisticated tools from nonlinear PDE analysis, variational calculus, geometric measure theory and functional analysis. In this minisymposium we showcase some recent approaches that include transport equations for image restoration, PDEs on graphs for data clustering, free discontinuity approaches for image segmentation and non-smooth variational approaches for multi-channel image processing.

*Organizer: Carola B. Schoenlieb*

*University of Cambridge, United Kingdom*

*Organizer: Laird Robert Hocking*

*University of Cambridge, United Kingdom*

**2:30-2:55 Discrete Varifolds, Point Clouds, and Surface Approximation**

Simon Masnou, University of Lyon 1, France

**3:00-3:25 Approximation of Curvature Dependent Functionals in Imaging**

Selim Esedoglu, University of California, Los Angeles, USA

**3:30-3:55 Limiting Aspects of Non-Convex TV$^q$ Models in Image Processing**

Michael Hintermüller, Humboldt University Berlin, Germany

**4:00-4:25 On Convex Finite-Dimensional Variational Methods in Imaging Sciences, and Hamilton-Jacobi Equations**

Jerome Darbon, ENS Cachan, France

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**MS18**

**Fluid Models, Turbulence and Data Assimilation - Part II of II**

2:30 PM-4:30 PM

*Room: Sedona - Main Level*

*For Part I see MS4*

Many dissipative dynamical systems of practical interest arise in the context of geophysical flows related to the atmosphere and ocean. The dynamics of such models are generically chaotic and “turbulent,” calling for a probabilistic framework to properly analyze the underlying phenomena. Moreover, due to the imprecise knowledge of the initial condition for the governing equations, it can be helpful to dynamically update the solution with data collected continuously-in-time to improve prediction. This symposium will therefore focus on the interplay of topics such as regularity, data assimilation, asymptotic dynamics and statistical/stochastic solutions in analyzing turbulence in dissipative dynamical systems.

*Organizer: Vincent R. Martinez*

*Tulane University, USA*

*Organizer: Michael S. Jolly*

*Indiana University, USA*

*Organizer: Animikh Biswas*

*University of Maryland, Baltimore County, USA*

**2:30-2:55 Minimal Scaling Laws Induced by the Scale of Local Isotropic Diffusion in 3D NSE**

Zoran Grujic, University of Virginia, USA

**3:00-3:25 Data Assimilation Algorithms for the Bénard Convection Model and Other Models of Turbulence**

Aseel Farhat, Indiana University

Bloomington, USA; Michael S. Jolly, Indiana University, USA; Evelyn Lunasin, United States Naval Academy, USA; Edriss S. Titi, Texas A&M University, USA and Weizmann Institute of Science, Israel

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*Radu Dascaliuc, Oregon State University, USA*

4:00-4:25 **Statistical Behavior of a Data Assimilation Algorithm for the 2D Navier-Stokes Equations**

*Cecilia F. Mondaini and Ciprian Foias, Texas A&M University, USA; Edriss S. Titi, Texas A&M University, USA and Weizmann Institute of Science, Israel*

continued in next column
Monday, December 7

**MS19**

**Analysis and Control of Fluid Models and Flow-coupled Systems - Part II of IV**

2:30 PM-4:30 PM  
**Room:** Palomas - Main Level

For Part 1 see MS5  
For Part 3 see MS31

This minisymposium will serve to promote and disseminate recent developments on evolution PDEs, especially those describing fluid or gas flows and their interaction with other types of dynamics such as plates or elastic solids, with fixed or moving interfaces. Questions on modeling, well-posedness, control, stability, optimization and numerical simulations will be of primary interest.

**Organizer:** Marcelo Disconzi  
*Vanderbilt University, USA*

**Organizer:** Irena M. Lasiecka  
*University of Memphis, USA*

**Organizer:** Daniel Toundykov  
*University of Nebraska-Lincoln, USA*

**Organizer:** Justin T. Webster  
*North Carolina State University, USA*

2:30-2:55 **Porous Medium Equation with Heterogeneous Constraints and Advection**  
Malgorzata Peszynska and Ralph E. Showalter, Oregon State University, USA; Justin T. Webster, North Carolina State University, USA

3:00-3:25 **Analysis of Nonlinear Poro-elastic and Poro-visco-elastic Models**  
Lorena Bociu, North Carolina State University, USA; Giovanna Guidoboni, Indiana University - Purdue University Indianapolis, USA; Riccardo Sacco, Politecnico di Milano, Italy; Justin T. Webster, North Carolina State University, USA

3:30-3:55 **Analysis of the Flow of Landau-De Gennes Energy Functional under Weak Anchoring Conditions**  
Changyou Wang, Purdue University, USA

4:00-4:25 **On the Evolution Equations of Free Liquid Fibers and Films**  
Thomas Hagen, University of Memphis, USA

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Monday, December 7

**MS20**

**Coherent Structures in Hamiltonian PDE - Part II of III**

2:30 PM-4:30 PM  
**Room:** Coronado - Main Level

For Part 1 see MS6  
For Part 3 see MS32

Hamiltonian partial differential equations appear in many fields including plasma physics, optics and fluid mechanics, where they can characterize wave phenomenon such as solitons, wave collapse and turbulence. Hamiltonian partial differential equations provide a variety of challenges, ranging from well-posedness to numerical methods. This session will survey recent advances in Hamiltonian Partial Differential Equations, including progress on blow-ups of nonlinear Schrodinger equations, rigorous derivation of focusing NLS from quantum many-body systems, and well-posedness of wave maps.

**Organizer:** Magdalena Czubak  
*Binghamton University, USA*

**Organizer:** Gideon Simpson  
*Drexel University, USA*

**Organizer:** Daniel Spirn  
*University of Minnesota, USA*

**Organizer:** Catherine Sulem  
*University of Toronto, Canada*

2:30-2:55 **Vortex Scattering Across Material Interfaces**  
Jeremy L. Marzuola, University of North Carolina at Chapel Hill, USA

3:00-3:25 **Dirac Points in the Spectrum of Periodic Planar Networks**  
Michael Goldberg, University of Cincinnati, USA

3:30-3:55 **Nonexistence of Small Doubly Periodic Coherent Structures**  
David Ambrose, Drexel University, USA

4:00-4:25 **KdV Dynamics and Traveling Waves in Diatomic Fpu**  
J. Douglas Wright, Drexel University, USA

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Monday, December 7

**MS21**

**Ginzburg-Landau Theory and Related Topics - Part II of III**

2:30 PM-4:30 PM  
**Room:** Center Ballroom - Main Level

For Part 1 see MS7  
For Part 3 see MS33

The mathematical tools developed to study variational models for superconducting systems are often successfully used in other areas of materials science, to examine phenomena such as topological defects in liquid crystals and solids. The minisymposium will feature speakers with an interest and background in the analysis and modeling of superconducting materials. Research on both dynamic and stationary problems will be presented. Topics will include behavior of minimizers, vortex filaments, vortex scattering and traveling waves in Ginzburg-Landau and related models.

**Organizer:** Tiziana Giorgi  
*New Mexico State University, USA*

**Organizer:** Dmitry Golovaty  
*University of Akron, USA*

2:30-2:55 **Vortices in Liquid Crystals, Superconductivity, Optics, and Hydrodynamics: Siblings Or Not?**  
Ibrahim Fatkullin, University of Arizona, USA

3:00-3:25 **Analysis of Nonlinear Porous Medium Equation with Heterogeneous Constraints and Advection**  
Malgorzata Peszynska and Ralph E. Showalter, Oregon State University, USA; Justin T. Webster, North Carolina State University, USA

3:30-3:55 **Analysis of the Flow of Landau-De Gennes Energy Functional under Weak Anchoring Conditions**  
Changyou Wang, Purdue University, USA

4:00-4:25 **On the Evolution Equations of Free Liquid Fibers and Films**  
Thomas Hagen, University of Memphis, USA
### MS22

**Multiscale Analysis, Modeling and Simulation for Applications in Material Science - Part II of III**

**Room:** Bouchon - Main Level

**For Part 1 see MS8**

**For Part 3 see MS37**

In recent years we have witnessed a tremendous growth of activity on developing methods for materials-related phenomena whose essential role extends over multiple scales in time and space. The proposed minisymposium will focus on multiscale modeling, analysis and simulation of the problems arising in composite and other heterogeneous media. In particular, topics that will be discussed include but not limited to are asymptotic analysis, homogenization, inverse problems, and computational tools for complex inhomogeneous media. The purpose of this section is to enable contact between researchers working on multiscale methods with an update on recent progress in this field.

**Organizer:** Yuliya Gorb  
*University of Houston, USA*

**Organizer:** Silvia Jimenez  
*Colgate University, USA*

**2:30-2:55 From Micro-imaging across Multiple Scales**

*Małgorzata Peszynska and Timothy Costa, Oregon State University, USA*

**3:00-3:25 Coupling Models for Darcy, Pre Darcy, and Post Darcy Flows in Porous Media: Analysis and Application**

*Akif Ibragimov, Texas Tech University, USA; Thinh T. Kieu, University of North Georgia, USA; Luan Hoang and Emine Celik, Texas Tech University, USA*

**3:30-3:55 Robust Optimization of Multiscale Viscoelastic Composites**

*Elena Cherkaev, University of Utah, USA*

**4:00-4:25 Hamilton-Jacobi and Eikonal Pdes from Iterated Homogenization Methods in Finite Elasticity**

*Oscar Lopez-Pamies, University of Illinois at Urbana-Champaign, USA*

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### MS23

**Transport Theory in Complex Particle Systems - Part II of II**

**2:30 PM - 4:30 PM**

**Room:** Rattlers - Main Level

**For Part 1 see MS9**

This minisymposium will focus on common issues associated with analytical methods for dispersive and dissipative nonlinear partial or integral transport equations arising in many areas of mathematical and statistical physics in the study of quantum and kinetic theories. These models arise in the study of microscopic dynamics of complex interacting systems derived into nonlinear and nonlocal quantum and kinetic systems and their macroscopic approximations into PDEs for classical dynamics. Discussions will focus on analytical properties of particle interacting transport models such as non-linear Schroedinger, Vlasov or Boltzmann type, by means of classical, probabilistic and stochastic analysis methods.

**Organizer:** Maja Taskovic  
*University of Texas at Austin, USA*

**Organizer:** Irene M. Gamba  
*University of Texas at Austin, USA*

**Organizer:** Natasa Pavlovic  
*University of Texas at Austin, USA*

**2:30-2:55 Some Recent Progress in Boundary Problem of Boltzmann Equation**

*Chanwoo Kim, University of Wisconsin, Madison, USA*

**3:00-3:25 Local Theory for the Boltzmann-Nordheim Equation in Non Isotropic Setting**

*Amit Einav, University of Cambridge, United Kingdom; Marc Briant, Brown University, USA*

**3:30-3:55 Anomalous Energy Transport in PFU-beta Chain**

*Sara Merino-Aceituno, Imperial College London, United Kingdom; Antoine Mellet, University of Maryland, USA*

**4:00-4:25 Exponential Tails for Solutions to the Homogeneous Boltzmann Equation**

*Maja Taskovic, University of Texas at Austin, USA; Ricardo J. Alonso, Pontificia Universidade Catolica Do Rio de Janeiro, Brazil; Irene M. Gamba and Natasa Pavlovic, University of Texas at Austin, USA*

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### MS24

**Modeling of Crowd Dynamics**

**2:30 PM - 4:30 PM**

**Room:** Chambers Lecture Hall - Main Level

Understanding the collective behavior of crowds and related groups of interacting individuals proves essential for industrial and urban planning. The design of evacuation routes in airplanes, buildings and public spaces, as well as the development of effective policing strategies, relies upon such an understanding. Researchers in mathematics and in physics have recently developed a set of models for collective human behavior that provide invaluable insight that contributes to the preparation for unexpected events. This session will bring together experimental and analytical researchers to discuss current developments of these models. The session will cover topics such as pedestrian dynamics and urban crime modeling.

**Organizer:** Chung-Min Lee  
*California State University, Long Beach, USA*

**Organizer:** James von Brecht  
*California State University, Long Beach, USA*

**2:30-2:55 Anisotropic Interactions in First-Order Crowd Models**

*Joep Evers and Razvan Fetecau, Simon Fraser University, Canada; Lenya Ryzhik, Stanford University, USA*

**3:00-3:25 Hotspots in a Nonlocal Crime Model**

*Scott McCalla, Montana State University, USA; Jonah Breslau, Pomona College, USA; Sorathan Chaturapruek, Harvey Mudd College, USA; Theodore Kolokolnikov, Dalhousie University, Canada; Daniel Yazdi, University of California, Los Angeles, USA*

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*continued on next page*
3:30-3:55 Contagion Shocks in One Dimension
Martin Short, Georgia Institute of Technology, USA; Li Wang, University of California, Los Angeles, USA; Jesus Rosado Linares, Universidad de Buenos Aires, Argentina; Andrea L. Bertozzi, University of California, Los Angeles, USA

4:00-4:25 Efficient Numerical Methods for Multiscale Human Crowd Dynamics with Emotional Contagion
Li Wang, University of California, Los Angeles, USA; Martin Short, Georgia Institute of Technology, USA; Andrea L. Bertozzi, University of California, Los Angeles, USA

Monday, December 7
MS25
Advances in Theoretical and Numerical Analysis of Parametrized PDEs in High Dimension - Part II of II
2:30 PM-4:30 PM
Room: Four Peaks - Upper Level

For Part 1 see MS11
This minisymposium focuses on advances in numerical analysis of parametrized PDEs. Predicting the behavior of the solution map relies on constructing solutions in terms of high-dimensional spaces, particularly in the case when the input data depend on a large number of parameters. For higher accuracy, simulations must increase the number of dimensions, and expend more effort resolving smooth or even discontinuous behavior within each dimension. The resulting explosion in computational effort is a symptom of the curse of dimensionality. This minisymposium aims at exploring recent breakthroughs in analysis of sparse sampling and representations, least squares projection, compressed sensing, low-rank approximations.

Organizer: Abdellah Chkifa
Oak Ridge National Laboratory, USA
Organizer: Hoang A. Tran
Oak Ridge National Laboratory, USA
Organizer: Clayton G. Webster
Oak Ridge National Laboratory, USA
Organizer: Guannan Zhang
Oak Ridge National Laboratory, USA

2:30-2:55 Polynomial Chaos Expansion Via Gradient-Enhanced \( \ell_1 \)-Minimization
Alireza Doostan, Jerrad Hampton, and Ji Peng, University of Colorado Boulder, USA

3:00-3:25 Structured and Unstructured Sampling Methods for the Approximation of Parametric PDEs
Abdellah Chkifa and Clayton G. Webster, Oak Ridge National Laboratory, USA

3:30-3:55 Least Squares Approximation in Multivariate Polynomial Spaces and Application to Elliptic PDEs with Stochastic Data
Giovanni Migliorati, Université Pierre et Marie Curie, France

4:00-4:25 Parameter Identification for PDEs with Random Data
Catalin S. Trenchea, University of Pittsburgh, USA

continued in next column
Monday, December 7

MS26
Complex Systems Arising in Biology and Economics - Part II of II

2:30 PM-4:00 PM

Room: Flagstaff B - Upper Level
For Part 1 see MS13
Partial differential equation systems have become ubiquitous in modern science. Applications arising in Biology and Economics provide complex systems which are challenging from a modeling, numerical, and analytical perspective. In this minisymposium, we will discuss several such complex systems and their relationship with current PDE research.

Organizer: Daniel Brinkman  
Arizona State University, USA

Organizer: Sebastien Motsch  
Arizona State University, USA

2:30-2:55 Coalescing Diffusion, and Composite Stochastic Particle-grid Methods for the Investigation of Blow-ups in the Keller-Segel and Similar PDEs
Gleb Zhelezov, University of Arizona, USA

3:00-3:25 Global Minimization with Interacting Particle Systems
Stephan Martin, Imperial College London, United Kingdom; Rene Pinnau, Claudia Totzeck, and Tse Oliver, Technische Universität Kaiserslautern, Germany

3:30-3:55 Multi-agent Dynamics Models for n-ary Markov Jump Processes on a Dense Graph
Juan Rodriguez and Irene M. Gamba, University of Texas at Austin, USA

CP2
Numerical Methods
2:30 PM-4:30 PM

Room: Flagstaff A - Upper Level
Chair: To Be Determined

2:30-2:45 Steady State and Sign Preserving Semi-Implicit Runge-Kutta Methods for ODEs with Stiff Damping Term
Tong Wu, Tulane University, USA

2:50-3:05 A Rbf-Descent Method for Wind Field Approximation
Miguel A. Moreles, Centro de Investigaciones en Matematicas, Mexico; Daniel Cervantes and Pedro Gonzalez-Casanova, UNAM, Mexico

3:10-3:25 An Analysis of Blended Three-step BDF Time Stepping Scheme For Navier-Stokes Type System Related To Soret Convection
S.S. Ravindran, University of Alabama, Huntsville, USA

3:30-3:45 Finite Volume MUSCL Approximation for Transport Equation Originating in a Neuronal Model
Paramjeet Singh, Thapar University, India

3:50-4:05 A Theoretical and Computational Framework for Measure-Valued Solutions to Conservation Laws
Mohammad Zakerzadeh and Georg May, RWTH Aachen University, Germany

4:10-4:25 An Asymptotic Preserving Implicit-Explicit Scheme for All-Froude Flows
Hamed Zakerzadeh and Sebastian Noelle, RWTH Aachen University, Germany

Coffee Break
4:30 PM-5:00 PM

Room: Forum - Lower Level

Monday, December 7

MS27
Deterministic and Stochastic Aspects of Fluid Dynamics - Part I of II

5:00 PM-7:00 PM

Room: Forum - Lower Level
For Part 2 see MS41
Models of fluid dynamics (Navier-Stokes/Euler equations, Primitive equations, etc...) are ubiquitous in science and play a significant role in subjects such as climate science, geophysics, and engineering. From the mathematical viewpoint, they provide a rich source of problems in partial differential equations, involving elements from analysis, probability theory, dynamical systems. Of great importance are questions ranging from global regularity to longtime behavior, with particular emphasis on statistical properties of solutions and their robustness with respect to singular and/or stochastic perturbations.

This minisymposium will bring together researchers at all career stages to discuss recent advances in mathematical fluid dynamics.

Organizer: Michele Coti Zelati  
University of Maryland, USA

Organizer: Honghu Liu  
University of California, Los Angeles, USA

Organizer: Temam Roger  
Indiana University Bloomington, USA

Organizer: Chuntian Wang  
Indiana University Bloomington, USA

5:00-5:25 Numerical Analysis of the Stochastic Navier-Stokes Equations: Stability and Convergence
Nathan Glatt Holtz, Virginia Tech, USA; Roger M. Temam, Indiana University, USA; Chuntian Wang, Indiana University Bloomington, USA

5:30-5:55 Mean Oscillations of the Vorticity Direction and A Priori Bounds on the Vorticity in the 3D NSE
Zoran Gajic, University of Virginia, USA

6:00-6:25 The Free Boundary Euler Equation
Igor Kukavica, University of Southern California, USA

6:30-6:55 Particle Laden Flow on an Incline
Andrea L. Bertozzi, University of California, Los Angeles, USA
**Monday, December 7**

**MS28**

**Dynamics of Partial Differential Equations - Part I of II**

5:00 PM-7:30 PM

*Room: Rio Verde - Main Level*

For Part 2 see MS69

Complex systems described by partial differential equations (PDEs) pose great challenges to understanding natural phenomena. They involve the nonlinear dynamics in infinite dimensional spaces. Despite progresses made in the last 50 years, the mathematical tools succeed only modestly in analyzing the PDEs dynamics. Nonetheless, a wide range of methods and techniques have been created to attack the problems. This minisymposium will bring together researchers from different branches of the field. It will cover various topics from abstract theory of dynamical systems in infinite dimensional spaces to their applications to PDEs in fluid mechanics, mathematical biology and quantum physics.

Organizer: Luan Hoang

Texas Tech University, USA

Organizer: Eric Olson

University of Nevada, Reno, USA

5:00-5:25 Generalized Gevrey Norms with Applications to Dissipative Equations

Anmikib Biswas, University of Maryland, Baltimore County, USA

5:30-5:55 Navier-Stokes-alpha Model for Channel Flows

Bingsheng Zhang, Texas A&M University, USA

6:00-6:25 Turbulence in Vertically Averaged 3D Rayleigh-Bénard Convection

Michael S. Jolly, Indiana University, USA

6:30-6:55 Spread of Phage Infection of Bacteria in a Petri Dish

Don Jones, Hal L. Smith, and Horst Thieme, Arizona State University, USA

7:00-7:25 Continuity of Attractors for Dynamical Systems

Luan Hoang, Texas Tech University, USA; Eric Olson, University of Nevada, Reno, USA; James Robinson, University of Warwick, United Kingdom

**Monday, December 7**

**MS29**

**Pattern Formation in Nonlinear Systems - Part II of II**

5:00 PM-7:00 PM

*Room: Sonora - Main Level*

For Part 1 see MS16

The general purpose of this special session is to bring together researchers who work on various issues related to nonlinear waves and patterns in partial differential equations that arise in physics, chemistry, and biology. More specifically, existence and stability of such solutions to partial differential equations in one and more dimensions will be discussed. The session will place a special emphasis on Evans function method and methods from bifurcation theory.

Organizer: Stephane Lafortune

College of Charleston, USA

Organizer: Vahagn Manukian

Miami University, USA

5:00-5:25 How Defects Are Born

Nicholas Ercolani, Nikola Kamburov, and Joceline Lega, University of Arizona, USA

5:30-5:55 Fast Pulses with Oscillatory Tails in the FitzHugh-Nagumo System

Paul Carter and Bjorn Sandstede, Brown University, USA

6:00-6:25 Oscillons Near Hopf Bifurcations of Planar Reaction Diffusion Equations

Kelly Mcquighan, Boston University, USA; Bjorn Sandstede, Brown University, USA

6:30-6:55 Stability of Traveling Waves in a Model for a Thin Liquid Film Flow

Anna Ghazaryan, Miami University, USA; Stephane Lafortune, College of Charleston, USA; Vahagn Manukian, Miami University, USA

**Monday, December 7**

**MS30**

**Convex Integration and Degenerate Solutions to Nonlinear PDEs in Geometry and Physics - Part II of II**

5:00 PM-7:00 PM

*Room: San Carlos - Main Level*

For Part 1 see MS3

This minisymposium concerns questions of flexibility and rigidity of solutions to nonlinear pdes, with a focus on degenerate (flexible) weak solutions which can be obtained through methods of convex integration. Recent advances regarding Holder continuous dissipative solutions to Euler equations have renewed the interest in applying these methods to a wider range of problems, including the Monge-Ampere and transport equations. Similar efforts have also lead to progress regarding isometric immersions. Our objective is to bring together scientists involved with flexibility vs. rigidity in fluid dynamics and in geometric pdes, in order to investigate discuss advances and challenges from different perspectives.

Organizer: Marta Lewicka

University of Pittsburgh, USA

Organizer: Reza Pakzad

University of Pittsburgh, USA

5:00-5:25 On Weak Solutions to the 2D Savage-Hutter Model of the Motion of a Gravity Driven Avalanche Flow

Agnieszka Swierczewska-Gwiazda, University of Warsaw, Poland

5:30-5:55 Recent Progress Towards Onsager's Conjecture

Tristan Buckmaster, Courant Institute of Mathematical Sciences, New York University, USA

6:00-6:25 Convex Integration and the Stationary Incompressible Euler Equations

Antoine Choffrut, University of Edinburgh, United Kingdom

6:30-6:55 Almost-isometric Deformations and Thin Elastic Sheets

Francesco Maggi, University of Texas at Austin, USA
Monday, December 7

**MS31**
**Analysis and Control of Fluid Models and Flow-coupled Systems - Part III of IV**

5:00 PM-6:30 PM

Room: Palomas - Main Level

For Part 2 see MS19
For Part 4 see MS45

This mini-symposium will serve to promote and disseminate recent developments on evolution PDEs, especially those describing fluid or gas flows and their interaction with other types of dynamics such as plates or elastic solids, with fixed or moving interfaces. Questions on modeling, well-posedness, control, stability, optimization and numerical simulations will be of primary interest.

Organizer: Justin T. Webster  
North Carolina State University, USA

Organizer: Marcelo Disconzi  
Vanderbilt University, USA

Organizer: Irena M. Lasiecka  
University of Memphis, USA

Organizer: Daniel Toundykov  
University of Nebraska-Lincoln, USA

5:00-5:25 Fluid-Elastic Structure Interaction with the Navier Slip Boundary Condition

Suncica Canic, University of Houston, USA; Boris Muha, University of Zagreb, Croatia

5:30-5:55 Uniform Stability to Non-Trivial Equilibrium of a Nonlinear Fluid-Structure Interaction Via Interface and Interior Feedback

Yongjin Lu, Virginia State University, USA

6:00-6:25 Decay Rates for Some Fluid-Structure Models

George Avalos, University of Nebraska, Lincoln, USA; Pelin Geredeli, Hacettepe University, Turkey

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**MS32**
**Coherent Structures in Hamiltonian PDEs - Part III of III**

5:00 PM-7:00 PM

Room: Coronado - Main Level

For Part 2 see MS20

Hamiltonian partial differential equations appear in many fields including plasma physics, optics and fluid mechanics, where they can characterize wave phenomenon such as solitons, wave collapse and turbulence. Hamiltonian partial differential equations provide a variety of challenges, ranging from well-posedness to numerical methods. This session will survey recent advances in Hamiltonian Partial Differential Equations, including progress on blow-ups of nonlinear Schrödinger equations, rigorous derivation of focusing NLS from quantum many-body systems, and well-posedness of wave maps.

Organizer: Magdalena Czubak  
Binghamton University, USA

Organizer: Gideon Simpson  
Drexel University, USA

Organizer: Daniel Spiri  
University of Minnesota, USA

Organizer: Catherine Sulem  
University of Toronto, Canada

5:00-5:25 On-Site and Off-Site Solitary Waves of Discrete Nonlinear Schrödinger Type Equations and the Peierls-Nabarro Barrier

Michael Jenkins and Michael I. Weinstein, Columbia University, USA

5:30-5:55 Existence and Stability Considerations for Schrödinger-Poisson Excited States with a Potential

Jeremy L. Marzuola, University of North Carolina at Chapel Hill, USA; Sarah Raynor, Wake Forest University, USA; Gideon Simpson, Drexel University, USA

6:00-6:25 On Dispersive Blow-Ups for Nonlinear Schrödinger Equations

Maja Taskovic and Younghun Hong, University of Texas at Austin, USA

6:30-6:55 The Rigorous Derivation of Focusing NLS from Quantum Many-Body Systems

Xuwen Chen and Justin Holmer, Brown University, USA

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**MS33**
**Ginzburg-Landau Theory and Related Topics - Part III of III**

5:00 PM-7:00 PM

Room: Center Ballroom - Main Level

For Part 2 see MS21

The mathematical tools developed to study variational models for superconducting systems are often successfully used in other areas of materials science, to examine phenomena such as topological defects in liquid crystals and solids. The minisymposium will feature speakers with an interest and background in the analysis and modeling of superconducting materials. Research on both dynamic and stationary problems will be presented. Topics will include behavior of minimizers, vortex filaments, vortex scattering and traveling waves in Ginzburg-Landau and related models.

Organizer: Tiziana Giorgi  
New Mexico State University, USA

Organizer: Dmitry Golovaty  
University of Akron, USA

5:00-5:25 Spectral Analysis of a Complex Schrödinger Operator in the Semiclassical Limit

Yaniv Almog, Louisiana State University, USA

5:30-5:55 Distances Between Classes in $W^{1,1}(\Omega, S^1)$

Itai Shafrir, Technion Israel Institute of Technology, Israel

6:00-6:25 A Degenerate Isoperimetric Problem and Traveling Waves to a Hamiltonian System of Allen-Cahn Type

Peter Sternberg, Indiana University, USA

6:30-6:55 Title Not Available at Time of Publication

Nicholas Michalowski, New Mexico State University, USA
Nonlocal Continuum Models: Theory, Computation, and Applications

5:00 PM-7:00 PM
Room: Chambers Lecture Hall - Main Level

Nonlocal continuum theory has become a valuable tool to bridge atomistic and continuum models for mesoscale and nanoscale systems. Examples include crack propagation, diffusion through porous media, and electrostatic interactions between biomolecules. This minisymposium will provide a forum to discuss and present nonlocal theories in these diverse application areas, as well as computational methods for solving them. In particular, speakers will highlight theoretical frameworks for identifying and validating nonlocal models, tools for analyzing and characterizing nonlocal problems, key results, and emerging modeling challenges.

Organizer: Jaydeep Bardhan
Northeastern University, USA
Organizer: Pavel Bochev
Sandia National Laboratories, USA

5:00-5:25 Heterogeneous Domain Decomposition Methods for Non-local Problems
Pavel Bochev and Marta D’Elia, Sandia National Laboratories, USA

5:30-5:55 The Richness of Fractional Integro-Differential Operators Defined by Convolution with the Lévy Measure
David A. Benson, Colorado School of Mines, USA

6:00-6:25 Nonlocal Electrostatics in Molecular Biology: Water as a Structured Material
Jaydeep Bardhan, Northeastern University, USA; Matthew G. Knepley, University of Chicago, USA

6:30-6:55 Computing of Ion-ion Correlations with Nonlocal Density Functional Theory
Dirk Gillespie, Rush University Medical Center, USA
Monday, December 7
MS37
Multiscale Analysis, Modeling and Simulation for Applications in Material Science - Part III of III
5:00 PM-7:00 PM
Room: Four Peaks - Upper Level
For Part 2 see MS22
In recent years we have witnessed a tremendous growth of activity on developing methods for materials-related phenomena whose essential role extends over multiple scales in time and space. The proposed minisymposium will focus on multiscale modeling, analysis and simulation of the problems arising in composite and other heterogeneous media. In particular, topics that will be discussed include but not limited to asymptotic analysis, homogenization, inverse problems, and computational tools for complex inhomogeneous media. The purpose of this section is to enable contact between researchers working on multiscale methods with an update on recent progress in this field.
Organizer: Silvia Jimenez
Colgate University, USA
Organizer: Yuliya Gorb
University of Houston, USA
5:00-5:25 Multiscale Mimetic Reduced-Order Models for Spectrally Accurate Wavefield Simulations
Vladimir L. Druskin, Schlumberger-Doll Research, USA; Alexander Mamonov, University of Houston, USA; Mikhail Zaslavsky, Schlumberger-Doll Research, USA
5:30-5:55 Homogenization of a Toy Model of Non-Linear Composites
Guillermo Goldstein, Georgia Institute of Technology, USA
6:00-6:25 Some Recent Mathematics Progress on Negative Index Materials and Their Applications
Hoai-Minh Nguyen, École Polytechnique Fédérale de Lausanne, Switzerland
6:30-6:55 Optimal Approach for the Numerical Stochastic Homogenization of Elliptic Problems
Leila Taghizadeh and Caroline Geiersbach, Vienna University of Technology, Austria; Clemens F. Heitzinger, Arizona State University, USA and Vienna University of Technology, Austria

Monday, December 7
MS38
Challenges in the Mechanics of Thin Elastic Structures - Part III of III
5:00 PM-7:00 PM
Room: Flagstaff A - Upper Level
For Part 2 see MS14
The mechanics of thin structures is a field where geometry and mechanics interact, leading to deep questions in PDE and the calculus of variations. Current issues include (i) understanding the patterns and defects produced by compressive loads in flat or cylindrical structures; (ii) understanding how growth, misfit, or crystalline defects influence the preferred shape of a thin structure; and (iii) understanding the emergence of localized structures such as folds and conical singularities. The talks in this 3-part minisymposium will address these and related problems, drawing on tools from geometry, mechanics, the calculus of variations, and PDE.
Organizer: Robert V. Kohn
Courant Institute of Mathematical Sciences, New York University, USA
5:00-5:25 Limits of Elastic Energies of Converging Elastic Bodies
Cy Maor and Raz Kupferman, Hebrew University, Israel
5:30-5:55 Plates with Incompatible Prestrain of Higher Order
Diego Ricciotti and Marta Lewicka, University of Pittsburgh, USA; Annie Raoul, Université Paris Descartes, France
6:00-6:25 Energy Scaling Laws for an Axially Compressed Thin Elastic Cylinder
Ian Tobasco, Courant Institute of Mathematical Sciences, New York University, USA
6:30-6:55 The Metric-Restricted Inverse Design Problem
Marta Lewicka, University of Pittsburgh, USA

Monday, December 7
MS39
Partial Differential Equations and Geometric Analysis - Part I of II
5:00 PM-7:00 PM
Room: Flagstaff B - Upper Level
For Part 2 see MS53
This minisymposium emphasizes recent developments in analysis of non-linear elliptic and parabolic partial differential equations arising in differential geometry, and especially geometric flow equations, including mean curvature flow, Ricci flow, and Yang-Mills gradient flow, together with their applications to differential geometry and mathematical physics.
Organizer: Paul Feehan
Rutgers University, USA
5:00-5:25 Willmore Surface Equation for Radially Symmetric Solutions
Jingyi Chen, University of British Columbia, Canada
5:30-5:55 Curvature Flows on Homogeneous Spaces: Applications of the Bracket Flow
David G. Glickenstein, University of Arizona, USA
6:00-6:25 Asymptotic Rigidity of Shrinking Gradient Ricci Solitons
Brett L. Kotschwar, Arizona State University, USA
6:30-6:55 Łojasiewicz-Simon Gradient Inequalities with Applications to Yang-Mills Pairs and Harmonic Maps
Manousos Maridakis, Rutgers University, USA

Monday, December 7
MS40
Multiscale Analysis, Modeling and Simulation for Applications in Material Science - Part II of III
5:00 PM-7:00 PM
Room: Four Peaks - Upper Level
For Part 2 see MS22
In recent years we have witnessed a tremendous growth of activity on developing methods for materials-related phenomena whose essential role extends over multiple scales in time and space. The proposed minisymposium will focus on multiscale modeling, analysis and simulation of the problems arising in composite and other heterogeneous media. In particular, topics that will be discussed include but not limited to asymptotic analysis, homogenization, inverse problems, and computational tools for complex inhomogeneous media. The purpose of this section is to enable contact between researchers working on multiscale methods with an update on recent progress in this field.
Organizer: Silvia Jimenez
Colgate University, USA
Organizer: Yuliya Gorb
University of Houston, USA
5:00-5:25 Multiscale Mimetic Reduced-Order Models for Spectrally Accurate Wavefield Simulations
Vladimir L. Druskin, Schlumberger-Doll Research, USA; Alexander Mamonov, University of Houston, USA; Mikhail Zaslavsky, Schlumberger-Doll Research, USA
5:30-5:55 Homogenization of a Toy Model of Non-Linear Composites
Guillermo Goldstein, Georgia Institute of Technology, USA
6:00-6:25 Some Recent Mathematics Progress on Negative Index Materials and Their Applications
Hoai-Minh Nguyen, École Polytechnique Fédérale de Lausanne, Switzerland
6:30-6:55 Optimal Approach for the Numerical Stochastic Homogenization of Elliptic Problems
Leila Taghizadeh and Caroline Geiersbach, Vienna University of Technology, Austria; Clemens F. Heitzinger, Arizona State University, USA and Vienna University of Technology, Austria
Monday, December 7

CP3

5:00 PM-7:00 PM
Room:Sedona - Main Level
Chair: Erwin Suazo, University of Texas, Rio Grande Valley
5:00-5:15 Weak and Strong Probabilistic Solutions for a Class of Strongly Nonlinear Parabolic Problems
Zakaria Ali and Mamadou Sango, University of Pretoria, South Africa
5:20-5:35 Existence of Mild Solution for An Impulsive Neutral Stochastic Fractional Integro-Differential Inclusions with Infinite Delay
Alka Chadha and Dwijendra N. Pandey, Indian Institute of Technology Roorkee, India
5:40-5:55 Global Existence of Solutions to System of Isentropic Gas Dynamics in a Divergent Nozzle with Friction
Yunguang Lu, Hangzhou Normal University, China; Xuezhou Lu, CNRS, France
6:00-6:15 Elliptic and Parabolic Differential-Difference Operators with Incommensurable Shifts
Anton M. Selitskii, Russian Academy of Sciences, Russia
Erwin Suazo, University of Texas, Rio Grande Valley, USA
6:40-6:55 Existence Results for Superlinear Elliptic Equations with Nonlinear Boundary Value Conditions
Xiaohui Yu, Shenzhen University, China

SIMA Editorial Board Meeting
7:30 PM-9:30 PM
Room:Chaparral - Main Level

Tuesday, December 8

Registration
8:00 AM-5:30 PM
Room:Grand Ballroom Foyer - Main Level

MS40

Equations of 3D Flows - Part I of II
8:30 AM-11:00 AM
Room:Forum - Lower Level
For Part 2 see MS55

This session is dedicated to mathematical analysis of partial differential equations arising in Fluid Mechanics. We want to bring together specialists working on various aspects of models of 3D flows, such as Navier-Stokes or Euler equations. We will present recent progress concerning the existence, asymptotic analysis and regularity of solutions. The aim is to compare the theory of strong and weak solutions, and to determine how the techniques of one may be used to find new results in the other.

Organizer: Piotr Mucha
Warsaw University, Poland

Organizer: Ewelina Zatorska
Warsaw University of Technology, Poland

8:30-8:55 Weak Vs. Strong Solutions to Complete Fluid Systems
Eduard Feireisl, Mathematical Institute ASCR, Prague, Czech Republic
9:00-9:25 Weak/Strong Uniqueness for the Compressible Euler System
Piotr Gwiazda, Warsaw University, Poland
9:30-9:55 Compressible Navier-Stokes Equations with Thermodynamically Unstable Pressure and Anisotropic Viscous Stress
Didier Bresch, Universite de Savoie, France

continued in next column
Tuesday, December 8

**MS41**

**Deterministic and Stochastic Aspects of Fluid Dynamics - Part II of II**

8:30 AM-10:30 AM

Room: Rio Verde - Main Level

For Part 1 see MS27

Models of fluid dynamics (Navier-Stokes/Euler equations, Primitive equations, etc...) are ubiquitous in science and play a significant role in subjects such as climate science, geophysics, and engineering. From the mathematical viewpoint, they provide a rich source of problems in partial differential equations, involving elements from analysis, probability theory, and dynamical systems. Of great importance are questions ranging from global regularity to longtime behavior, with particular emphasis on statistical properties of solutions and their robustness with respect to singular and/or stochastic perturbations. This minisymposium will bring together researchers at all career stages to discuss recent advances in mathematical fluid dynamics.

Organizer: Michele Coti Zelati
University of Maryland, USA

Organizer: Honghu Liu
University of California, Los Angeles, USA

Organizer: Temam Roger
Indiana University Bloomington, USA

Organizer: Chuntian Wang
Indiana University Bloomington, USA

8:30-8:55 Computation of Entropic Measure-Valued Solutions for Euler Equations
Eitan Tadmor, University of Maryland, USA

9:00-9:25 Wasserstein Metrics in Stochastic Partial Differential Equations
Nathan Glatt-Holtz, Virginia Tech, USA

9:30-9:55 Non-Markovian Reduced Equations for Stochastic PDEs
Michaël Chekroun, University of California, Los Angeles, USA

10:00-10:25 Shell Models for Turbulent Flows
Susan Friedlander, University of Southern California, USA; Nathan Glatt Holtz, Virginia Tech, USA; Vlad C. Vicol, Princeton University, USA

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Tuesday, December 8

**MS42**

**PDEs for Defects Problems in Materials Science - Part I of II**

8:30 AM-10:30 AM

Room: Sonora - Main Level

For Part 2 see MS56

This minisymposium brings together experts in PDE modelling and analysis of defects in materials science, such as dislocations, cracks, grain boundaries, nucleation, etc. The minisymposium will focus on recent progress in this field and future directions.

Organizer: Jianfeng Lu
Duke University, USA

Organizer: Yang Xiang
Hong Kong University of Science and Technology, Hong Kong

8:30-8:55 Quantum Dots and Dislocations: Dynamics of Materials Defects
Irene Fonseca, Carnegie Mellon University, USA

9:00-9:25 Discrete and Continuum Models for the Long-range Elastic Effects of Stepped Epitaxial Surfaces
Yang Xiang and Tao Luo, Hong Kong University of Science and Technology, Hong Kong; Aaron Yip, Purdue University, USA

9:30-9:55 Beyond the Burton-Cabrera-Frank (BCF) Model of Surface Defects: A Study in 1+1 Dimensions
Dionisios Margetis, University of Maryland, College Park, USA

10:00-10:25 PDEs From Scaling Limits of Atomistic Models in Crystal Surface Evolution
Jeremy L. Marzuola, University of North Carolina at Chapel Hill, USA

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Tuesday, December 8

**MS43**

**Numerical Methods for PDE and Applications in Computational and Data Science - Part I of II**

8:30 AM-10:30 AM

Room: San Carlos - Main Level

For Part 2 see MS57

Partial differential equations (PDE) are playing increasingly important roles in computational and data science problems. Applications of PDE require efficient and accurate numerical schemes, and this presents a new array of computational challenges and opportunities. This minisymposium will address recent advances in numerical schemes, as well as new applications of PDE in computational and data science. Some topics to be addressed include machine learning, crowd motion, optimal transportation, materials science, and numerical schemes for viscosity solutions.

Organizer: Jeff Calder
University of California, Berkeley, USA

Organizer: Adam M. Oberman
McGill University, Canada

8:30-8:55 Numerical Schemes for the Hamilton-Jacobi Equation Continuum Limit of Non-dominated Sorting
Kangping Zhu, GSA Capital, USA; Robert V. Kohn, Courant Institute of Mathematical Sciences, New York University, USA

9:00-9:25 Prediction Without Probability
Jeff Calder, University of California, Berkeley, USA

9:30-9:55 Beyond the Burton-Cabrera-Frank (BCF) Model of Surface Defects: A Study in 1+1 Dimensions
Dionisios Margetis, University of Maryland, College Park, USA

10:00-10:25 PDEs From Scaling Limits of Atomistic Models in Crystal Surface Evolution
Jeremy L. Marzuola, University of North Carolina at Chapel Hill, USA

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Tuesday, December 8

**MS41**

**Deterministic and Stochastic Aspects of Fluid Dynamics - Part II of II**

8:30 AM-10:30 AM

Room: Rio Verde - Main Level

For Part 1 see MS27

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Tuesday, December 8

**MS42**

**PDEs for Defects Problems in Materials Science - Part I of II**

8:30 AM-10:30 AM

Room: Sonora - Main Level

For Part 2 see MS56

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Tuesday, December 8

**MS43**

**Numerical Methods for PDE and Applications in Computational and Data Science - Part I of II**

8:30 AM-10:30 AM

Room: San Carlos - Main Level

For Part 2 see MS57
Tuesday, December 8

MS44

Mathematical Analysis of Liquid Crystals - Part I of III
8:30 AM-10:30 AM
Room:Sedona - Main Level
For Part 2 see MS78

Organizer: Valeriy Slastikov
University of Bristol, United Kingdom

Organizer: Arghir Zarnescu
University of Sussex, United Kingdom

8:30-8:55 Weak Anchoring for a Two-Dimensional Liquid Crystal
Lia Bronsard, McMaster University, Canada

9:00-9:25 Line Defects in the Asymptotic Analysis of Landau-De Gennes Minimizers
Giacomo Canevari, University of Oxford, United Kingdom

9:30-9:55 On the K13 Problem in the Oseen-Frank Theory of Nematic Liquid Crystals
Arghir Zarnescu, University of Sussex, United Kingdom

10:00-10:25 The Micro-Micro Description for Elastic Complex Fluids
Chun Liu, Pennsylvania State University, USA

Tuesday, December 8

MS45

Analysis and Control of Fluid Models and Flow-coupled Systems - Part IV of IV
8:30 AM-10:30 AM
Room:Palomas - Main Level
For Part 3 see MS31

Organizer: Valeriy Slastikov
University of Bristol, United Kingdom

Organizer: Arghir Zarnescu
University of Sussex, United Kingdom

8:30-8:55 Controllability of a Cochlea Model and Related Fluid Elastic Systems
Scott Hansen, Iowa State University, USA

9:00-9:25 Interface Singularities in Fluid Dynamics
Steve Shkoller, University of California, Davis, USA; Daniel Coutand, Heriot-Watt University, United Kingdom

9:30-9:55 Global Existence for a Fluid-structure Model
Mihaela Ignatova, Princeton University, USA; Igor Kukavica, University of Southern California, USA; Irena M. Lasiecka, University of Memphis, USA; Amjad Tuffaha, The Petroleum Institute of Abu Dhabi, United Arab Emirates

10:00-10:25 Fluid-structure Interaction with Strongly Damped Structure: Optimal Regularity Under Control Acting at the Interface
Roberto Triggiani and Irena M. Lasiecka, University of Memphis, USA

Tuesday, December 8

MS46

Large-Time Dynamics of the Navier-Stokes Equations and Related PDEs - Part I of II
8:30 AM-10:30 AM
Room:Coronado - Main Level
For Part 2 see MS60

The accurate, reliable prediction of the long-time dynamical evolution of hydrodynamic systems has become increasingly important in the climatological, astrophysical, and geophysical sciences. Mathematically quantifying this behaviour allows for more accurate and cost-effective reduced models, and helps validate existing models, leading to more realistic real-time predictions for the long-time dynamics of such systems. This minisymposium will address the long-time dynamics of hydrodynamic models such as the Navier-Stokes equations and related models. Of particular interest are the study of the global attracting set, techniques in data assimilation, asymptotically reduced models, and the global well-posedness in time of these models.

Organizer: Jared P. Whitehead
Brigham Young University, USA

8:30-8:55 Recent Advances in the Pseudospectral Method
John C. Bowman, University of Alberta, Canada

9:00-9:25 Uniformly Attracting Invariant Sets for Critical SQG Equations
Peter Constantin, Princeton University, USA; Michele Coti Zelati, University of Maryland, USA; Vlad C. Vicol, Princeton University, USA

9:30-9:55 Data Assimilation Using Approximate Inertial Manifolds
Michael S. Jolly, Indiana University, USA

10:00-10:25 A Diffuse Interface Model for Two-Phase Groundwater Flow
Daozhi Han, Florida State University, USA
Tuesday, December 8

**MS47**

**Quasilinear PDE in Models from Mathematical Physics - Part II of II**

8:30 AM-10:00 AM

Room: Center Ballroom - Main Level

For Part 1 see MS34

Speakers will talk on new developments in analysis for PDE with strongly nonlinear effects.

Organizer: Jeremy L. Marzuola

University of North Carolina at Chapel Hill, USA

Organizer: Daniel Tataru

University of California, Berkeley, USA

8:30-8:55 The Euler-Maxwell and Related Models

Benjamin Dodson, Brown University, USA

9:00-9:25 Title Not Available at Time of Publication

Benjamin Dodson, Johns Hopkins University, USA

9:30-9:55 Title Not Available at Time of Publication

Herbert Koch, Bonn University, Germany

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**Tuesday, December 8**

**MS48**

**Singularities of High Order PDEs Describing Liquid Jets and Films - Part I of II**

8:30 AM-10:30 AM

Room: Bouchon - Main Level

For Part 2 see MS61

Liquid films and jets of micro- or nanoscale thickness occur widely in nature and industrial processes. Mathematical models describing them are often represented by high order coupled PDEs of parabolic or mixed type. Interplay between nonlinear curvature and viscosity terms with those describing intermolecular interactions leads to formation of sophisticated analytical and geometric singularities of their solutions, e.g., finite time jet breakup, film rupture, cusps or moving contact lines with singular asymptotics. Self-similar structure of these singularities can be analyzed using asymptotical analysis and nonlinear simulations. The minisymposium provides a platform to investigate these questions from analytical and numerical perspectives.

Organizer: Marco A. Fontelos

Institute for Mathematics, CSIC, Spain

Organizer: Georgy Kitavtsev

University of Bristol, United Kingdom

8:30-8:55 Singularities in Jet and Bubble Breakup and Related Applications

Marco A. Fontelos, Institute for Mathematics, CSIC, Spain

9:00-9:25 Healing Capillary Films

Zhong Zheng, Princeton University, USA; Marco A. Fontelos, Institute for Mathematics, CSIC, Spain; Sangwoo Shin and Howard A Stone, Princeton University, USA

9:30-9:55 Existence and Application of Cusps and Cuspidal Edges at Fluid Interfaces

Rouslan Krechetnikov, University of Alberta, Canada

10:00-10:25 Higher-Order PDE Describing Two-Phase Flow in Porous Media

Melissa Strait and Michael Shearer, North Carolina State University, USA

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**Tuesday, December 8**

**MS49**

**Singular Perturbations and Boundary Layers - Theory and Numerical Aspects - Part II of II**

8:30 AM-10:30 AM

Room: Rattlers - Main Level

For Part 1 see MS35

The main purpose of this session is to bring together specialists in the field of singular perturbations and boundary layers. In the presence of boundaries, the behavior of the solutions to the Navier-Stokes in the limit of vanishing viscosity is still an outstanding problem in mathematical fluid dynamics. Similar problems occur in many other areas of sciences. Furthermore, numerical methods for singularly perturbed equations remain challenging problems. This minisymposium is meant to be a platform to exchange ideas on these problems.

Organizer: Gung-Min Gie

University of Louisville, USA

Organizer: YoungJoon Hong

Indiana University, USA

Organizer: Chang-Yeol Jung

Ulsan National Institute of Science and Technology, South Korea

Organizer: Roger M. Temam

Indiana University, USA

8:30-8:55 Sharp Interface Limit of the Coupled Cahn-Hilliard-Stokes-Darcy System

Xiaoming Wang, Florida State University, USA

9:00-9:25 Stability of Time Periodic Solutions of the Navier-Stokes-Maxwell System?

Slim Ibrahim, University of Victoria, Canada; Nader Masmoudi, Courant Institute of Mathematical Sciences, New York University, USA; Pierre-Gilles Lemarie, University of Evry-Val-d’Essonne, France

9:30-9:55 Title Not Available at Time of Publication

Xiaohui Feng, University of Tennessee, USA

10:00-10:25 Initial-Boundary Layer Associated with the Darcy-Brinkman-Oberbeck-Boussinesq Model for Convection in Porous Medium

Daozhi Han, Florida State University, USA
Tuesday, December 8

**MS50**

**Recent Development in Modeling, Control, Theoretical and Numerical Analysis of Complex Systems with Dynamic Boundaries - Part I of II**

8:30 AM-11:00 AM

Room: Chambers Lecture Hall - Main Level

For Part 2 see MS64

Many outstanding open problems of modern science and engineering involve free boundaries whose dynamics are determined as a part of the solution. The analysis of the underlying PDE systems poses significant mathematical challenges. This minisymposium will highlight some recent advances in analytical and computational studies for such systems. Examples include inverse free boundary problems, optimal control of phase transition processes, multi-phase fluid mixture flow, inverse scattering problems, stochastic differential equations and optimal control, viscoelastic fluid simulation, interfaces for nonlinear degenerate and singular parabolic PDEs, electrical impedance tomography based cancer detection model.

Organizer: Ugur G. Abdulla  
Florida Institute of Technology, USA

Organizer: Jian Du  
Florida Institute of Technology, USA

Organizer: Vladislav Bukshhtynov  
Florida Institute of Technology, USA

8:30-8:55 On the Optimal Control of Parabolic Free Boundary Problems  
Ugur G. Abdulla, Florida Institute of Technology, USA

9:00-9:25 SDEs and Optimal Control, a Method of Evolving Junction  
Haomin Zhou, Georgia Institute of Technology, USA

9:30-9:55 Reconstruction in Phaseless Inverse Scattering Problems  
Michael V. Klibanov, University of North Carolina, Charlotte, USA

10:00-10:25 A Necessary and Sufficient Condition for the Continuity of Local Minima of Parabolic Variational Integrals with Linear Growth  
Colin James Klaus, Vanderbilt University, USA

10:30-10:55 On the Optimal Control of the Inverse Multiphase Stefan Problem  
Bruno Paggi Cevallos, University of Minnesota, USA; Ugur G. Abdulla, Florida Institute of Technology, USA

continued in next column
Hypersurfaces with Almost Constant Mean Curvature and Capillarity Theory

11:00 AM-11:45 AM
Room:Forum - Lower Level
Chair: Robert V. Kohn, Courant Institute of Mathematical Sciences, New York University, USA

Alexandrov's theorem asserts that a (bounded, embedded) constant mean curvature (cmc) hypersurface must be a sphere. It is well-known that if this condition is relaxed and the mean curvature is just assumed to be close to a constant, then the corresponding hypersurfaces do not need to be close to a sphere. Indeed any family of nearby spheres with equal radii connected by short catenoidal necks can be slightly perturbed to obtain examples of almost-cmc hypersurfaces. We show that these examples actually capture the only possible behavior of almost-cmc hypersurfaces, by proving various quantitative bounds on the distance between an almost-cmc hypersurface and a collection of tangent spheres of equal radii in terms of their mean curvature oscillation.

This is a joint work with G. Ciraolo (U Palermo). We next discuss these issues for the nonlocal mean curvature introduced by Caffarelli and Souganidis, showing in particular a remarkable rigidity property of the nonlocal problem which prevents bubbling phenomena, in other words, every nonlocal almost-cmc hypersurface must be close to a single sphere. This is a joint work with G. Ciraolo, A. Figalli (UT Austin) and M. Novaga (U Pisa).

Francesco Maggi
University of Texas at Austin, USA
Tuesday, December 8

IP4

Long Time Dynamics for Two Dimensional Water Wave Models
11:45 AM-12:30 PM
Room: Forum - Lower Level
Chair: Robert V. Kohn, Courant Institute of Mathematical Sciences, New York University, USA

The water wave type equations describe the evolution of the free surface of an inviscid, incompressible fluid evolving under the action of gravity, surface tension, etc. Understanding the long time dynamics for such fluid models is a challenging yet very interesting problem. The aim of this talk is to present some recent ideas and results in this direction for two dimensional fluids. This work is joint with Mihaela Ifrim, and also in part with John Hunter and Benjamin Harrop-Griffiths.

Daniel Tataru
University of California, Berkeley, USA

Lunch Break
12:30 PM-2:30 PM
Attendees on their own

Tuesday, December 8

MS45

Inverse Scattering and Dispersive Nonlinear Equations - Part II of II
2:30 PM-4:30 PM
Room: Forum - Lower Level

For Part I see MS40

This session is dedicated to mathematical analysis of partial differential equations arising in Fluid Mechanics. We want to bring together specialists working on various aspects of models of 3D flows, such as Navier-Stokes or Euler equations. We will present recent progress concerning the existence, asymptotic analysis and regularity of solutions. The aim is to compare the theory of strong and weak solutions, and to determine how the techniques of one may be used to find new results in the other.

Organizer: Piotr Mucha
Warsaw University, Poland

Organizer: Ewelina Zatorska
Warsaw University of Technology, Poland

2:30-2:55 Global Existence of Solutions to the 3D Navier-Stokes Equations with Degenerate Viscosities
Alexis F. Vasseur, University of Texas at Austin, USA; Cheng Yu, University of Texas, USA

3:00-3:25 Primitive Equations and Convergence to the 3D-Quasi-Geostrophic Model
Frederic Charve, Université Paris-Est, France

3:30-3:55 On Multiphase Flows: Modeling and Analysis
Konstantina Trivisa, University of Maryland, USA

4:00-4:25 Initial-Boundary Value Problems of Integrable Systems
Stephanos Venakides, Duke University, USA

Tuesday, December 8

MS55

Equations of 3D Flows - Part II of II
2:30 PM-4:30 PM
Room: Rio Verde - Main Level

For Part I see MS40

This session is dedicated to mathematical analysis of partial differential equations arising in Fluid Mechanics. We want to bring together specialists working on various aspects of models of 3D flows, such as Navier-Stokes or Euler equations. We will present recent progress concerning the existence, asymptotic analysis and regularity of solutions. The aim is to compare the theory of strong and weak solutions, and to determine how the techniques of one may be used to find new results in the other.

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4:00-4:25 Initial-Boundary Value Problems of Integrable Systems
Stephanos Venakides, Duke University, USA
Tuesday, December 8

MS56
PDEs for Defects Problems in Materials Science - Part II of II
2:30 PM-4:30 PM
Room: Sonora - Main Level
For Part 1 see MS42
This minisymposium brings together experts in PDE modelling and analysis of defects in materials science, such as dislocations, cracks, grain boundaries, nucleation, etc. The minisymposium will focus on recent progress in this field and future directions.
Organizer: Jianfeng Lu
Duke University, USA
Organizer: Yang Xiang
Hong Kong University of Science and Technology, Hong Kong
2:30-2:55 Motion by Mean Curvature for a Second Order Gradient Theory
Drew Swartz and Aaron Yip, Purdue University, USA
3:00-3:25 Variational Models for Crystal Image Analysis
Jianfeng Lu, Duke University, USA
3:30-3:55 Hölder Gradient Estimates for Parabolic Homogeneous p-Laplacian Equations
Tianling Jin, Hong Kong University of Science and Technology, Hong Kong; Luis Silvestre, University of Chicago, USA
4:00-4:25 A Non-local Variational Problem Arising from Studies of Nonlinear Charge Screening in Graphene Monolayers
Jianfeng Lu, Duke University, USA; Vitaly Moroz, Swansea University of South Wales, United Kingdom; Cyril B. Muratov, New Jersey Institute of Technology, USA

Tuesday, December 8

MS57
Numerical Methods for PDE and Applications in Computational and Data Science - Part II of II
2:30 PM-4:30 PM
Room: San Carlos - Main Level
For Part 1 see MS43
Partial differential equations (PDE) are playing increasingly important roles in computational and data science. Applications of PDE require efficient and accurate numerical schemes, and this presents a new array of computational challenges and opportunities. This minisymposium will address recent advances in numerical schemes, as well as new applications of PDE in computational and data science. Some topics to be addressed include machine learning, crowd motion, optimal transportation, materials science, and numerical schemes for viscosity solutions.
Organizer: Jeff Calder
University of California, Berkeley, USA
Organizer: Adam M. Oberman
McGill University, Canada
2:30-2:55 Novel Techniques for Integrating over Implicitly Defined Curves and Surfaces
Catherine M. Kublik, University of Dayton, USA
3:00-3:25 Numerical Methods for Anisotropic Curvature Flow of Networks of Surfaces
Selim Esedoglu, University of California, Los Angeles, USA
3:30-3:55 Hölder Gradient Estimates for Parabolic Homogeneous p-Laplacian Equations
Tianling Jin, Hong Kong University of Science and Technology, Hong Kong; Luis Silvestre, University of Chicago, USA
4:00-4:25 Fast Numerical Methods for Optimal Transportation for General Costs
Yuanlong Ruan and Adam M. Oberman, McGill University, Canada

Tuesday, December 8

MS58
Analytical Methods in Fluid Mechanics - Part I of II
2:30 PM-4:30 PM
Room: Sedona - Main Level
For Part 2 see MS70
The main purpose of this minisymposium is to bring together junior researchers who have already established themselves as specialists and, in some cases, leaders in the field of mathematical fluid mechanics. The complementary yet cohesive nature of the speakers' expertise, that is, the use of similar analytical tools in the study of the classical and geophysical fluid mechanics, gives focus and purpose to the minisymposium. This minisymposium is meant as a platform to exchange ideas on a variety of problems concerning the behavior of fluids.
Organizer: Gung-Min Gie
University of Louisville, USA
Organizer: James P. Kelliher
University of California, Riverside, USA
Organizer: Anna L. Mazzucato
Pennsylvania State University, USA
2:30-2:55 Recent Developments on the Magnetohydrodynamics and Related Systems
Kazuo Yamazaki, Washington State University, USA
3:00-3:25 An Anisotropic Partial Regularity Criterion for the 3D Incompressible Navier-Stokes Equations
Walter Rusin, Oklahoma State University, USA
3:30-3:55 Recent Progress on the Exterior Domain Problem on a Hyperbolic Plane
Magdalena Czubak, Binghamton University, USA
4:00-4:25 Small Moving Rigid Body into a Viscous Fluid
Christophe Lacave, University Paris 7-Denis Diderot, France
Tuesday, December 8

**MS59**

**PDE Models and Control of Swarm Dynamics - Part I of II**

2:30 PM-4:30 PM

*Room: Palomas - Main Level*

For Part 2 see MS71

PDEs can be used to model the spatiotemporal dynamics of large collectives, or “swarms,” of discrete individuals. These models enable the prediction, analysis, and control of swarm dynamics in multi-robot tasks, multi-vehicle coordination, and the study of self-organized behaviors in biological, social, and economic systems. The reliable use of PDEs in swarm applications requires further research on differences between discrete and continuum models and the controllability of the models.

**Organizer:** Andrea L. Bertozzi  
University of California, Los Angeles, USA

**Organizer:** Spring M. Berman  
Arizona State University, USA

**2:30-2:55** Control of PDE Models of Robotic Swarms with Stochastic Behaviors  
*Spring M. Berman, Arizona State University, USA*

**3:00-3:25** Large System Limits in Control of Multi-Vehicular Formations  
*Bassam A. Bamieh, University of California, Santa Barbara, USA*

**3:30-3:55** Phase Transitions in a Kinetic Cucker-Smale Model with Preferred Speed and Diffusion  
*Alethea Barbaro, Case Western Reserve University, USA; Jose Canizo, University of Birmingham, United Kingdom; Jose Carrillo and Pierre Degond, Imperial College London, United Kingdom*

**4:00-4:25** A Blob Method for the Aggregation Equation  
*Katy Craig, University of California, Santa Barbara, USA; Andrea L. Bertozzi, University of California, Los Angeles, USA*

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**MS60**

**Large-Time Dynamics of the Navier-Stokes Equations and related PDEs - Part II of II**

2:30 PM-4:30 PM

*Room: Coronado - Main Level*

For Part 1 see MS46

The accurate, reliable prediction of the long-time dynamical evolution of hydrodynamic systems has become increasingly important in the climatological, astrophysical, and geophysical sciences. Mathematically quantifying this behavior allows for more accurate and cost-effective reduced models, and helps validate existing models, leading to more realistic real-time predictions for the long-time dynamics of such systems. This minisymposium will address the long-time dynamics of hydrodynamic models such as the Navier-Stokes equations and related models. Of particular interest are the study of the global attracting set, techniques in data assimilation, asymptotically reduced models, and the global well-posedness in time of these models.

**Organizer:** Jared P. Whitehead  
Brigham Young University, USA

**2:30-2:55** On the Semin-type Regularity Criteria of the Navier-Stokes Equations and MHD Equations  
*Yuan Pei, University of Nebraska, Lincoln, USA*

**3:00-3:25** On the Attractor for the Semi-dissipative Boussinesq Equations  
*Animikh Biswas, University of Maryland, Baltimore County, USA*

**3:30-3:55** Forward Discretely Self-Similar Solutions of the Navier-Stokes Equations  
*Zachary Bradshaw and Tai-Peng Tsai, University of British Columbia, Canada*

**4:00-4:25** Finite Dimensionality of the Global Attractor for the Solutions to the 3D Primitive Equations with Viscosity  
*Ning Ju, Oklahoma State University, USA*

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**MS61**

**Singularities of High Order PDEs Describing Liquid Jets and Films - Part II of II**

2:30 PM-4:30 PM

*Room: Center Ballroom - Main Level*

For Part 1 see MS48

Liquid films and jets of micro- or nanoscale thickness occur widely in nature and industrial processes. Mathematical models describing them are often represented by high order coupled PDEs of parabolic or mixed type. Interplay between nonlinear curvature and viscosity terms with those describing intermolecular interactions leads to formation of sophisticated analytical and geometric singularities of their solutions, e.g. finite time jet breakup, film rupture, cusps or moving contact lines with singular asymptotics. Self-similar structure of these singularities can be analyzed using asymptotical analysis and nonlinear simulations. The minisymposium provides a platform to investigate these questions from analytical and numerical perspectives.

**Organizer:** Marco A. Fontelos  
Institute for Mathematics, CSIC, Spain

**Organizer:** Georgiy Kitavtsev  
University of Bristol, United Kingdom

**2:30-2:55** Asymptotical Decay and Rupture of Solutions to Thin Film Equations  
*Georgiy Kitavtsev, University of Bristol, United Kingdom; Roman Taranets, University of California, Los Angeles, USA*

**3:00-3:25** The Thin Film Equation Close to Self-similarity  
*Christian Seis, Universitiätsamlt Bonn, Germany*

**3:30-3:55** Rigorous Asymptotics of Traveling-Wave Solutions to the Thin-Film Equation and Tanner’s Law  
*Manuel V. Gnann, University of Michigan, USA; Lorenzo Giacomelli, University of Rome La Sapienza, Italy; Felix Otto, Max Planck Institute for Mathematics in the Sciences, Germany*

**4:00-4:25** Dispersive and Diffusive Shock Waves  
*Micahel Shearer, North Carolina State University, USA; Mark Hoefer, University of Colorado Boulder, USA; Gennady El, Loughborough University, United Kingdom*
### Tuesday, December 8

**MS62**  
**Water Waves - Part I of II**  
2:30 PM-4:30 PM  
*Room: Bouchon - Main Level*

*For Part 2 see MS74*

The last decade has seen an impressive advance in the understanding of both permanent progressive waves (steady water waves) and the evolution of general initial data. Theories have been developed to incorporate such physical effects as vorticity, wind, stagnation and internal waves. Mathematically, water waves are generally governed by nonlinear nonlocal equations. In steady form, these become (degenerate) elliptic problems, while in time-dependent form they exhibit hyperbolic behavior (such as finite-time singularities). In this minisymposium particular attention will be paid to the free surface Euler equations, but contributions related to other dispersive models of water waves are also welcome.

**Organizer:** Mats Ehrnstrom  
Norwegian University of Science and Technology, Norway

**Organizer:** Samuel Walsh  
University of Missouri, USA

**2:30-2:55 The Dynamics of Floating Structures**  
**David Lannes**, Universite de Bordeaux I, France

**3:00-3:25 Three-Dimensional Solitary Water Waves with Weak Surface Tension**  
**Mark D. Groves**, Universitats des Saarlandes, Germany

**3:30-3:55 On the Highest Wave for the Whitham Equation**  
**Erik Wahlén**, Lund University, Sweden; Mats Ehrnstrom, Norwegian University of Science and Technology, Norway

**4:00-4:25 Existence and Qualitative Theory for Solitary Stratified Water Waves**  
**Samuel Walsh**, University of Missouri, USA; Ming Chen, University of Pittsburgh, USA; Miles Wheeler, Courant Institute of Mathematical Sciences, New York University, USA

### Tuesday, December 8

**MS63**  
**New Trends in Elliptic and Partial Differential Equations - Part I of II**  
2:30 PM-4:30 PM  
*Room: Rattlers - Main Level*

*For Part 2 see MS75*

This minisymposium aims to gather specialists on various closely related topics in parabolic and elliptic differential equations. The speakers will present on free boundary problems, homogenization, variational methods, and fractional diffusion. These areas of research are often interrelated and borrow and lend techniques, approaches, and methods from each other. Furthermore, many of the presentations will address problems that involve more than one of the aforementioned areas. The presentations will present new trends in these topics as well as the techniques and methods developed to drive these topics forward.

**Organizer:** Francesco Maggi  
University of Texas at Austin, USA

**Organizer:** Mark Allen  
University of Texas at Austin, USA

**2:30-2:55 Parabolic Problems with a Fractional Time Derivative**  
**Mark Allen**, Luis Caffarelli, and Alexis F. Vasseur, University of Texas at Austin, USA

**3:00-3:25 The Obstacle Problem for the Fractional Laplacian with Drift**  
**Camelia Pop**, University of Minnesota, USA; Nicola Garofalo, Universita di Padova, Italy; Arkshak Petrosyan, Purdue University, USA; Mariana Smit Vega Garcia, University of Duisburg-Essen, Germany

**3:30-3:55 Regularity for Boundary Nonlocal Equations**  
**Pablo R. Stinga**, University of Texas at Austin, USA

**4:00-4:25 Singular Points in Two-Phase Free Boundary Problems for Harmonic Measure**  
**Matthew Badger**, University of Connecticut, USA; Max Engelstein, University of Chicago, USA; Tatiana Toro, University of Washington, USA

### Tuesday, December 8

**MS64**  
**Recent Development in Modeling, Control, Theoretical and Numerical Analysis of Complex Systems with Dynamic Boundaries - Part II of II**  
2:30 PM-4:30 PM  
*Room: Chambers Lecture Hall - Main Level*

*For Part 1 see MS50*

Many outstanding open problems of modern science and engineering involve free boundaries whose dynamics are determined as a part of the solution. The analysis of the underlying PDE systems poses significant mathematical challenges. This minisymposium will highlight some recent advances in analytical and computational studies for such systems. Examples include inverse free boundary problems, optimal control of phase transition processes, multiphase fluid mixture flow, inverse scattering problems, stochastic differential equations and optimal control, viscoelastic fluid simulation, interfaces for nonlinear degenerate and singular parabolic PDEs, electrical impedance tomography based cancer detection model.

**Organizer:** Ugur G. Abdulla  
Florida Institute of Technology, USA

**Organizer:** Jian Du  
Florida Institute of Technology, USA

**Organizer:** Vladislav Bukshytynov  
Florida Institute of Technology, USA

**2:30-2:55 Computational Studies on Dynamical Boundaries in Two-Phase Gels**  
**Jian Du**, Florida Institute of Technology, USA; Aaron L. Fogelson, University of Utah, USA; Robert D. Guy, University of California, Davis, USA

**3:00-3:25 On the Optimal Control of the Stefan Problem**  
**Jonathan Goldfarb** and Ugur G. Abdulla, Florida Institute of Technology, USA

*continued on next page*
Tuesday, December 8
MS65
Self-organization Phenomena in Elliptic and Parabolic Systems - Part II of II
2:30 PM-4:30 PM
Room: Four Peaks - Upper Level
For Part 1 see MS51
This minisymposium is devoted to studies of solutions to elliptic and parabolic PDE systems arising from physical and biological systems, often of multiple constituents, with self-organizing properties. Examples include Gier-Meinhardt type reaction diffusion equations, Ohta-Kawasaki block copolymer problems, and equations of Micro-Electromechanical Systems. Recently developed analytic, asymptotic, and computational techniques will be presented. These methods capture many geometric structures in the PDE solutions. The geometric structures may appear as a single object, or as multiple components in an assembly. In the latter case one can often identify a growth property and an inhibition property that drive pattern formation.

Organizer: Xiaofeng Ren
George Washington University, USA

2:30-2:55 Minimizers of an Energy Modelling Nanoparticle-Polymer Blends
Ihsan A. Topaloglu, McMaster University, Canada

3:00-3:25 Stationary Points of Binary and Ternary Inhibitory Systems
Xiaofeng Ren, George Washington University, USA

3:30-3:55 The Impact of the Domain Boundary on An Inhibitory System: Boundary Half Discs in Stationary Assemblies
David Shoup, Alvernia University, USA

4:00-4:25 Emergent Parabolic Scaling of Nano-Faceting Crystal Growth
Stephen J. Watson, University of Glasgow, Scotland, United Kingdom

Tuesday, December 8
MS66
Free Boundary Problems Involving Interfaces and/or Elastic Deformations - Part I of II
2:30 PM-4:30 PM
Room: Flagstaff A - Upper Level
For Part 2 see MS82
The behavior of free surfaces has long been of both mathematical and physical interest. This minisymposium will bring together an interdisciplinary group of researchers working on understanding the underlying principles governing free boundary problems and cover a variety of applications such as the encapsulation of liquid drops by elastic sheets, the dynamics of grain boundary networks, and the modeling of the earth’s crust. Common to all these diverse problems is the presence strong nonlinearities and small scale parameters, which leads to a unifying challenge of trying to understand and predict the nature of solutions across multiple scales.

Organizer: Nicholas D. Brubaker
University of Arizona, USA

Organizer: John A. Gemmer
Brown University, USA

2:30-2:55 Capillary Induced Deflections of a Thin Elastic Plate
Nicholas D. Brubaker, University of Arizona, USA

3:00-3:25 Surfaces Produced at Vapor-to-Particle Nucleation and Growth Interfaces
Patrick Shipman, Colorado State University, USA

Vladislav Bukshtyrov and Ugur G. Abdulla, Florida Institute of Technology, USA

David Stein, Robert Guy, and Becca Thomases, University of California, Davis, USA
Tuesday, December 8

**CP4**

**Geometric and Evolution Problems**

*2:30 PM-4:30 PM*

*Room: Flagstaff B - Upper Level*

*Chair: Matteo Rinaldi*

*Carnegie Mellon University, USA*

2:30-2:45 On the Cheeger Constant of An Annulus

*Hamilton Bueno* and *Grey Ercole*,

*Universidade Federal de Minas Gerais, Brazil; Shirley Macedo, Universidade Federal de Ouro Preto, Brazil*

2:50-3:05 Stationary Disk Assemblies on Inhibitory Vesicles

*Yeyao Hu* and *Xiaofeng Ren, George Washington University, USA*

3:10-3:25 Asymptotics for Dilute Emulsions with Surface Tension

*Grigor Nika* and *Bogdan M. Vernescu, Worcester Polytechnic Institute, USA*

3:30-3:45 Slow Motion for the Nonlocal Allen-Cahn in N Dimensions

*Matteo Rinaldi* and *Ryan Murray, Carnegie Mellon University, USA*

3:50-4:05 Conservative Parabolic Problems

*Max O. Souza,* Universidade Federal Fluminense, Brazil; *Olga Danilkina, University of Dodoma, Tanzania; Fabio Chalub, Universidade Nova de Lisboa, Portugal*


*Haomin Zhou, Georgia Institute of Technology, USA*

**Coffee Break**

*4:30 PM-5:00 PM*

*Room: Forum - Lower Level*

Tuesday, December 8

**MT1**

**PDE Aspects of Mean Field Games**

*5:00 PM-7:00 PM*

*Room: Forum - Lower Level*

The purpose of the Minitutorial is to briefly describe the various PDEs appearing in Mean Field Games, show examples of applications, discuss the numerical analysis and conclude with open problems.

*Organizer: Pierre Cardaliaguet*

*Université Paris Dauphine, France*

*Speaker: Pierre Cardaliaguet, Université Paris Dauphine, France*

**Intermission**

*7:00 PM-7:15 PM*

**SIAG/APDE Business Meeting**

*(open to SIAG/APDE members)*

*7:15 PM-8:00 PM*

*Room: Forum - Lower Level*

Complimentary beer and wine will be served.

Wednesday, December 9

**Registration**

*8:00 AM-5:30 PM*

*Room: Grand Ballroom Foyer - Main Level*
Wednesday, December 9

**MS67**
Recent Advances in Theoretical and Numerical Aero- and Hydrodynamics? - Part I of III
8:30 AM-11:00 AM
Room: Forum - Lower Level
For Part 2 see MS83
The Navier-Stokes and Euler equations are the fundamental equations modeling the behavior of fluids. They have a broad range of applications in aerodynamics, geophysics, meteorology and engineering. Despite the fact that the mathematical analysis of these equations has a long and rich history, yet many important and interesting problems remain challenging and far to be well understood. Our symposium will be an opportunity to see and share, among its participants and attendees, the recent progress in the theory of incompressible Navier-Stokes and Euler equations and related systems. In particular, the focus will be on the two main axes: Boundary Layer theory and well-posedness issues in hydrodynamics.

Organizer: Slim Ibrahim
University of Victoria, Canada
Organizer: Makram Hamouda
Indiana University, USA

8:30-8:55 Well-posedness of Initial and Boundary-value Problems for the Inviscid Linear and Non-linear Shallow Water Equations. Connection with the Primitive Equations
Roger M. Temam and Aimin Huang, Indiana University, USA

9:00-9:25 Approximating Long-time Statistical Behavior of Dissipative Systems
Xiaoming Wang, Florida State University, USA

9:30-9:55 Theoretical and Numerical Studies of Staggered-grid Schemes on Unstructured Meshes
Qingshan Chen, Clemson University, USA

10:00-10:25 New Time Differencing Methods for Stiff Problems and Applications
Chang-Yeol Jung and Thien Binh Nguyen, Ulsan National Institute of Science and Technology, South Korea

10:30-10:55 Invariant Measures for Passive Scalars in the Small Noise Inviscid Limit
Michele Coti Zelati and Jacob Bedrossian, University of Maryland, USA; Nathan Glatt-Holtz, Virginia Tech, USA

**MS68**
Numerical Approximation of Spectra and Computer-assisted Proof - Part I of II
8:30 AM-10:30 AM
Room: Rio Verde - Main Level
For Part 2 see MS81
This minisymposium seeks to explore the interfaces between numerical approximation, computer-assisted proof, and stability of travelling waves. For many physically relevant systems, spectral stability or instability has only been determined for a limited portion of the parameter space for which waves exist. Recent advances in both numerical approximation algorithms and computer-assisted proof are providing new approaches to the study of stability of travelling waves. These numerical methods do not provide a paper and pencil proof, but do provide rigorous verification of stability properties. This minisymposium seeks to bring together experts from both communities to further accelerate development of this emerging subfield.

Organizer: Kevin Zumbrun
Indiana University, USA
Organizer: Blake Barker
Brown University, USA

8:30-8:55 Rigorous Computation of Unstable Manifolds for Nonlinear Parabolic Pdes Via the Parametrization Method
Christian P. Reinhardt, VU University, Amsterdam, Netherlands; Jason Mireles-James, Florida Atlantic University, USA

9:00-9:25 Approximating Long-time Statistical Behavior of Dissipative Systems
Xiaoming Wang, Florida State University, USA

9:30-9:55 Theoretical and Numerical Studies of Staggered-grid Schemes on Unstructured Meshes
Qingshan Chen, Clemson University, USA

10:00-10:25 New Time Differencing Methods for Stiff Problems and Applications
Chang-Yeol Jung and Thien Binh Nguyen, Ulsan National Institute of Science and Technology, South Korea

10:30-10:55 Invariant Measures for Passive Scalars in the Small Noise Inviscid Limit
Michele Coti Zelati and Jacob Bedrossian, University of Maryland, USA; Nathan Glatt-Holtz, Virginia Tech, USA

continued in next column
Wednesday, December 9
MS69
Dynamics of Partial Differential Equations - Part II of II
8:30 AM-11:00 AM
Room: Sonora - Main Level
For Part I see MS28
Complex systems described by partial differential equations (PDEs) pose great challenges to understanding natural phenomena. They involve the nonlinear dynamics in infinite dimensional spaces. Despite progresses made in the last 50 years, the mathematical tools succeed only modestly in analyzing the PDEs dynamics. Nonetheless, a wide range of methods and techniques have been created to attack the problems. This minisymposium will bring together researchers from different branches of the field. It will cover various topics from abstract theory of dynamical systems in infinite dimensional spaces to their applications to PDEs in fluid mechanics, mathematical biology and quantum physics.
Organizer: Luan Hoang
Texas Tech University, USA
Organizer: Eric Olson
University of Nevada, Reno, USA
8:30-8:55 Asymptotic Stability of Solitary Waves in 1-D Nonlinear Dirac Equation
Tuoc Van Phan, University of Tennessee, Knoxville, USA
9:00-9:25 On the Kolmogorov Entropy of the Weak Global Attractor of the 3D Navier-Stokes Equations
Cecilia F. Mondaini, Ciprian Foias, and Bingsheng Zhang, Texas A&M University, USA
9:30-9:55 Global Solutions to the Derivative NLS Equation with the Inverse Scattering Transform Method
Dmitry Pelinovsky and Yusuke Shimabukuro, McMaster University, Canada
10:00-10:25 Determining Wavenumber for Fluid Equations
Alexey Cheskidov, University of Illinois, Chicago, USA
10:30-10:55 On the Inviscid Limit
Peter Constantin, Princeton University, USA

Wednesday, December 9
MS70
Analytical Methods in Fluid Mechanics - Part II of II
8:30 AM-10:30 AM
Room: Sedona - Main Level
For Part I see MS58
The main purpose of this minisymposium is to bring together junior researchers who have already established themselves as specialists and, in some cases, leaders in the field of mathematical fluid mechanics. The complementary yet cohesive nature of the speakers’ expertise, that is, the use of similar analytical tools in the study of the classical and geophysical fluid mechanics, gives focus and purpose to the minisymposium. This minisymposium is meant as a platform to exchange ideas on a variety of problems concerning the behavior of fluids.
Organizer: Gung-Min Gie
University of Louisville, USA
Organizer: James P. Kelliher
University of California, Riverside, USA
Organizer: Anna L. Mazzucato
Pennsylvania State University, USA
8:30-8:55 On Global Existence for Euler-Maxwell System
Benoit Pausader, Princeton University, USA
9:00-9:25 Incompressible Euler Equations and the Effect of Changes at a Distance
Elaine Cozzi, Oregon State University, USA; James P. Kelliher, University of California, Riverside, USA
9:30-9:55 Rigorous Bounds on the Transport of Heat in Rayleigh-Bénard Convection at Infinite Prandtl Number
Jared P. Whitehead, Brigham Young University, USA
10:00-10:25 Title Not Available at Time of Publication
Gung-Min Gie, University of Louisville, USA

Wednesday, December 9
MS71
PDE Models and Control of Swarm Dynamics - Part II of II
8:30 AM-10:30 AM
Room: Palomas - Main Level
For Part I see MS59
PDEs can be used to model the spatiotemporal dynamics of large collectives, or “swarms,” of discrete individuals. These models enable the prediction, analysis, and control of swarm dynamics in multi-robot tasks, multi-vehicle coordination, and the study of self-organized behaviors in biological, social, and economic systems. The reliable use of PDEs in swarm applications requires further research on differences between discrete and continuum models and the controllability of the models. To facilitate discussions on these problems, this minisymposium will bring together mathematicians and engineers who apply techniques from kinetic theory, network science, numerical analysis, and optimal control to swarm PDE models.
Organizer: Andrea L. Bertozzi
University of California, Los Angeles, USA
Organizer: Spring M. Berman
Arizona State University, USA
8:30-8:55 Inhomogeneous Boltzmann-Type Equations Modeling Opinion Leadership and Political Segregation
Bertram Düring, University of Sussex, United Kingdom
9:00-9:25 Adaptive Control of Multiscale Dynamical Systems
Silvia Ferrari, Cornell University, USA; Pingping Zhu, Duke University, USA
9:30-9:55 Macroscopic PDEs for Flocking Dynamics
Sebastien Motsch, Arizona State University, USA
10:00-10:25 Kinetic Models for Differential Games
Christian Ringhofer, Arizona State University, USA
Wednesday, December 9

**MS72**

**Nonlinear Parabolic Equations and Applications - Part I of IV**

8:30 AM - 10:30 AM

Room: Coronado - Main Level

For Part 2 see MS85

Nonlinear parabolic differential equations play an important role in many applications, including fluid dynamics, phase transitions, image processing, materials sciences, and geometry. This session focuses on recent developments in these areas, with an emphasis on well-posedness, qualitative behavior, and numerical analysis of solutions.

Organizer: Gieri Simonett
Vanderbilt University, USA

Organizer: Patrick Guidotti
University of California, Irvine, USA

Organizer: Yuanzhen Shao
Vanderbilt University, USA

8:30-8:55 Coupling Einstein and Navier-Stokes Equations

Marcelo Disconzi, Vanderbilt University, USA

9:00-9:25 On Minimizers of the Landau-De Gennes Energy Functional under Weak Anchoring Boundary Conditions

Changyou Wang, Purdue University, USA

9:30-9:55 Doubling Estimates, Vanishing Order and Nodal Sets of Steklov Eigenfunctions

Jiuyi Zhu, Chris Sogge, and Xing Wang, Johns Hopkins University, USA

10:00-10:25 Well-Posedness for Nonlinear Wave Equations

Geng Chen, Georgia Institute of Technology, USA

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**MS73**

**Recent Developments in the Analysis of the Navier-Stokes, Euler, and Related Models: Part I of III**

8:30 AM - 10:30 AM

Room: Center Ballroom - Main Level

For Part 2 see MS95

The emphasis will be on the analysis of the Navier-Stokes equation, Euler equation, and related models, describing for instance the interaction with solid bodies immersed in the fluid, the effect of having a magnetized fluid, or the influence of boundaries. These equations are used to model various physical phenomena ranging from the theory of turbulence to oceanography. Besides the fundamental questions of existence and uniqueness of solutions, the talks in this session will address central qualitative properties of equations, such as regularity, (in)stability, long time dynamics, analysis of special solutions (self-similar, axis-symmetric), the behavior in singular limit regimes (the inviscid limit of the Navier-Stokes equation).

Organizer: Igor Kukavica
University of Southern California, USA

Organizer: Christophe Lacave
Universite Paris 7-Denis Diderot, France

Organizer: Vlad C. Vicol
Princeton University, USA

8:30-8:55 Complex Fluids and Electroconvection

Peter Constantin, Princeton University, USA

9:00-9:25 On Minimizers of the Landau-Dec Gennes Energy Functional under Weak Anchoring Boundary Conditions

Changyou Wang, Purdue University, USA

9:30-9:55 Doubling Estimates, Vanishing Order and Nodal Sets of Steklov Eigenfunctions

Jiuyi Zhu, Chris Sogge, and Xing Wang, Johns Hopkins University, USA

10:00-10:25 Well-Posedness for Nonlinear Wave Equations

Geng Chen, Georgia Institute of Technology, USA
Wednesday, December 9

**MS75**
**New Trends in Elliptic and Partial Differential Equations - Part II of II**
8:30 AM-10:30 AM

Room: Rattlers - Main Level
For Part 1 see MS63
This minisymposium aims to gather specialists on various closely related topics in parabolic and elliptic differential equations. The speakers will present on free boundary problems, homogenization, variational methods, and fractional diffusion. These areas of research are often interrelated and borrow and lend techniques, approaches, and methods from each other. Furthermore, many of the presentations will address problems that involve more than one of the aforementioned areas. The presentations will present new trends in these topics as well as the techniques and methods developed to drive these topics forward.

Organizer: Francesco Maggi
North Carolina State University, USA
Organizer: Mark Allen
University of Texas at Austin, USA

8:30-8:55 Homogenization of the Peierls-Nabarro Model for Dislocation Dynamics
Stefania Patrizi, WIAS, Berlin, Germany

9:00-9:25 Poincare Inequalities and Diffusion Along Ergodic Flows
Stefan Steinerberger, Yale University, USA

9:30-9:55 Some Inverse Problems in Periodic Homogenization of Hamilton-Jacobi Equations
Hung Tran, University of Chicago, USA

10:00-10:25 Second-Order Gamma-Limit for the Cahn-Hilliard Functional with Applications to Slow Motion of Phase Boundaries
Ryan Murray, Giovanni Leoni, and Matteo Rinaldi, Carnegie Mellon University, USA

continued in next column

**MS76**
**Uncertainty Quantification for Hyperbolic and Kinetic Equations - Part I of II**
8:30 AM-10:30 AM

Room: Chambers Lecture Hall - Main Level
For Part 2 see MS89
Hyperbolic and kinetic equations often contain uncertain parameters due to inaccurate modeling, measurements, or empirical constitutive relations. A proper quantification of these uncertainties is therefore of practical importance to obtain reliable predictions to solutions of such equations. Moreover, the nonlinear nature of these problems poses great challenges in designing and analyzing efficient numerical/computational methods. We will report recent progress of uncertainty quantification for hyperbolic, kinetic, and related problems.

Organizer: Alina Chertock
North Carolina State University, USA
Organizer: Jingwei Hu
Purdue University, USA
Organizer: Alexander Kurganov
Tulane University, USA

8:30-8:55 A Stochastic Galerkin Method for Nonlinear Systems of Hyperbolic Conservation Laws with Uncertainty
Alina Chertock, North Carolina State University, USA; Alexander Kurganov, Tulane University, USA; Shi Jin, Shanghai Jiao Tong University, China, and the University of Wisconsin-Madison, USA

9:00-9:25 Poincare Inequalities and Diffusion Along Ergodic Flows
Stefan Steinerberger, Yale University, USA

9:30-9:55 Some Inverse Problems in Periodic Homogenization of Hamilton-Jacobi Equations
Hung Tran, University of Chicago, USA

10:00-10:25 Second-Order Gamma-Limit for the Cahn-Hilliard Functional with Applications to Slow Motion of Phase Boundaries
Ryan Murray, Giovanni Leoni, and Matteo Rinaldi, Carnegie Mellon University, USA

Per Pettersson, University of Bergen, Norway

10:00-10:25 Uncertainty Quantification with Limited Data
Xiu Yang, Huan Lei, and Nathan Baker, Pacific Northwest National Laboratory, USA; Guang Lin, Purdue University, USA
Wednesday, December 9

MS77

Control of Partial Differential Equations and Applications
8:30 AM-10:30 AM
Room: Four Peaks - Upper Level

The objective of this MS on “Control of PDE’s and Applications” is to gather four high-level talks by experts of the subject, giving an overview of some techniques used to control complex processes modeled by partial differential equations: The four talks are well-balanced between theoretical aspects (how to prove that a given PDE is controllable: for instance, Boussinesq or Euler equation), qualitative results (such as turnpike properties for controlled PDE’s), and concrete motivating applications (for instance, design of feedback in production models).

Organizer: Emmanuel Trelat
Université Pierre et Marie Curie, France

8:30-8:55 Feedback Control and Optimization of Release and Dispatch Policies in Production Models
Dieter Armbruster, Arizona State University, USA

9:00-9:25 On the Control of the Improved Boussinesq Equation
Eduardo Cerpa, Universidad Técnica Federico Santa María, Chile

9:30-9:55 A Controllability Result for the Non-Isentropic 1-D Euler Equation
Olivier Glass, Université Paris Dauphine, France

10:00-10:25 Turnpike Property for the Optimal Control of Partial Differential Equations
Can Zhang, Université Paris 6, France

Wednesday, December 9

MS78

Mathematical Analysis of Liquid Crystals - Part II of III
8:30 AM-10:00 AM
Room: Flagstaff A - Upper Level

For Part 1 see MS44
For Part 3 see MS111

Liquid crystals are the main entry point into the fascinating world of complex materials with complex micro-structural properties. Yet, despite being the simplest representative of such materials, and of enormous technological importance, liquid crystals are not understood at a basic, fundamental level of description. The proposed minisymposium aims to gather the main contributors to recent advances in the area and to set new directions by determining the major open problems.

Organizer: Valeriy Slastikov
University of Bristol, United Kingdom

Organizer: Arghir Zarnescu
University of Sussex, United Kingdom

8:30-8:55 Dimension Reduction for the Landau-De Gennes Model in Planar Thin Films
Peter Sternberg, Indiana University, USA

9:00-9:25 Active Liquid Crystal Models and Their Applications in Life Science
Qi Wang, University of South Carolina, USA and Beijing Computational Science Research Center, China; Jia Zhao, University of North Carolina at Chapel Hill, USA; Xiaogang Yang, Beijing Computational Science Research Center, China

9:30-9:55 Vorticity Driven Dynamics in Nematic Liquid Crystals
Xiaoyu Zheng, Kent State University, USA; Peter Palffy-Muhoray, Kent State University, USA

Wednesday, December 9

MS79

The Mathematics of Optics and Photonics - Part I of II
8:30 AM-10:30 AM
Room: Flagstaff B - Upper Level

For Part 2 see MS92

Driven by spectacular advances in the design capabilities of materials at the nanoscale, there has been recent exponential growth in the fields of plasmonics and nano-optics. Once exotic phenomena such as extraordinary optical transmission, surface-enhanced Raman scattering, and surface plasmon resonances are now at the heart of everyday technologies. As evidenced by a recent NRC report and an upcoming IMA program, the time is ripe for mathematicians to contribute. The goal of this session is to bring together world experts in the modeling, rigorous analysis, and numerical simulation of Maxwell’s equations to further advance the progress which has already been made.

Organizer: David P. Nicholls
University of Illinois, Chicago, USA

8:30-8:55 Surface Plasmon Resonance Biosensors: Analysis and Numerical Simulation
David P. Nicholls, University of Illinois, USA

9:00-9:25 Active Liquid Crystal Models and Their Applications in Life Science
Qi Wang, University of South Carolina, USA and Beijing Computational Science Research Center, China; Jia Zhao, University of North Carolina at Chapel Hill, USA; Xiaogang Yang, Beijing Computational Science Research Center, China

9:30-9:55 Vorticity Driven Dynamics in Nematic Liquid Crystals
Xiaoyu Zheng, Kent State University, USA; Peter Palffy-Muhoray, Kent State University, USA

10:00-10:25 Turnpike Property for the Optimal Control of Partial Differential Equations
Can Zhang, Université Paris 6, France
Wednesday, December 9

CP5

Modeling
8:30 AM-10:30 AM
Room: San Carlos - Main Level
Chair: TBD

8:30-8:45 Modeling Semi-Arid Deserts Through (in)stabilities of Localized Structure
Thomas Bellsky, University of Maine, USA

8:50-9:05 Analytical and Numerical Modeling of Ground Heat Exchangers
Paul Christodoulides, Lazaros Aresti, Georgios Florides, and Vassilios Messaritis, Cyprus University of Technology, Cyprus

Elias A. Gudiño and Adélia Sequeira, University of Lisbon, Portugal

9:30-9:45 An Advection and Age-Structured Approach to Modeling Bird Migration and Indirect Transmission of Avian Influenza
Rachel L. Jennings and Rongsong Liu, University of Wyoming, USA; Stephen Gourley, University of Surrey, United Kingdom

9:50-10:05 Turing Pattern Formation in a Host-Parasitoid-Hyperparasitoid System
Nitu Kumari, Indian Institute of Technology, Mandi, India

10:10-10:25 A Stationary Core-Shell Assembly in a Ternary Inhibitory System
Chong Wang and Xiaofeng Ren, George Washington University, USA

Coffee Break
10:30 AM-10:55 AM
Room: Forum - Lower Level

Wednesday, December 9

Announcements
10:55 AM-11:00 AM
Room: Forum - Lower Level

IP5

Optimal Shape and Location of Sensors or Actuators in PDE Models
11:00 AM-11:45 AM
Room: Forum - Lower Level
Chair: Piermarco Cannarsa, University of Rome II, Tor Vergata, Italy

We consider the problem of optimizing the shape and the location of sensors or actuators for systems whose evolution is driven by a linear PDE model. This problem is frequently encountered in applications where one wants for instance to maximize the quality of the reconstruction of solutions by using only partial observations. For example, we model and solve the following informal question: What is the optimal shape and location of a thermometer? We stress that we want to optimize not only the placement but also the shape of the observation domain, over the class of all possible measurable subsets of the domain having a prescribed measure. We model this optimal design problem as the one of maximizing a functional that we call the randomized observability constant, which reflects what happens for random initial data, and which is of a spectral nature. Solving this problem is then strongly dependent on the PDE model under consideration. For parabolic equations, we prove the existence and uniqueness of a best domain, regular enough, and whose algorithmic construction depends in general on a finite number of modes. In contrast, for wave or Schrodinger equations, relaxation may occur, and our analysis reveals intimate relations with quantum chaos, more precisely with quantum ergodicity properties of the eigenfunctions. These works are in collaboration with Y. Privat (Paris 6) and E. Zuazua (BCAM Bilbao).

Charles Smart
Cornell University, USA

IP6

The Abelian Sandpile and Circle Packings
11:45 AM-12:30 PM
Room: Forum - Lower Level
Chair: Govind Menon, Brown University, USA

The Abelian sandpile is a simple and deterministic diffusion process on graphs, devised as a model of self-organized criticality by Bak, Tang, and Weisenfeld. The scaling limit of the sandpile on a periodic graph is a nonlinear elliptic partial differential equation with complicated algebraic structure. I will discuss the sandpile, the algebraic structure of its scaling limit, and explicit descriptions of the fractals it approximates.

Emmanuel Trélat
Université Pierre et Marie Curie, France

Lunch Break
12:30 PM-2:00 PM
Attendees on their own
Wednesday, December 9

MS80
Scaling Limits of Particle Systems
3:00 PM-5:00 PM
Room: Forum - Lower Level
The purpose of this minisymposium is to survey recent progress on problems at the interface between partial differential equations, kinetic theory and probability theory. The talks in this minisymposium treat scaling limits of interacting particle systems and connections between PDE with random data and stochastic processes that describe both branching and coagulation.

Organizer: Govind Menon
Brown University, USA
Organizer: Charles Smart
Massachusetts Institute of Technology, USA
3:00-3:25 A Derivation of the Kinetic Wave Equation
Pierre Germain, New York University, USA
3:30-3:55 On Deriving Stochastic Burgers Equations from a Class of Particle Systems
Sunder Sethuraman, University of Arizona, USA
4:00-4:25 Scalar Conservation Laws with Markov Initial Data
David Kaspar, Brown University, USA
4:30-4:55 Coagulation Dynamics in Branching Processes
Robert Pego, Carnegie Mellon University, USA

Wednesday, December 9

MS81
Numerical Approximation of Spectra and Computer-assisted Proof - Part II of II
3:00 PM-5:00 PM
Room: Rio Verde - Main Level
For Part I see MS68
This minisymposium seeks to explore the interfaces between numerical approximation, computer-assisted proof, and stability of travelling waves. For many physically relevant systems, spectral stability or instability has only been determined for a limited portion of the parameter space for which waves exist. Recent advances in both numerical approximation algorithms and computer-assisted proof are providing new approaches to the study of stability of travelling waves. These numerical methods do not provide a paper and pencil proof, but do provide rigorous verification of stability properties. This mini symposium seeks to bring together experts from both communities to further accelerate development of this emerging subfield.

Organizer: Kevin Zumbrun
Indiana University, USA
Organizer: Blake Barker
Brown University, USA
3:00-3:25 Computational Evans-Function Techniques for the Spectral Stability of Viscous Detonation Waves
Gregory Lyng, University of Wyoming, USA
3:30-3:55 Error Estimates for Numerical Evans Approximation
Kevin Zumbrun, Indiana University, USA
4:00-4:25 Error Estimates for Numerical Evans Approximation
Kevin Zumbrun, Indiana University, USA
4:30-4:55 Rigorous Verification of Stability of Traveling Waves Via Computer Assisted Proof
Blake Barker, Brown University, USA

Intermission
2:45 PM-3:00 PM
Wednesday, December 9

**MS82**

Free Boundary Problems Involving Interfaces and/or Elastic Deformations - Part II of II

3:00 PM-5:00 PM

Room: Sonora - Main Level

For Part 1 see MS66

The behavior of free surfaces has long been of both mathematical and physical interest. This minisymposium will bring together an interdisciplinary group of researchers working on understanding the underlying principles governing free boundary problems and cover a variety of applications such as the encapsulation of liquid drops by elastic sheets, the dynamics of grain boundary networks, and the modeling of the earth’s crust. Common to all these diverse problems is the presence strong nonlinearities and small scale parameters, which leads to a unifying challenge of trying to understand and predict the nature of solutions across multiple scales.

Organizer: Nicholas D. Brubaker
University of Arizona, USA

Organizer: John A. Gemmer
Brown University, USA

3:00-3:25 Nonlinear Spatio-Temporal Instability Regime for Electrically Forced Viscous Jets
Saúl O. Orizaga, University of Arizona, USA; Daniel N. Riahi, University of Illinois at Urbana-Champaign, USA

3:30-3:55 Shapes of One-Phase Free Boundaries in the Plane
Nikola Kamburov, University of Arizona, USA; David Jerison, Massachusetts Institute of Technology, USA

4:00-4:25 Minimizers of Anisotropic Surface Tensions under Gravity from a Symmetrization Viewpoint
Eric Baer, University of Wisconsin, Madison, USA

4:30-4:55 Comparison Theorems for a Class of Degenerate Elliptic Operators
Lotfi Hermi, University of Arizona, USA

**MS83**

Recent Advances in Theoretical and Numerical Aero- and Hydrodynamics? - Part II of III

3:00 PM-5:00 PM

Room: San Carlos - Main Level

For Part 1 see MS67
For Part 3 see MS98

The Navier-Stokes and Euler equations are the fundamental equations modeling the behavior of fluids. They have a broad range of applications in aerodynamics, geophysics, meteorology and engineering. Despite the fact that the mathematical analysis of these equations has a long and rich history, yet many important and interesting problems remain challenging and far to be well understood. Our symposium will be an opportunity to see and share, among its participants and attendees, the recent progress in the theory of incompressible Navier-Stokes and Euler equations and related systems. In particular, the focus will be on the two main axes: Boundary Layer theory and well-posedness issues in hydrodynamics.

Organizer: Slim Ibrahim
University of Victoria, Canada

Organizer: Makram Hamouda
Indiana University, USA

3:00-3:25 Well-Posedness and Regularity for a Class of Thin-Film Free Boundary Problems
Manuel V. Gnann, University of Michigan, USA

3:30-3:55 Ill-posedness Results for Transport Equations
Tarek M. Elgindi, Princeton University, USA

4:00-4:25 Some Recent Progresses in Boundary Layer Analysis
Gung-Min Gie, University of Louisville, USA

4:30-4:55 Singular Perturbation Analysis of the Scattering Problem
Youngjoon Hong, University of Illinois at Chicago, USA

**MS84**

Polymer Models

3:00 PM-5:00 PM

Room: Palomas - Main Level

Complete fluid systems are usually in form of coupled equations of Navier-Stokes type with nonlinear equations e.g. of transport type, (degenerate) parabolic or kinetic type. For various equations being components of the systems there are developed and well established the methods and functional spaces structure. However, coupling these equations together gives rise to completely new problems. Flows of polymers, multi-component mixtures, collective dynamics to name a few, are such examples. Precise understanding the interplay between the basic properties of the fluid, transport phenomena and diffusion is a crucial step in analysis of such systems.

Organizer: Piotr Gwiazda
Warsaw University, Poland

3:00-3:25 On Concentrated Polymers Model
Piotr Gwiazda, Warsaw University, Poland

3:30-3:55 Estimating Fragmentation in Polymerization Equations
Marie Doumic, INRIA Rocquencourt, France

4:00-4:25 Weak Solutions to Cucker-Smale System
Piotr Mucha, Warsaw University, Poland

4:30-4:55 Kinetic Models for the Description of Sedimenting Suspensions
Athanasios Tzavaras, King Abdullah University of Science & Technology (KAUST), Saudi Arabia
Nonlinear parabolic differential equations play an important role in many applications, including fluid dynamics, phase transitions, image processing, materials sciences, and geometry. This session focuses on recent developments in these areas, with an emphasis on well-posedness, qualitative behavior, and numerical analysis of solutions.

Organizer: Gieri Simonett
Vanderbilt University, USA

Organizer: Patrick Guidotti
University of California, Irvine, USA

Organizer: Yuanzhen Shao
Vanderbilt University, USA

3:00-3:25 Existence and Stability of Weak Solutions for a Degenerate Parabolic System of Thin Film Type
Joachim Escher, Leibniz University Hannover, Germany

3:30-3:55 A Free Boundary Problem for MEMS
Christopher Walker, Leibniz University Hannover, Germany

4:00-4:25 On Qualitative Properties of Solutions to Microelectromechanical Systems with General Permittivity
Christina Lienstromberg, Leibniz University Hannover, Germany

4:30-4:55 Stability of Cylinders in Surface Diffusion Flow under General Perturbations
Jeremy LeCrone, Kansas State University, USA

Non-local Equations - Part I of II

Motivated by the study of Lévy processes or coming from various applications, so-called anomalous diffusion appears now in many models. We can mention for instance dislocation dynamics, hydraulic fractures and fluid dynamics among many others. The corresponding partial differential equations involve (singular) integral terms such as the fractional Laplacian. These equations raise new analytical challenges and their study attracted a lot of attention in recent years. For instance, to address regularity issues in the case of parabolic/elliptic equations, many new tools and techniques were introduced in the last fifteen years.

Organizer: Cyril Imbert
CNRS and École Normale Supérieure, Paris, France

3:00-3:25 On Neumann Type Problems for Non-Local Equations
Emmanuel Chasseigne, Guy Barles, and Christine Georgelin, Université François Rabelais, France; Espen Jakobsen, NTNU, Norway

3:30-3:55 Global Well-Posedness of a Non-local Burgers Equation
Cyril Imbert, CNRS and École Normale Supérieure, Paris, France; Roman Shvydkoy, University of Illinois, Chicago, USA; François Vigneron, Université Paris-Est, France

4:00-4:25 Global Regularity for 2D Muskat Problem with Finite Slope
Roman Shvydkoy, University of Illinois, Chicago, USA; Peter Constantin and Vlad C. Vicol, Princeton University, USA; Francisco Gancedo, University of Seville, Spain

4:30-4:55 A Non-local Porous Medium Equation
Piotr Biler, University of Wroclaw, Poland; Cyril Imbert, CNRS and École Normale Supérieure, Paris, France; Grzegorz Karch, University of Wroclaw, Poland
**Wednesday, December 9**

### MS88
**Vortices: Analysis and Simulation - Part I of II**

3:00 PM-5:00 PM  
*Room: Rattlers - Main Level*

For Part 2 see MS102  
This minisymposium will cover analysis and simulations of vortices in areas ranging from continuum to quantum mechanics. It addresses questions of stability, localization, mean field limit, and blowup of solutions to GL, BCE, and the Euler Equations, as well as numerical methods for vortex dynamics on the sphere, and the generation and separation of vorticity at walls.

The symposium brings together senior researchers with a range of expertise as well as more junior scientists.

**Organizer:** Monika Nitsche  
*University of New Mexico, USA*

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<th>Time</th>
<th>Title</th>
<th>Speaker</th>
<th>Institution</th>
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<tbody>
<tr>
<td>3:00-3:25</td>
<td>A Mean Field Limit of Bec Vortices</td>
<td>Daniel Spirn</td>
<td>University of Minnesota, USA</td>
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<tr>
<td>3:30-3:55</td>
<td>Blow-Up Criteria for the 3D Incompressible Euler Equations Based on the Voigt Regularization</td>
<td>Adam Larios</td>
<td>University of Nebraska, Lincoln, USA</td>
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<tr>
<td>4:00-4:25</td>
<td>Vorticity Dynamics in Rotating Flow: Geophysical Applications</td>
<td>Peter A. Bosler</td>
<td>Sandia National Laboratories, USA</td>
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<tr>
<td>4:30-4:55</td>
<td>Deflection of Vortex Dipoles by a Flat Plate, With and Without Viscosity</td>
<td>Monika Nitsche</td>
<td>University of New Mexico, USA</td>
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### MS89
**Uncertainty Quantification for Hyperbolic and Kinetic Equations - Part II of II**

3:00 PM-5:00 PM  
*Room: Chambers Lecture Hall - Main Level*

For Part 1 see MS76  
Hyperbolic and kinetic equations often contain uncertain parameters due to inaccurate modeling, measurements, or empirical constitutive relations. A proper quantification of these uncertainties is therefore of practical importance to obtain reliable predictions to solutions of such equations. Moreover, the nonlinear nature of these problems poses great challenges in designing and analyzing efficient numerical/computational methods.

We will report recent progress of uncertainty quantification for hyperbolic, kinetic, and related problems.

**Organizer:** Alina Chertock  
*North Carolina State University, USA*

**Organizer:** Jingwei Hu  
*Purdue University, USA*

**Organizer:** Alexander Kurganov  
*Tulane University, USA*

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<tr>
<td>3:00-3:25</td>
<td>A Stochastic Galerkin Method for the Boltzmann Equation with Uncertainty Efficient in the Fluid Regime</td>
<td>Jingwei Hu</td>
<td>Purdue University, USA</td>
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<tr>
<td>3:30-3:55</td>
<td>Regularity of Solutions of Hamilton Jacobi Equation on a Domain</td>
<td>Albert Fathi</td>
<td>Ecole Normale Superieure de Lyon, France</td>
</tr>
<tr>
<td>4:00-4:25</td>
<td>Analysis and Approximation of Parametric Hyperbolic Pde</td>
<td>Peter Jantsch</td>
<td>University of Tennessee, USA</td>
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<tr>
<td>4:30-4:55</td>
<td>A Path-based Method for Simulating Large Deviations and Rare Events in Stochastic Nonlinear Schroedinger Equations</td>
<td>Jinglai Li</td>
<td>Shanghai Jiao Tong University, China</td>
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### MS90
**Analysis of Hamilton-Jacobi Equation: Optimization, Dynamics and Control - Part I of II**

3:00 PM-5:00 PM  
*Room: Four Peaks - Upper Level*

For Part 2 see MS93  
Hamilton-Jacobi equation and its manifold applications represent an important crossroads of many areas of research in pure and applied mathematics: PDEs, dynamical systems, optimal transport, control, stochastic analysis, etc… The interaction and the combination of these diverse points of view have revealed extremely fruitful over recent years and have led to important advancements in this field.

The aim of this minisymposium is to bring together important experts working on the subject from different perspectives, with the goal of informing the participants about the present state of research, discussing recent developments and proposing new lines of investigation and collaborations.

**Organizer:** Alfonso Sorrentino  
*University of Rome II, Tor Vergata, Italy*

**Organizer:** Piermarco Cannarsa  
*University of Rome II, Tor Vergata, Italy*

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<tr>
<td>3:00-3:25</td>
<td>Homogenization of Equivariant Hamilton-Jacobi Equations</td>
<td>Alfonso Sorrentino</td>
<td>University of Rome II, Tor Vergata, Italy</td>
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<td>3:30-3:55</td>
<td>Regularity of Solutions of Hamilton Jacobi Equation on a Domain</td>
<td>Albert Fathi</td>
<td>Ecole Normale Superieure de Lyon, France</td>
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<td>4:00-4:25</td>
<td>Regularity of Weak Kam Solutions</td>
<td>Ludovic Rifford</td>
<td>Université de Nice, Sophia Antipolis, France</td>
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<tr>
<td>4:30-4:55</td>
<td>Weak Kam Theory on the Infinite Symmetric Product of the Torus</td>
<td>Wilfrid Gangbo</td>
<td>Georgia Institute of Technology, USA</td>
</tr>
</tbody>
</table>
Wednesday, December 9

**MS91**

**Minisymposium**

3:00 PM-5:00 PM  
Room: Flagstaff A - Upper Level

Organizer: Luis Vega  
Basque Center for Applied Mathematics, Spain

3:00-3:25 On the Leapfrogging Phenomena in Fluid Mechanics  
Dicier Smets, Université Pierre et Marie Curie, France

3:30-3:55 Vortex Filaments in the Euler Equation  
Robert Jerrard, University of Toronto, Canada

4:00-4:25 The Evolution of the Vortex Filament Equation for a Regular Polygon  
Francisco de la Hoz, University of the Basque Country, Spain

4:30-4:55 Nearly Parallel Vortex Filaments in the Ginzburg-Landau Equations  
Andres A. Contreras, New Mexico State University, USA

**MS92**

**The Mathematics of Optics and Photonics - Part II of II**

3:00 PM-3:30 PM  
Room: Flagstaff B - Upper Level

For Part 1 see MS79

Organizer: David P. Nicholls  
University of Illinois, Chicago, USA

3:00-3:25 Field Enhancement in Nanogaps  
Junshan Lin, Auburn University, USA

3:30-3:55 Lattice Model of a Fracture in a Composite Infinite Strip  
Aleksandr Smirnov, Louisiana State University, USA

4:00-4:15 Linearized Problem for Viscous Free Surface Flow  
Kyoko Tomoeda and Yoshiaki Teramoto, Setsunan University, Japan

Mikheil Tutberidze, Ilia State University, Georgia

4:40-4:55 Dimension Reduction, Stochastic Parametrization and Data Assimilation for Transport in the Ocean  
Shankar C. Venkataramani, University of Arizona, USA; Clint Dawson, University of Texas at Austin, USA; Juan M. Restrepo, Oregon State University, USA; William Rosenthal, Pacific Northwest National Laboratory, USA

5:00-5:15 Development of Shear Banding of PEC Model in Poiseuille Flow  
Taige Wang and Michael Renardy, Virginia Tech, USA

**CP6**

3:00 PM-5:20 PM  
Room: Sedona - Main Level

Chair: Taige Wang, Virginia Tech, USA

3:00-3:15 Unified Method to Solve the Heat Equation  
Byounseon Choi, Seoul National University, Korea; DAUN Jeong, Samsung Advanced Institute of Technology, Korea; M.Y. Choi, Seoul National University, Korea

3:30-3:45 Self-focusing of Co-propagating Optical Beams  
Alexey Sukhinin, Southern Methodist University, USA

4:00-4:15 Linearized Problem for Viscous Free Surface Flow  
Kyoko Tomoeda and Yoshiaki Teramoto, Setsunan University, Japan

Mikheil Tutberidze, Ilia State University, Georgia

4:40-4:55 Dimension Reduction, Stochastic Parametrization and Data Assimilation for Transport in the Ocean  
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5:00-5:15 Development of Shear Banding of PEC Model in Poiseuille Flow  
Taige Wang and Michael Renardy, Virginia Tech, USA

**Coffee Break**

5:00 PM-5:15 PM  
Room: Forum - Lower Level
Wednesday, December 9

**MT2**

**Simulating Stochastic Systems**

5:15 PM-7:15 PM

Room: Forum - Lower Level

Organizer: Jonathan Weare
University of Chicago, USA

This minitutorial will introduce the simulation of stochastic processes for a variety of important tasks in the physical and biological sciences. Mathematically these tasks can be characterized as the estimation of very high dimensional integrals and the only practical approaches to solving them involve random sampling. We will focus on the computer simulation of diffusion processes. Special attention will be paid to important complicating factors such as conditioning and rare events.

**Speaker**

Jonathan Weare, University of Chicago, USA

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Thursday, December 10

**MS93**

**Analysis of Hamilton-Jacobi Equation: Optimization, Dynamics and Control - Part II of II**

8:30 AM-10:30 AM

Room: Forum - Lower Level

For Part 1 see MS90

Hamilton-Jacobi equation and its manifold applications represent an important crossroads of many areas of research in pure and applied mathematics: PDEs, dynamical systems, optimal transport, control, stochastic analysis, etc... The interaction and the combination of these diverse points of view have revealed extremely fruitful over recent years and have led to important advancements in this field. The aim of this minisymposium is to bring together important experts working on the subject from different perspectives, with the goal of informing the participants about the present state of research, discussing recent developments and proposing new lines of investigation and collaborations.

Organizer: Alfonso Sorrentino
University of Rome II, Tor Vergata, Italy

Organizer: Piermarco Cannarsa
University of Rome II, Tor Vergata, Italy

8:30-8:55 Compactness Estimates for Hamilton-Jacobi Equations

Piermarco Cannarsa, University of Rome II, Tor Vergata, Italy

9:00-9:25 Stochastic Homogenization of Non Convex Hamilton-Jacobi Equations

Pierre Cardaliaguet, Université Paris Dauphine, France


Wei Cheng, Nanjing University, China

10:00-10:25 An Abstract K.A.M. Theorem with Applications to Pdes

Michela Procesi, Università di Roma “La Sapienza”, Italy
Thursday, December 10

**MS94**

**Advances in Numerical Methods for PDEs with Applications - Part I of II**

8:30 AM-10:30 AM

Room: Rio Verde - Main Level

For Part 2 see MS107

This minisymposium is focused on numerical methods for solving PDEs using finite element methods, boundary element methods and fast solvers. These techniques are widely applicable due to their conformation with geometry and allows us to work with minimal regularity assumptions. Part of the focus will be on PDE constrained optimization problems. The field of PDE constrained optimization requires expertise in PDEs, continuous and discrete optimization, linear and non-linear functional analysis, numerical analysis, and scientific computing. Several applications ranging from acoustic and elastic wave propagation, to free boundary problems will be discussed.

Organizer: Harbir Antil
George Mason University, USA

Organizer: Lise-Marie Imbert-Gerard
Courant Institute of Mathematical Sciences, New York University, USA

8:30-8:55 Direct Scattering by a Penetrable Media
Lise-Marie Imbert-Gerard, Sivaram Ambikasaran, and Carlos C. Borges, Courant Institute of Mathematical Sciences, New York University, USA; Leslie Greengard, Simons Foundation and Courant Institute of Mathematical Sciences, New York University, USA

9:00-9:25 Sub-Linear Solver for the 2D High-Frequency Helmholtz Equation
Leonardo Zepeda-Núñez and Laurent Demanet, Massachusetts Institute of Technology, USA

Tomáš Sánchez-Vizuet and Francisco J. J. Sayas, University of Delaware, USA

10:00-10:25 Droplet Footprint Control
Shawn W. Walker, Louisiana State University, USA

**MS95**

**Recent Developments in the Analysis of the Navier-Stokes, Euler, and Related Models: Part II of III**

8:30 AM-10:30 AM

Room: Sonora - Main Level

For Part 1 see MS73
For Part 3 see MS108

The emphasis will be on the analysis of the Navier-Stokes equation, Euler equation, and related models, describing for instance the interaction with solid bodies immersed in the fluid, the effect of having a magnetized fluid, or the influence of boundaries. These equations are used to model various physical phenomena ranging from the theory of turbulence to oceanography. Besides the fundamental questions of existence and uniqueness of solutions, the talks in this session will address central qualitative properties of equations, such as regularity, (in)stability, long time dynamics, analysis of special solutions (self-similar, axisymmetric), the behavior in singular limit regimes (the inviscid limit of the Navier-Stokes equation).

Organizer: Igor Kukavica
University of Southern California, USA

Organizer: Christophe Lacave
Université Paris 7-Denis Diderot, France

Organizer: Vlad C. Vicol
Princeton University, USA

8:30-8:55 Striated Regularity of Velocity for the Euler Equations
James P. Kelliher, University of California, Riverside, USA; Hantaek Bae, Ulsan National Institute of Science and Technology, South Korea

9:00-9:25 How to Control Flutter Arising in Flow Structure Interactions
Irena M. Lasiecka, University of Memphis, USA

9:30-9:55 Weak Vorticity Formulation, Circulation, Net Force and Torque
Dragos Iftimie, Université de Lyon 1, France; Milton Lopes Filho, Federal University of Rio de Janeiro, Brazil; Helena J. Nussenzveig Lopes, Universidade Federal do Rio de Janeiro, Brazil; Franck Sueur, Université Pierre et Marie Curie, France

10:00-10:25 Optimal Mixing Rates
Anna L. Mazzucato, Pennsylvania State University, USA

Thursday, December 10

**MS96**

**Data Assimilation for PDE Models - Part I of II**

8:30 AM-10:30 AM

Room: San Carlos - Main Level

For Part 2 see MS109

One may aim to update the state and/or parameters of a PDE model in the presence of observations. For time-dependent problems in which the observations arrive sequentially, and the update needs to be done online, this is referred to as Data Assimilation. The Data Assimilation problem enjoys a rich interplay between Control Theory and Probability and for PDE models it is quite challenging. Furthermore, the field is still relatively young with much potential for contributions. This minisymposium will bring together experts in both theoretical and computational aspects of Data Assimilation for PDE models.

Organizer: Kody Law
Oak Ridge National Laboratory, USA

Organizer: Fabio Nobile
EPFL, Switzerland

8:30-8:55 Bayesian Filtering as Transportation
Alessio Spantini, Tarek Moselhy, and Youssef M. Marzouk, Massachusetts Institute of Technology, USA

9:00-9:25 Accuracy of Suboptimal Bayesian Filters in the Presence of Model Error
Michal Branicki, University of Edinburgh, United Kingdom; K Law, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; A Majda, Courant Institute of Mathematical Sciences, New York University, USA; A. Stuart, University of Warwick, United Kingdom

9:30-9:55 Stratification of Markov Processes for Rare Event Simulation
Jonathan Weare, University of Chicago, USA

10:00-10:25 Continuous Data Assimilation for Modified 3D Navier-Stokes Equations
Saber Trabelsi, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

Thursday, December 10

MS97
Around Euler Equations - Part I of II
8:30 AM-10:30 AM
Room:Sedona - Main Level
For Part 2 see MS110

The Euler equations, which govern inviscid flow, form a system of hyperbolic conservation laws. It is known that their solutions are not smooth even for regular initial data. For that reason the concept of weak solutions has become a successful tool in the modern studies in hydrodynamics. The last years brought a significant progress in the studies on Euler equations. We will concentrate on the recent advances on Euler and similar systems including the results using the method of convex integration, methods of optimal transport theory, et al.

Organizer: Agnieszka Swierczewska-Gwiazda
University of Warsaw, Poland

8:30-8:55 Recent Advances Concerning the Three-dimensional Primitive Equations of Atmospheric and Oceanic Dynamics
Chongsheng Cao, Florida International University, USA; Jinkai Li, Weizmann Institute of Science, Israel; Edriss S. Titi, Texas A&M University, USA and Weizmann Institute of Science, Israel

9:00-9:25 A Variational Time Discretization for the Compressible Euler Equations
Michael Westdickenberg, RWTH Aachen University, Germany

9:30-9:55 Surprising Solutions to the Isentropic System of Gas Dynamics
Elisabetta Chiodaroli, École Polytechnique Fédérale de Lausanne, Switzerland

10:00-10:25 Uniqueness of Rarefaction Waves in Multidimensional Compressible Euler Systems
Ondrej Kreml, Mathematical Institute ASCR, Prague, Czech Republic

MS98
Recent Advances in Theoretical and Numerical Aero- and Hydrodynamics? - Part III of III
8:30 AM-10:00 AM
Room:Palomas - Main Level
For Part 2 see MS83

The Navier-Stokes and Euler equations are the fundamental equations modeling the behavior of fluids. They have a broad range of applications in aerodynamics, geophysics, meteorology and engineering. Despite the fact that the mathematical analysis of these equations has a long and rich history, yet many important and interesting problems remain challenging and far to be well understood. Our symposium will be an opportunity to see and share, among its participants and attendees, the recent progress in the theory of incompressible Navier-Stokes and Euler equations and related systems. In particular, the focus will be on the two main axes: Boundary Layer theory and well-posedness issues in hydrodynamics.

Organizer: Slim Ibrahim
University of Victoria, Canada

Organizer: Makram Hamouda
Indiana University, USA

8:30-8:55 Long Time Stability of the Implicit Euler Scheme for An Incompressible Two-Phase Flow Model
Florentina Tone, University of West Florida, USA; Theodore Tachim Medjo, Florida International University, USA

9:00-9:25 Global Well Posedness For A Two-Fluid Model
Shengyi Shen and Slim Ibrahim, University of Victoria, Canada; Yoshikazu Giga, University of Tokyo, Japan; Tsuyoshi Yoneda, University of Victoria, Canada

9:30-9:55 Global Existence Results for the Stable Muskat Equation
Omar Lazar and Diego Córdoba, Consejo Superior Investigaciones Científicas, Spain

MS99
Nonlinear Parabolic Equations and Applications - Part III of IV
8:30 AM-10:30 AM
Room:Coronado - Main Level
For Part 2 see MS85
For Part 4 see MS112

Nonlinear parabolic differential equations play an important role in many applications, including fluid dynamics, phase transitions, image processing, materials sciences, and geometry. This session focuses on recent developments in these areas, with an emphasis on well-posedness, qualitative behavior, and numerical analysis of solutions.

Organizer: Patrick Guidotti
University of California, Irvine, USA

Organizer: Yuanzhen Shao
Vanderbilt University, USA

Organizer: Gieri Simonett
Vanderbilt University, USA

8:30-8:55 Some Degenerate Parabolic Equations Inspired by Image Processing
Patrick Guidotti, University of California, Irvine, USA

9:00-9:25 High-Order Time Stepping for Nonlinear PDE Through Componentwise Approximation of Matrix Functions
James V. Lambers, University of Southern Mississippi, USA

9:30-9:55 Traveling Wave Solutions for Some Reaction Diffusion Equations with Fractional Laplacians
Changfeng Gui, University of Connecticut, USA

10:00-10:25 Finite-Time Blow Up and Long-Wave Unstable Thin-Film Equations
Marina Chugunova, Claremont Graduate University, USA
Thursday, December 10

**MS100**

**PDE Methods for Problems in Materials Science - Part II of II**

8:30 AM-10:30 AM

*Room: Center Ballroom - Main Level*

*For Part 1 see MS86*

The minisymposium is intended for an audience interested in the analysis, numerics and modeling of PDE applied to materials science, with an emphasis in soft matter systems. Research related to the mathematical description of materials via energy functionals will be presented and questions of minimizers structures will be addressed. Topics will include analysis of defect structures in liquid crystals, numerical approximation of pattern formation in smectic liquid crystals, dynamics of chevron structures in smectic materials, phase transition in nanoparticle-block blends, and existence of solutions to the Chan-Hilliard equation with phase-dependent diffusion mobility.

**Organizer:** Lia Bronsard  
*McMaster University, Canada*

**Organizer:** Tiziana Giorgi  
*New Mexico State University, USA*

8:30-8:55 *Wetting-Driven Phase Transition in a Nanoparticle-Block Copolymer Blend*

Stan Alama, Lia Bronsard, and Ihsan A. Topaloglu  
*McMaster University, Canada*

9:00-9:25 *Minimizers of the Landau-De Gennes Energy Around a Spherical Colloid Particle*

Stan Alama, McMaster University, Canada

9:30-9:55 *The Landau-De Gennes Model for Nematic Liquid Crystalline Films*

Dmitry Golovaty, University of Akron, USA; Alberto Montero, Pontificia Universidad Católica de Chile, Chile; Peter Sternberg, Indiana University, USA

10:00-10:25 *Properties of Minimizers for the Maier-Saupe Energy*

Daniel Phillips, Purdue University, USA

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Thursday, December 10

**MS101**

**Non-local Equations - Part II of II**

8:30 AM-10:30 AM

*Room: Bouchon - Main Level*

*For Part 1 see MS87*

Motivated by the study of Lévy processes or coming from various applications, so-called anomalous diffusion appears now in many models. We can mention for instance dislocation dynamics, hydraulic fractures and fluid dynamics among many others. The corresponding partial differential equations involve (singular) integral terms such as the fractional Laplacian. These equations raise new analytical challenges and their study attracted a lot of attention in recent years. For instance, to address regularity issues in the case of parabolic/elliptic equations, many new tools and techniques were introduced in the last fifteen years.

**Organizer:** Cyril Imbert  
*CNRS and École Normale Supérieure, Paris, France*

8:30-8:55 *Crystal Dislocations with Different Orientation and Collisions*

Stefania Patrizi, WIAS, Berlin, Germany

9:00-9:25 *A Family of Higher Order Parabolic Non-Local Equations*

Rana Tarhini, Université Paris-Est, France

9:30-9:55 *Propagation in Some Nonlocal Population Dynamics Models*

Matthieu Alfaro, Université Montpellier II, France

10:00-10:25 *On a Fractional Thin Film Equation for Hydraulic Fractures*

Antoine Mellet, University of Maryland, USA

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Thursday, December 10

**MS102**

**Vortices: Analysis and Simulation - Part II of II**

8:30 AM-10:30 AM

*Room: Rattlers - Main Level*

*For Part 1 see MS88*

This minisymposium will cover analysis and simulations of vortices in areas ranging from continuum to quantum mechanics. It addresses questions of stability, localization, mean field limit, and blowup of solutions to GL, BCE, and the Euler Equations, as well as numerical methods for vortex dynamics on the sphere, and the generation and separation of vorticity at walls. The symposium brings together senior researchers with a range of expertise as well as more junior scientists.

**Organizer:** Monika Nitsche  
*University of New Mexico, USA*

8:30-8:55 *Hovering in Oscillatory Flows*

Eva Kanso, University of Southern California, USA

9:00-9:25 *Data-driven Vortex Modeling of Separated Flows*

Jeff D. Eldredge, University of California, Los Angeles, USA

9:30-9:55 *Vortex Shedding from Smooth Two-Dimensional Objects Using Boundary Layers*

Shreyas Mandre, Xinjun Guo, and Ponnulakshmi Kartheeswaran, Brown University, USA

10:00-10:25 *Numerical Study of Hierarchical Vorticity Separations of Viscous Flow Past Wedges*

Ling Xu, University of Michigan, USA
Thursday, December 10

**MS103**

*Numerical Approximation of Boundary Value Problems Involving Fractional Differential Operators*

8:30 AM-10:30 AM

*Room: Chambers Lecture Hall - Main Level*

Boundary value problems involving non-local operators arise from modeling a number of physical processes including porous media flow, Levy diffusion processes, geostrophic models. In this symposium, we consider the stability and approximation of boundary value problems involving fractional differential operators.

Organizer: Joseph Pasciak  
Texas A&M University, USA

8:30-8:55 *Approximation of Fractional Powers of Accretive Operators.*  
Joseph Pasciak and Andrea Bonito, Texas A&M University, USA

9:00-9:25 *A Petrov-Galerkin Finite Element Method for Fractional Convection-Diffusion Equations.*  
Bangti Jin, University College London, United Kingdom; Zhi Zhou, Columbia University, USA

Abner J. Salgado, University of Tennessee, USA

10:00-10:25 *On the Wellposedness of Boundary-Value Problems of Fdes.*  
Hong Wang, University of South Carolina, USA

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**MS104**

*Nonlinear Waves and Patterns - Part I of II*

8:30 AM-10:30 AM

*Room: Flagstaff A - Upper Level*

For Part 2 see MS113

This minisymposium presents new advances in the theory of nonlinear waves and patterns for a wide range of model equations. The speakers will discuss both Hamiltonian and dissipative systems, posed on discrete and continuous spatial domains.

Organizer: Hermen Jan Hupkes  
University of Leiden, The Netherlands

Organizer: Martina Chirilus-Bruckner  
University of Leiden, The Netherlands

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**MS105**

*Structure Preserving Numerical Methods for Kinetic and Wave Equations - Part I of II*

8:30 AM-10:30 AM

*Room: Flagstaff B - Upper Level*

For Part 2 see MS114

Speakers will address topics of current interest in the broad area of numerical analysis for kinetic and wave equations. There will be particular emphasis on structure preserving, such as energy preserving, entropy satisfying, bound preserving, asymptotic preserving, numerical methods. The topics will span a range from theoretical results to novel algorithms, and will include talks focused on a variety of interesting application areas.

Organizer: Hailiang Liu  
Iowa State University, USA

Organizer: Yulong Xing  
Oak Ridge National Laboratory, USA

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**MS106**

*Nonlinear Waves and Patterns - Part II of II*

8:30 AM-10:30 AM

*Room: Flagstaff A - Upper Level*

For Part 1 see MS104

Speakers will address topics of current interest in the broad area of numerical analysis for kinetic and wave equations. There will be particular emphasis on structure preserving, such as energy preserving, entropy satisfying, bound preserving, asymptotic preserving, numerical methods. The topics will span a range from theoretical results to novel algorithms, and will include talks focused on a variety of interesting application areas.

Organizer: Hailiang Liu  
Iowa State University, USA

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**MS107**

*Agent-Based and Continuum Models for Stripe Formation in Zebrafish*

10:00-10:25

*Room: Flagstaff B - Upper Level*

Speaker: Alexandria Volkening and Bjorn Sandstede, Brown University, USA
Thursday, December 10

CP7

8:30 AM-10:30 AM
Room: Four Peaks - Upper Level
Chair: To Be Determined

8:30-8:45 Optimal Design of Energy Conversion Devices
Lincoln Collins and Kaushik Bhattacharya, California Institute of Technology, USA

8:50-9:05 On the Existence of Maximizers for Airy-Strichartz Inequalities
Luiz G. Farah, Universidade Federal de Minas Gerais, Brazil

9:10-9:25 Stability and Bifurcation of a Flexible Loop Spanned by a Fluid Film
Eliot Fried, Okinawa Institute of Science and Technology, Japan

9:30-9:45 Positive Solution for a Class of Coupled (p,q)-Laplacian Nonlinear Systems
Eder M. Martins and Wenderson Ferreira, Universidade Federal de Ouro Preto, Brazil

Fabio Natali, State University of Maringa, Brazil; Ademir Pastor, State University of Campinas, Brazil

Coffee Break
10:30 AM-10:55 AM
Room: Forum - Lower Level

Closing Remarks
10:55 AM-11:00 AM
Room: Forum - Lower Level

Thursday, December 10

IP7
Scientific Computing in the Movies and Virtual Surgery
11:00 AM-11:45 AM
Room: Forum - Lower Level
Chair: Fabio Nobile, EPFL, Switzerland

New applications of scientific computing for solid and fluid mechanics problems include simulation of virtual materials for movie special effects and virtual surgery. Both disciplines demand physically realistic dynamics for such materials as water, smoke, fire, and brittle and elastic objects. These demands are different from those traditionally encountered and new algorithms are required. Teran’s talk will address the simulation techniques needed in these fields and some recent results including: simulated surgical repair of biomechanical soft tissues, extreme deformation of elastic objects with contact, high resolution incompressible flow, clothing and hair dynamics. Also included is discussion of a new algorithm used for simulating the dynamics of snow in Disney’s animated feature film, “Frozen”.

Joseph Teran
University of California, Los Angeles, USA

Thursday, December 10

IP8
Customising Image Analysis Using Nonlinear Partial Differential Equations
11:45 AM-12:30 PM
Room: Forum - Lower Level
Chair: To Be Determined

When assigned with the task of extracting information from given image data the first challenge one faces is the derivation of a truthful model for both the information and the data. Such a model can be determined by the a-priori knowledge about the image (information), the data and their relation to each other. The source of this knowledge is either our understanding of the type of images we want to reconstruct and of the physics behind the acquisition of the data or we can thrive to learn parametric models from the data itself. The common question arises: how can we customise our model choice to a particular application? Or better how can we make our model adaptive to the given data?

Starting from the first modelling strategy this talk will lead us from nonlinear diffusion equations and subdifferential inclusions of total variation type functionals as the most successful image model today to non-smooth second- and third-order variational models, with data models for Gaussian and Poisson distributed data as well as impulse noise. These models exhibit solution-dependent adaptivities in form of nonlinearities or non-smooth terms in the PDE or the variational problem, respectively. Applications for image denoising, inpainting and surface reconstruction are given. After a critical discussion of these different image and data models we will turn towards the second modelling strategy and propose to combine it with the first one using a PDE constrained optimisation method that customises a parametrised form of the model by learning from examples. In particular, we will consider optimal parameter derivation for total variation denoising with multiple noise distributions and optimising total generalised variation regularisation for its application in photography.

Carola-Bibiane Schönlieb
University of Cambridge, United Kingdom

Lunch Break
12:30 PM-2:30 PM
Attendees on their own
Thursday, December 10
MS106
Complex Analysis and PDEs
2:30 PM-4:30 PM
Room:Forum - Lower Level
This is a period of burgeoning activity in many aspects of complex analysis including (1) Riemann-Hilbert problems and applications to random matrix theory and nonlinear wave equations; (2) Singularity analysis of complexified real equations; (3) Conformal mappings for multiply-connected domains and Riemann surfaces; (4) Interface motion in two dimensions and connections to integrable systems; and (5) Developments in numerical conformal mapping techniques. This minisymposium will feature the interplay between, and applications of, many of these recent developments to PDE/free boundary problems.
Organizer: Shankar C. Venkataramani
University of Arizona, USA

2:30-2:55 Multi-Scale Conformal Maps for Singular Interfaces in Free Boundary Problems
Shankar C. Venkataramani, University of Arizona, USA; Stuart Kent, Detroit Labs, USA

3:00-3:25 Conformal Mapping Technique for a Supercavitating Flow Around a Wedge Or a Hydrofoil
Anna Zemlyanova, Kansas State University, USA

3:30-3:55 Weak Solutions for Integrable Free-Boundary Dynamics in Two Dimensions
Razvan Teodorescu, University of South Florida, Tampa, USA

4:00-4:25 Burgers Equation in the Complex Plane and Random Matrix Theory
Govind Menon, Brown University, USA

Thursday, December 10
MS107
Advances in Numerical Methods for PDEs with Applications - Part II of II
2:30 PM-4:30 PM
Room:Rio Verde - Main Level
For Part 1 see MS94
This mini-symposium is focused on numerical methods for solving PDEs using finite element methods, boundary element methods and fast solvers. These techniques are widely applicable due to their conformity with geometry and allows us to work with minimal regularity assumptions. Part of the focus will be on PDE constrained optimization problems. The field of PDE constrained optimization requires expertise in PDEs, continuous and discrete optimization, linear and non-linear functional analysis, numerical analysis, and scientific computing. Several applications ranging from acoustic and elastic wave propagation, to free boundary problems will be discussed.
Organizer: Harbir Antil
George Mason University, USA

2:30-2:55 A Fractional Space-time Optimal Control Problem: Analysis and Discretization
Harbir Antil, George Mason University, USA; Enrique Otalora, University of Maryland and George Mason University, USA; Abner J. Salgado, University of Tennessee, Knoxville, USA

3:00-3:25 The State of the Art in Polytopal Finite Element Methods
Andrew Gillette, University of Texas at Austin, USA

3:30-3:55 C0 DG Methods for Elliptic Problems in Non-divergence Form
Michael J. Neilan, University of Pittsburgh, USA

4:00-4:25 Finite Element Approximation of the Isacs Equation
Abner J. Salgado, University of Tennessee, USA; Wujun Zhang, University of Maryland, USA

Thursday, December 10
MS108
Recent Developments in the Analysis of the Navier-Stokes, Euler, and Related Models: Part III of III
2:30 PM-4:30 PM
Room:Sonora - Main Level
For Part 2 see MS95
The emphasis will be on the analysis of the Navier-Stokes equation, Euler equation, and related models, describing for instance the interaction with solid bodies immersed in the fluid, the effect of having a magnetized fluid, or the influence of boundaries. These equations are used to model various physical phenomena ranging from the theory of turbulence to oceanography. Besides the fundamental questions of existence and uniqueness of solutions, the talks in this session will address central qualitative properties of equations, such as regularity, (in)stability, long time dynamics, analysis of special solutions (self-similar, axis-symmetric), the behavior in singular limit regimes (the inviscid limit of the Navier-Stokes equation).
Organizer: Igor Kukavica
University of Southern California, USA

2:30-2:55 A New Analytic Approach to Wave Turbulence
Tristan Buckmaster, Courant Institute of Mathematical Sciences, New York University, USA

3:00-3:25 Normal Form Transformations for Capillary-Gravity Water Waves
Christophe Lacave, Universite Paris 7-Denis Diderot, France

3:30-3:55 Well/Ill-Posedness for Transport Equations
Vlad C. Vicol, Princeton University, USA

4:00-4:25 Persistence of Regularity for Solutions of the Boussinesq Equations in Sobolev Spaces
Fei Wang, University of Southern California, USA
Thursday, December 10

**MS109**

**Data Assimilation for PDE Models - Part II of II**

2:30 PM-4:30 PM

*Room:* San Carlos - Main Level

*For Part 1 see MS96*

One may aim to update the state and/or parameters of a PDE model in the presence of observations. For time-dependent problems in which the observations arrive sequentially, and the update needs to be done online, this is referred to as Data Assimilation. The Data Assimilation problem enjoys a rich interplay between Control Theory and Probability and for PDE models it is quite challenging. Furthermore, the field is still relatively young with much potential for contributions. This minisymposium will bring together experts in both theoretical and computational aspects of Data Assimilation for PDE models.

*Organizer:* Kody Law  
Oak Ridge National Laboratory, USA

*Organizer:* Fabio Nobile  
EPFL, Switzerland

2:30-2:55 Sequential Data Assimilation for Urban Crime Model  
Naratip Santitissadeekorn, University of Surrey, United Kingdom

3:00-3:25 Continuous Data Assimilation with Stochastically Noisy Data  
Hokima Bessaih, University of Wyoming, USA; Eric Olson, University of Nevada, Reno, USA; Edriss S. Titi, Texas A&M University, USA and Weizmann Institute of Science, Israel

3:30-3:55 Title Not Available at Time of Publication  
Viet Ha Hoang, Nanyang Technological University, Singapore

4:00-4:25 Kalman Filtering and Inverse Problems with Infinitely Dimensional Data  
Jan Mandel, University of Colorado at Denver, USA

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**Thursday, December 10**

**MS110**

**Around Euler Equations - Part II of II**

2:30 PM-4:30 PM

*Room:* Sedona - Main Level

*For Part 1 see MS97*

The Euler equations, which govern inviscid flow, form a system of hyperbolic conservation laws. It is known that their solutions are not smooth even for regular initial data. For that reason the concept of weak solutions has become a successful tool in the modern studies in hydrodynamics. The last years brought a significant progress in the studies on Euler equations. We will concentrate on the recent advances on Euler and similar systems including the results using the method of convex integration, methods of optimal transport theory, et al.

*Organizer:* Agnieszka Swierczewska-Gwiazda  
University of Warsaw, Poland

2:30-2:55 Weak-Strong Uniqueness for Inviscid Flows  
Emil Wiedemann, University of Bonn, Germany

3:00-3:25 Conservative Weak Solutions of the 2D Euler Equations  
Milton Lopes Filho, Universidade Federal do Rio de Janeiro, Brazil

3:30-3:55 Entropy Stable Methods for Numerical Solutions of the Multidimensional Euler and Ideal Magnetohydrodynamics Equations  
Christian Klingenberg, Wurzburg University, Germany

4:00-4:25 The Cauchy Problem for the Pressureless Euler/Isentropic Navier-Stokes Equations  
Young-Pil Choi, Imperial College London, United Kingdom; Bongsuk Kwon, Ulsan National Institute of Science and Technology, South Korea

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**Thursday, December 10**

**MS111**

**Mathematical Analysis of Liquid Crystals - Part III of III**

2:30 PM-4:30 PM

*Room:* Palomas - Main Level

*For Part 2 see MS78*

Liquid crystals are the main entry point into the fascinating world of complex materials with complex microstructural properties. Yet, despite being the simplest representative of such materials, and of enormous technological importance, liquid crystals are not understood at a basic, fundamental level of description. The proposed minisymposium aims to gather the main contributors to recent advances in the area and to set new directions by determining the major open problems.

*Organizer:* Valeriy Slastikov  
University of Bristol, United Kingdom

*Organizer:* Arghir Zarnescu  
University of Sussex, United Kingdom

2:30-2:55 Modeling the Motion and Locomotion of Liquid Crystal Elastomers  
Peter Palffy-Muhoray, Fred Minkowski, Mykhailo Pevnyi, and Xiaoyu Zheng, Kent State University, USA

3:00-3:25 Features of Minimizers to Liquid Crystals Energies  
Daniel Phillips, Purdue University, USA

3:30-3:55 On the Classical and Statistical Dynamics of Hard, Non-Spherical Particle Systems  
Mark Wilkinson, Courant Institute of Mathematical Sciences, New York University, USA

4:00-4:25 Aggregation Models for Liquid Crystals with Polydispersity  
Ibrahim Fatkullin, University of Arizona, USA; Valeriy Slastikov, University of Bristol, United Kingdom
Nonlinear Parabolic Equations and Applications - Part IV of IV
2:30 PM-4:30 PM
Room: Coronado - Main Level
For Part 3 see MS99
Nonlinear parabolic differential equations play an important role in many applications, including fluid dynamics, phase transitions, image processing, materials sciences, and geometry. This session focuses on recent developments in these areas, with an emphasis on well-posedness, qualitative behavior, and numerical analysis of solutions.

Organizer: Yuanzhen Shao
Vanderbilt University, USA

Organizer: Patrick Guidotti
University of California, Irvine, USA

Organizer: Gieri Simonett
Vanderbilt University, USA

2:30-2:55 Maximal Regularity Theory
Yuanzhen Shao, Vanderbilt University, USA

3:00-3:25 Existence and Maximal $L^p$-Regularity of Solutions for the Porous Medium Equation on Manifolds with Conical Singularities
Elmar Schrohe, Leibniz University Hannover, Germany

3:30-3:55 On Fluid Flows and Phase Transitions
Gieri Simonett, Vanderbilt University, USA

4:00-4:25 Liouville Theorems for the Navier Stokes Equation on a Hyperbolic Space
Magdalena Czubak, Binghamton University, USA

Nonlinear Waves and Patterns - Part II of II
2:30 PM-4:30 PM
Room: Flagstaff A - Upper Level
For Part 1 see MS104
This minisymposium presents new advances in the theory of nonlinear waves and patterns for a wide range of model equations. The speakers will discuss both Hamiltonian and dissipative systems, posed on discrete and continuous spatial domains.

Organizer: Hermen Jan Hupkes
University of Leiden, The Netherlands

Organizer: Martina Chirilus-Bruckner
University of Leiden, The Netherlands

2:30-2:55 Structure and Stability in Localized Patterns
Elizabeth J. Makrides and Bjorn Sandstede, Brown University, USA

3:00-3:25 Traveling Fronts in Holling-Tanner Model with Slow Diffusion
Anna Ghazaryan, Miami University, USA

3:30-3:55 Nonlinear Damping Estimates and Stability of Large-amplitude Periodic Wave Trains
Kevin Zumbrun, Indiana University, USA

4:00-4:25 Evolution and Interaction of Localized Structures with Oscillatory Tails
Martina Chirilus-Bruckner, University of Leiden, The Netherlands

Structure Preserving Numerical Methods for Kinetic and Wave Equations - Part II of II
2:30 PM-4:30 PM
Room: Flagstaff B - Upper Level
For Part 1 see MS105
Speakers will address topics of current interest in the broad area of numerical analysis for kinetic and wave equations. There will be particular emphasis on structure preserving, such as energy preserving, entropy satisfying, bound preserving, asymptotic preserving, numerical methods. The topics will span a range from theoretical results to novel algorithms, and will include talks focused on a variety of interesting application areas.

Organizer: Hailiang Liu
Iowa State University, USA

Organizer: Yulong Xing
Oak Ridge National Laboratory, USA

Organizer: Hui Yu
RWTH Aachen University, Germany

2:30-2:55 L2 Stable Discontinuous Galerkin Methods for One-dimensional Two-way Wave Equations
Yulong Xing, University of Tennessee and Oak Ridge National Laboratory, USA

3:00-3:25 An Asymptotic Preserving Maxwell Solver Resulting in the Darwin Limit
Andrew J. Christlieb, Michigan State University, USA

Kjetil Lye and Siddhartha Mishra, ETH Zürich, Switzerland

4:00-4:25 Velocity Scaling Methods for Kinetic Equations with Nonlocal Interactions
Changhui Tan, Rice University, USA
Thursday, December 10  
**CP8**  
**Hyperbolic and Flow Problems**  
**2:30 PM-4:30 PM**  
**Room:** Center Ballroom - Main Level  
**Chair:** To Be Determined  

2:30-2:45 Nonuniqueness of Solutions to the Euler-Smoluchowski System for Compressible Fluids  
Joshua Ballew, Carnegie Mellon University, USA  

2:50-3:05 Central-Upwind Scheme for Shallow Water Equations with Discontinuous Bottom Topography  
Andrew Bernstein and Alina Chertock, North Carolina State University, USA; Alexander Kurganov, Tulane University, USA  

3:10-3:25 Nonlinear Wave-Diffraction in Real Fluids  
Neelam Gopita and Vishnu D. Sharma, Indian Institute of Technology-Bombay, India  

3:30-3:45 Exact Two-Point Water Saturation Cdf for Stochastic Two-Phase Immiscible Flows  
Fayadh Ibrahima and Hamdi Tchelepi, Stanford University, USA  

3:50-4:05 Homogenization of Linear Hyperbolic Stochastic Partial Differential Equation with Rapidly Oscillating Coefficients: The Two Scale Convergence Method  
Mogtaba A. Mohammed and Mamadou Sango, University of Pretoria, South Africa  

4:10-4:25 Approximate Controllability of Fractional Parabolic Integrodifferential Equations  
Anurag Shukla, N Sukavanam, and D.N. Pandey, Indian Institute of Technology Roorkee, India  

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Thursday, December 10  
**CP9**  
**2:30 PM-4:30 PM**  
**Room:** Bouchon - Main Level  
**Chair:** Kristoffer Varholm, Norwegian University of Science and Technology, Norway  

2:30-2:45 Symmetry Properties and A Priori Decay Estimate for Traveling Wave Solutions to the Whitham Equation  
Long Pei, NTNU, Norway; Gabriele Brull, Leibniz University Hannover, Germany; Mats Ehrnstrom, Norwegian University of Science and Technology, Norway  

2:50-3:05 Nonclassical Shocks in Hall-Mhd Flow  
Triveni P. Shakla and Vishnu D. Sharma, Indian Institute of Technology-Bombay, India  

3:10-3:25 Optimal Dirichlet Type Boundary Condition Control for the 1D Wave Equation: Finite Horizon, Infinite Horizon  
Ilya Smirnov, Lomonosov Moscow State University, Russia  

3:30-3:45 On the Nonlinear Elliptic Equation Connected with the Solitary Waves  
Nino Khatiashvili, Tbilisi State University, Republic of Georgia  

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Thursday, December 10  
**CP10**  
**Solitary, Shock Waves, Atmospheric Problems**  
**2:30 PM-3:50 PM**  
**Room:** Chambers Lecture Hall - Main Level  
**Chair:** Eric Stachura  

2:30-2:45 On Ellipticity of Balance Equations for Atmosphere Dynamics  
Andrei Bourchtein and Ludmila Bourchtein, Pelotas State University, Brazil  

2:50-3:05 Almost Automorphic Mild Solutions for Abstract Differential Equations with Iterated Deviating Arguments  
Vikram Singh, Dwijendra Pandey, and Alka Chadda, Indian Institute of Technology Roorkee, India  

3:10-3:25 Uniform Refraction in Negative Refractive Index Materials  
Eric Stachura and Cristian Gutierrez, Temple University, USA  

3:30-3:45 On the Nonlinear Elliptic Equation Connected with the Solitary Waves  
Nino Khatiashvili, Tbilisi State University, Republic of Georgia
Thursday, December 10

**CP11**

**Stochastic Problems**

**2:30 PM-4:30 PM**

*Room:* Four Peaks - Upper Level

*Chair:* Ani P. Velo, University of San Diego, USA

**2:30-2:45** Approximation of Solutions to Stochastic Fractional Integro-Differential Equation with Deviated Argument

Renu Chaudhary, Dwijendra N Pandey, and Alka Chadda, Indian Institute of Technology Roorkee, India

**2:50-3:05** The Dynamic Multi-Newsvendor Problem

Zhaohu Fan, Pennsylvania State University, USA

**3:10-3:25** Approximate Controllability of Semi Linear Control System with Delay Using Tikhonov Regularization

Ravinder Katta and Sukavanam Nagarajan, Indian Institute of Technology Roorkee, India

**3:30-3:45** Optimal Multi-Level Monte-Carlo Method for a System of Stochastic PDEs

Leila Taghizadeh, Amirreza Khodadadian, and Caroline Geiersbach, Vienna University of Technology, Austria; Clemens F. Heitzinger, Arizona State University, USA and Vienna University of Technology, Austria

**3:50-4:05** Analytical Results for Stress and Particle Velocity on Impact Problems in Elastic Layered Media

Ani P. Velo, University of San Diego, USA; George Gazonas, Army Research Office, USA

**4:10-4:25** Liouville SLE Boundaries on CFT Torus Defined with Scholastic Schrödinger Equation.

Scott M. Little, Northcentral University, USA; Dan Cervo, Yavapai College, USA
PD15 Abstracts

SIAM Conference on Analysis of Partial Differential Equations

December 7-10, 2015
DoubleTree Resort by Hilton
Paradise Valley-Scottsdale
Scottsdale, Arizona USA

Abstracts are printed as submitted by the authors.
SIAM Conference on Analysis of Partial Differential Equations

December 7-10, 2015
DoubleTree Resort by Hilton Paradise Valley-Scottsdale
Scottsdale, Arizona USA
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Ward, Michael, MS51, 10:00 Tue
Watson, Stephen J., MS65, 4:00 Tue
Weare, Jonathan, MT2, 5:15 Wed
Weare, Jonathan, MT2, 5:15 Wed
Weare, Jonathan, MS96, 9:30 Thu
Webster, Clayton G., MS11, 8:30 Mon
Webster, Clayton G., MS11, 10:00 Mon
Webster, Clayton G., MS25, 2:30 Mon
Webster, Justin T., MS5, 8:30 Mon
Webster, Justin T., MS19, 2:30 Mon
Webster, Justin T., MS31, 5:00 Mon
Webster, Justin T., MS45, 8:30 Tue
Wei, Chaozhen, CP9, 4:10 Thu
Westdickenberg, Michael, MS97, 9:00 Thu
Wetzel, Alfredo N., MS52, 9:30 Tue
Whitehead, Jared P., MS46, 8:30 Tue
Whitehead, Jared P., MS60, 2:30 Tue
Whitehead, Jared P., MS70, 9:30 Wed
Wiedemann, Emil, MS10, 2:30 Thu
Wilkinson, Mark, MS111, 3:30 Thu
Wright, J. Douglas, MS20, 4:00 Mon
Wu, Qiliang, MS16, 4:30 Mon
Wu, Tong, CP2, 2:30 Mon
Wu, Yilun, MS52, 9:00 Tue

X
Xiang, Yang, MS42, 8:30 Tue
Xiang, Yang, MS42, 9:00 Tue
Xiang, Yang, MS56, 2:30 Tue
Xing, Yulong, MS105, 8:30 Thu
Xing, Yulong, MS114, 2:30 Thu
Xing, Yulong, MS114, 2:30 Thu
Xiu, Dongbin, MS76, 9:00 Wed
Xu, Ling, MS102, 10:00 Thu

Y
Yamazaki, Kazuo, MS58, 2:30 Tue
Yan, Baisheng, MS3, 8:30 Mon
Yang, Xiu, MS76, 10:00 Wed
Yao, Yao, MS15, 3:00 Mon
Yip, Aaron, MS56, 2:30 Tue
Yousef, Feras, MS21, 4:00 Mon
Yu, Hui, MS105, 8:30 Thu
Yu, Hui, MS105, 9:00 Thu
Yu, Hui, MS114, 2:30 Thu

Z
Zakerzadeh, Hamed, CP2, 4:10 Mon
Zakerzadeh, Mohammad, CP2, 3:50 Mon
Zarnescu, Arghir, MS44, 8:30 Tue
Zarnescu, Arghir, MS44, 9:30 Tue
Zarnescu, Arghir, MS78, 8:30 Wed
Zarnescu, Arghir, MS111, 2:30 Thu
Zatorska, Ewelina, MS40, 8:30 Tue
Zatorska, Ewelina, MS40, 10:30 Tue
Zatorska, Ewelina, MS55, 2:30 Tue
Zemlyanova, Anna, MS106, 3:00 Thu
Zepeda-Nuñez, Leonardo, MS94, 9:00 Thu
Zhang, Bingsheng, MS28, 5:30 Mon
Zhang, Can, MS77, 10:00 Wed
Zhang, Guannan, MS11, 8:30 Mon
Zhang, Guannan, MS25, 2:30 Mon
Zhelezov, Gleb, MS26, 2:30 Mon
Zheng, Xiaoyu, MS78, 9:30 Wed
Zheng, Zhong, MS48, 9:00 Tue
Zhou, Haomin, MS50, 9:00 Tue
Zhou, Haomin, CP4, 4:10 Tue
Zhou, Zhi, MS103, 9:00 Thu
Zhu, Jiuyi, MS72, 9:30 Wed
Zhu, Kangping, MS43, 9:00 Tue
Zumbrun, Kevin, MS68, 8:30 Wed
Zumbrun, Kevin, MS81, 3:00 Wed
Zumbrun, Kevin, MS81, 4:00 Wed
Zumbrun, Kevin, MS113, 3:30 Thu

Italicized names indicate session organizers
Conference Budget
SIAM Conference on Analysis of Partial Differential Equations
December 7-10, 2015
Scottsdale, Arizona

Expected Paid Attendance 370

Revenue
Registration Income $126,880
Total $126,880

Expenses
Printing $3,300
Organizing Committee $3,800
Invited Speakers $11,250
Food and Beverage $25,036
AV Equipment and Telecommunication $27,200
Advertising $5,000
Conference Labor (including benefits) $51,793
Other (supplies, staff travel, freight, misc.) $9,600
Administrative $14,540
Accounting/Distribution & Shipping $7,753
Information Systems $13,979
Customer Service $5,280
Marketing $8,293
Office Space (Building) $5,245
Other SIAM Services $5,540
Total $197,609

Net Conference Expense ($70,729)

Support Provided by SIAM $70,729
$0

Estimated Support for Travel Awards not included above:
Early Career and Students 34 $24,300