# Division of Fluid Dynamics Newsletter

A Division of the American Physical Society

## THE 62ND ANNUAL DFD MEETING Minneapolis, MN November 22-24, 2009

The 62nd Annual Meeting of the American Physical Society's Division of Fluid Dynamics (DFD) will be held in Minneapolis, Minnesota from November 22nd to 24th, 2009. The meeting will be hosted by the University of Minnesota and will be held at the Minneapolis Convention Center in downtown Minneapolis.

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The articles in this issue represent the views of the Division of Fluid Dynamics (DFD) publication committee and are not necessarily those of individual DFD members or the APS.

#### **Meeting Venue**

The Minneapolis Convention Center is conveniently located close to hotels, retailers, entertainment and dining facilities, and is connected by an enclosed, climate controlled skyway system. "Eat Street" and downtown Minneapolis provide a wide variety of eating options within walking distance of the Convention Center. Additionally, concession stands are located throughout the Convention Center.

Oral presentations will be held in rooms on the first and second levels of the Convention Center. Exhibits, the Gallery of Fluid Motion, and refreshment breaks will be held in one large ballroom, and the Main Auditorium will be used for the awards ceremony.

#### **Minneapolis**

Minneapolis is compact and easy to navigate. Known as the "City of Lakes", Minneapolis has a vibrant downtown with easy access to theater, museums and fine dining. Please visit the Minneapolis Convention and Visitors Center at **http://www.minneapolis.org** for more information.

#### Housing and Meeting Registration

Registration for the meeting and housing will open in early June and can be accessed through the meeting website: http://dfd2009.umn.edu.

Two hotels will be used for the 2009 APS/DFD meeting. To receive the special meeting room rate, please reference the APS room block if placing your reservation by phone, or go to **http://dfd2009.umn.edu** and click on "accommodations".

#### **Hilton Minneapolis**

1-800-HILTONS, 1001 Marquette Ave., South \$148 + tax, single/double \$168 + tax, triple \$188 + tax, quad

#### **Doubletree Minneapolis**

1-800-245-8011, 1101 LaSalle Ave. \$129 + tax, single/double/triple/quad

#### **Key Dates**

Early June Meeting Registration Opens Check http://dfd2009.umn.edu for more information

October 12th Early meeting registration ends

#### **November 9th**

Cancellation deadline (no refunds after this date)

#### **November 9th**

Onsite meeting registration required after this date

#### Hotels

June 1st Reservations open (reduced rate)

October 12th (Earlier if rooms sell out) Reduced rate ends

June 1st – August 7th Abstract submission

#### August 7th

Travel grant application due to APS/DFD

#### **Gallery of Fluid Motion**

September 14th

Email intent to submit poster or video on or before this date

October 16th Video submission deadline

#### **Scientific Program**

This year's scientific program will include three award lectures, invited lectures, minisymposia, contributed papers, poster sessions, exhibits, and the Gallery of Fluid Motion. More than 1400 contributed abstracts, divided into 20 concurrent sessions, are anticipated.

#### **Awards Program**

Each year the APS Division of Fluid Dynamics presents the Fluid Dynamics Prize, the Francois Frenkiel Award, and the Andreas Acrivos Dissertation Award. The 2009 award winners will be announced in the Fall. Each award winner will give a lecture at the meeting.

#### **Invited Lectures and Minisymposia**

Approximately eight invited lectures on topics of broad interest to the DFD community will be given by experts in the field. The program will also include approximately five minisymposia, each consisting of five 26 minute talks. Minisymposia topics typically include fluid dynamics education, international research, tutorials/reviews, and focus sessions dealing with exciting current research. The specific speakers and minisymposia will be announced on the meeting website closer to the meeting.

#### **Gallery of Fluid Motion**

The 27th Annual Gallery of Fluid Motion will be held as part of the Meeting. The Gallery consists of aesthetically pleasing and insightful posters or videos of fluid motion submitted by attendees. Both computational and experimental entries are encouraged. Poster and video entries must not duplicate one another. Outstanding posters, selected by a panel of referees, will be recognized during the meeting, will also be displayed at the Annual APS meeting in March, 2010, and will appear in the September 2010 issue of the *Physics of Fluids*.

Please see the meeting website for information on how to submit Gallery of Fluid Motion entries.

#### **Audiovisual Equipment**

All rooms will be equipped with an LCD projector, screen, microphone, and pointer. Speakers must provide their own laptop computer to use with the projector. A Speaker Ready Room with technicians will be available to help attendees ensure that their presentations work smoothly with the LCD projection equipment.

#### **Conference Reception**

Always a highlight of the meeting, the Conference Reception will be held at the Hilton Minneapolis on Sunday evening, November 22, 2009. The reception is included in the registration fee for those who register as APS Members, Nonmembers, Graduate Students, and Retired Members. Additional tickets may be purchased for \$75 each.

#### **Exhibitors**

The Convention Center Ballroom will host staffed booths belonging to various vendors and exhibitors. Attendees are very welcome to stop by, and interact with the exhibitors. For more information on exhibits or sponsorship, please contact Professor Krishnan Mahesh (mahesh@aem.umn.edu) or Meetings and More (301 641-4150, mtgs911@aol.com).

#### **Meeting Hosts**

The meeting is hosted by: The University of Minnesota

#### **Meeting Chair**

Prof. Krishnan Mahesh University of Minnesota mahesh@aem.umn.edu

#### **Meeting Information:**

**Contact Meetings and More** General Information (Monica Malouf) Phone: (301) 526-8129

Exhibiting and Sponsorship Information (Peggy Holland) Phone: (301) 641-4150 Fax: (301) 240-396-5900 Email: mtgs911@aol.com

#### 2009 Conference Website http://dfd2009.umn.edu

#### **Future APS/DFD Meetings**

2010 Long Beach, CA; Prof. Julian A. Domaradzki, Meeting Chair University of Southern California

2011 Baltimore, MD; Prof. Andrea Prosperetti, Meeting Chair Johns Hopkins University

## Call for APS/DFD Officers and Executive Committee Candidates

The Nominating Committee of the APS Division of Fluid Dynamics invites suggestions for candidates for Vice-Chair, Secretary/Treasurer, and two Member-at-Large positions for the Executive Committee of the DFD. Please send the names of potential candidates to the Chair of the Nominating Committee by June 12, 2009:

#### Prof. John Kim

Department of Mechanical and Aerospace Engineering University of California, Los Angeles 420 Westwood Plaza, Los Angles, CA 90095-1597 jkim@seas.ucla.edu

Officers and Members-at-Large of the Executive Committee must be members of the Division for at least two years prior to nomination. The member elected as Vice-Chair shall serve in that office for one year, then for one year as Chair-Elect, then for one year as Chair of the Executive Committee, and finally, one year as Past Chair. The Secretary/Treasurer and the Members-at-Large serve for three years. More information on these positions can be found at the governance section of the APS DFD website: http://units.aps.org/units/dfd/.

The Nominating Committee will select two nominees for each position.

#### 2008 Andreas Acrivos Dissertation Award

John R. Taylor, Massachusetts Institute of Technology, received the Andreas Acrivos Dissertation Award for his thesis entitled, "Numerical Simulations of the Stratified Oceanic Bottom Boundary Layer." The award recognizes an exceptional young scientist for original, outstanding doctoral thesis work in fluid dynamics done in the United States. Dr. Taylor did his doctoral thesis work at the University of California, San Diego under the direction of Prof. Sutanu Sarkar.

#### 2008 Francois Frenkiel Award

Jonathan B. Freund, University of Illinois at Urbana – Champaign was the recipient of the François Frenkiel Award, which recognizes significant contributions to fluid mechanics that have been published in the *Physics of Fluids* during the preceding year by young investigators. The citation reads: "For insightful numerical simulations which elucidate the mechanism leading to leukocyte marginations observed in microvessels."

## APS/DFD 2008 Awards, Prizes, New Fellows, and Gallery Winners



#### 2008 Fluid Dynamics Prize

Julio Mario Ottino, of Northwestern University, was the recipient of the 2008 Fluid Dynamics Prize that recognizes major contributions to fundamental fluid dynamics made during a career of outstanding work. The citation reads: "For outstanding contributions to the fundamental understanding of chaotic mixing in laminar flows, to mixing and segregation in granular flows and for ground-breaking experimental work that has led to the broad application of these concepts."

#### **New APS/DFD Fellows**

Each year the number of new Fellows is limited to be no more than  $\frac{1}{2}$  of 1% of the membership. The new 2008 Fellows are:



#### Dwight Barkley, University of Warwick

For combining computation and dynamical systems analyses to obtain remarkable insights into hydrodynamic instabilities and patterns in diverse systems, including flow past a cylinder, channel flow, laminar-turbulent bands, and thermal convection.



#### Osman Basaran, Purdue University

For computational, theoretical, and experimental work on improving fundamental understanding of pinch-off singularities, drop formation, and electrohydrodynamics, and for development of nonstandard inkjet printing applications.





William Stephen Childress, New York University For pioneering contributions to dynamo theory, geophysical fluid dynamics and biological fluid mechanics including locomotion.



#### Richard Lueptow, Northwestern University

For careful experiments and simulations in a broad range of areas including granular flow, Taylor Couette flow, physical acoustics, turbulent flow, membrane filtration, and sprays as well as noteworthy service to the Division of Fluid Dynamics.



Julian Andrzej Domaradzki, University of Southern California For insightful contributions to the development of subgrid-scale algo-

rithms for computational fluid dynamics and for their use to illuminate the physics of the energy transfer between eddy scales in large eddy simulations of turbulent flow fields.



## Mujeeb Malik,

NASA Langley Research Center For pioneering contributions to the understanding of the breakdown of cross flow vortices in threedimensional boundary layers, attachment-line and hypersonic boundary layer instability including real gas effects, and developing physics-based methods for the prediction of laminar-turbulent



## Elisabeth Guazzelli, CNRS-Paris

For extensive and careful experiments revealing complex phenomena in mobile particulate systems.



#### Kazhikathra Kailasanath, Naval Research Laboratory

For contributions to advanced computational techniques and basic understanding of the dynamics of chemically reactive flows and their application in design, analysis, and performance of propulsion concepts.



#### Manoochehr Koochesfahani, Michigan State University

For his pioneering contributions to the development of experimental techniques including laser induced fluorescence, molecular tagging velocimetry and thermometry, and quantum dot imaging, and for his fundamental studies of turbulent mixing.



#### John Lister, University of Cambridge

Manifold contributions to the dynamics of free surface flows, their singular structures, and applications to flows and transport processes relevant to the earth sciences.



#### Paolo Orlandi, University of Rome

transition.

For his contributions to the study of turbulence, vortex dynamics, and other areas of fluid mechanics, in particular through the application of low-order energy-conserving finite-difference numerical techniques.



#### Michael Plesniak, George Washington University

For fundamental contributions to understanding complex turbulent shear flows including the effects of curvature, multiple strain rates, three-dimensional boundary layers, and non-canonical jets in crossflow.



### Leslie Smith,

University of Wisconsin, Madison For important and insightful contributions to the understanding of turbulence in engineering and geophysical flows through theory and numerical simulations.

#### Kyle Squires, Arizona State University

For his role in discovering the mechanisms creating concentration fluctuations of inertial particles in turbulent flow, and for fundamental contributions to the computational modeling of wall turbulence in complex geometries.



#### Victor Yakhot, Boston University

For seminal contributions to turbulence and combustion modeling.

#### Winners of the 2008 Gallery of Fluid Motion

#### **Posters**

Wetting and lubricating film instabilities in microchannels Thomas Cubaud, Stony Brook University, USA.

**Cavitation within a droplet** G. L. Heijnen, *University of Twente, The Netherlands*; P. A. Quinto-Su, X. Zhao and C.D. Ohl, *Nanyang Technological University, Singapore.* 

**Capillary origami in nature** Sunghwan Jung, Pedro Reis, Jillian James and John Bush, *Massachusetts Institute of Technology, USA.* 

**Bursting bubbles** Henri Lhuissier, I.R.P.H.E, Marseille; Emmanuel Villermaux, I.R.P.H.E, *Université de Provence, France.* 

**Dynamics of flagellar swimming in a viscous fluid** Mahmut-Selman Sakar, Cindy Lee and Paulo E. Arratia, *University of Pennsylvania, USA.* 

The flat-plate boundary layer from Blasius to fully turbulent Xiaohua Wu, Royal Military College of Canada, Canada; Parviz Moin, Stanford University, USA.

#### Videos

Why don't mackerel swim like eels? The role of form and kinematics on the hydrodynamics of undulatory swimming Iman Borazjani and Fotis Sotiropoulos, *St. Anthony Falls Lab, University of Minnesota, USA.* 

**Evaporating cocktails** Sam Dehaeck, Christophe Wylock and Pierre Colinet, *Free University of Brussels, Belgium.* 

Surface texture and pulsation due to balloon bursting in different liquids Enrique Soto Castruita and Andrew Belmonte, *Pennsylvania State University, USA*.

**Tornadoes in a microchannel** Carlos L. Perez and Jonathan D. Posner, *Arizona State University, USA.* 

**Optically induced electrokinetic patterning and manipulation of particles** Stuart J. Williams, Aloke Kumar and Steven T. Wereley, *Purdue University, USA*.

## Highlights of the 61st Annual DFD Meeting in San Antonio, Texas



The 2008 DFD meeting was held in November at the San Antonio Convention Center in San Antonio, Texas. Highlights included three award lectures, eight invited lectures, and approximately 1500 additional contributed papers. A total of about 150 contributed sessions covered a wide range of fluid dynamics topics. There were 55 poster entries and 38 video entries submitted to the Gallery of Fluid Motion. Total registration was 1747, 28% of which were international attendees representing 35 countries. This included 59 undergraduates and 720 graduate students. Invited lectures were presented by Alec Gallimore (U. Michigan), Stephen Fauve (Ecole Normale Superieure, Paris), Elaine Oran (Naval Research Laboratory), James Brasseur (Penn State), David Youngs (Aldermaston, UK), Joseph Fernando (Arizona State), Patrick Tabeling (MMN-ESPCI, Paris) and Paolo Padoan (UCSD). In addition, the meeting included six minisymposia: Videos and Multimedia for Fluids Instruction; Lagrangian Coherent Structures in Fluid Flows; Flow Visualizations in Low Temperature Helium; High Raleigh Number Convection: Is there an Ultimate Regime?; Tip Streaming and Flow/ EHD Flow Focusing; and Computational Challenges in Modeling Transient Detonation. Highlights from the winning poster and video entries will be published in a special Gallery of Fluid Motion article in the September 2009 issue of the *Physics of Fluids* as well as being posted on the Physics of Fluids web site.

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A highlight of the 2008 DFD meeting was the enthusiastic participation by group of about 40 students and junior researchers from various universities across Mexico. Travel and lodging were sponsored by Halliburton and Schlumberger.

## APS March Meeting & Cyber News



What is common among a meteorite, a fuel droplet, and a grain of sand? Or between circulatory systems in the human body and in the oceans? Well known within DFD, fluid dynamics is indeed a fascinating subject with diverse applications even if not well understood in society at large. Some of these applications may even have great impact for human life. While combined use of experiments, theory and computation has always been important, rapid advances in computing power are now providing many new opportunities for progress. These considerations helped motivate a joint DFDDCOMP invited session called Fluid Dynamics and Computational Science at the 2009 APS March Meeting in Pittsburgh, where five outstanding speakers hailing from different academic or research disciplines shared the excitement of their recent discoveries and future plans in the new Cyber era. Subsequently, a majority of the speakers also participated at a press conference called by AIP's Media Services Unit, where they spoke in general terms to a number of reporters about the importance of their research specialty, and the future promise of advanced tools in high-performance computing (HPC).





The first talk of the session, given by P. Padoan (UC San Diego), relates turbulent clustering of inertial particles to the dynamics of interstellar clouds. Euler simulations of particleladen compressible turbulence have been carried out for particles at 16 different Stokes numbers, to help understand the process of planetismal formation, which in turn leads to the formation of terrestrial planets. The second speaker, G.E. Karniadakis (Brown Univ.) then described an ambitious project using resources at several supercomputing sites simultaneously to simulate blood flow in the human arterial tree. A close network of collaborators with biomedical expertise is working on the long-term goal of enabling new cardiovascular treatment techniques. Next, J.H. Chen (Sandia National Labs) described simulations of flames with complex turbulencechemistry interactions which provide fundamental insight useful for modeling in alternative fuel applications. Large resource allocations at the

Department of Energy's leadership class computer facilities have made very large simulations including many chemical species feasible. The fourth speaker, F. Zhang (Penn State Univ.) discussed fluid-dynamical and computer aspects of hurricane predictions where advances in high-performance computing are raising future prospects for greater accuracy in predictions of both storm trajectory and intensity. Natural limitations on predictability also suggest that probabilistic methods based on cloudresolving ensembles will be of much utility in improving disaster preparedness. Finally, S. Elghobashi (UC Irvine) spoke about the challenges of studying multiple regimes of two-way coupling in particle-laden turbulent flows,

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including applications in desert sandstorms. While most studies use a point-particle approach the challenges of resolving spherical particles via the immersed boundary method were also carefully addressed.

All of the five presentations briefly described above were very stimulating, and were followed by several questions from the audience. The breadth of subject matter covered at the session clearly showed that the language of fluid dynamics is widely spoken, in fields of science that stir great curiosity in the public mind, as well as those which have direct impact on public well-being or can potentially lead to futuristic technologies in service of society.

It is true, of course, that the limitation of five speakers per invited session does not pretend to do justice to the vitality of our discipline yet, as there are also a number of other research groups increasingly engaged in pursuit of HPC, and/or working to make new modes of Cyberenabled collaborative knowledge discovery a reality.

Incidentally, a new sorting category, called Cyber Fluid Dynamics, was initiated at the DFD Annual Meeting in 2008. This is a broader area of endeavor than Computational Fluid Dynamics, which happens to share the same acronym and is more focused on the development of numerical techniques. Instead, the main themes of CyberFD can be interpreted to include several areas of increasing importance: such as HPC-driven algorithmic adaptations, community code development, as well as effective approaches for analyzing and sharing large datasets of either computational or experimental/observational in origin. Submissions to this new category in 2009 are expected to benefit from increasing attention given to topics of a Cyber nature; and exchange of ideas in this broad context will be important in preparing our community for future opportunities that will require a greater collaborative spirit than before. The DFD's Ad-Hoc Committee on Cyber Fluid Dynamics is interested in suggestions on how to help our community move forward along these directions, as computational capacities provided by major funding agencies continue to expand.

Acknowledgments: Funds in support of the invited session above were provided by the Fluid Dynamics Program at NSF.

- Prof. P. K. Yeung



#### IN MEMORIAM Phillip Geoffrey Saffman, 1931 - 2008

Philip G. Saffman, the Theodore von Kármán Professor of Applied Mathematics and Aeronautics, Emeritus, at the California Institute of Technology, passed away on

August 17, 2008, after a long illness. Prof. Saffman was an eminent mathematician and scientist and a gifted teacher. Early in his career he examined the phenomenon of viscous fingering, which occurs when a low-viscosity fluid is injected into a higher-viscosity fluid; the phenomenon has become known as the "Saffman-Taylor Instability." The range of his body of work also included extensive explorations of vortex instability and the dynamics of arrays of vortices. His work with vortices led him to a new mathematical analysis of the wake turbulence caused by jet aircraft as they take off, resulting in a theory describing the conditions behind several aircraft accidents. He was the author of **Vortex Dynamics**, published by Cambridge University Press (1992).

Saffman was born in Leeds, England, and received his BA, MA, and PhD from the University of Cambridge. In 1964 he accepted Caltech's appointment as a full professor in fluid mechanics within the Division of Engineering and Applied Science. He was named von Kármán Professor in 1995.

He was a Fellow of the American Academy of Arts and Sciences, and in 1988 was elected a Fellow to the Royal Society, England's premier scientific organization. He also received the Otto Laporte Award in 1994 from the American Physical Society Division of Fluid Dynamics. Saffman served as associate editor for both the *Journal of Fluid Mechanics* and *Physical Review Letters* and was most recently an editorial board member for the journal *Studies in Applied Mathematics*.

Prof. Saffman is survived by his wife, Ruth; children Louise, Mark, and Emma; and grandchildren Timothy, Gregory, Rae (née Sarah), Jenny, Nadine, Aaron, Miriam, and Alexandra.

A Memorial Symposium honoring the life and work of Philip Saffman will be held on the Caltech campus in Pasadena, CA on Friday, May 29, 2009. More information on the Symposium may be found at http://www.acm.caltech.edu/saffman/.

## APS/DFD 2009 Leadership & Contact Information

DFD members are invited to contact the DFD Leadership with suggestions and concerns.

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Member-at-Large Jean Hertzberg (11/06-10/09) University of Colorado -Boulder

Member-at-Large Martin Maxey (11/06-10/09) Brown University

Member-at-Large Anette Hosoi (11/07-10/10) *MIT* 

Member-at-Large Laurette Tuckerman (11/07-10/10) *LIMSI* 

Member-at-Large Lance Collins (11/08-10/11) Cornell University

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(12/10)

(12/10)