MPE2013 Events at the Institute for Computational and Experimental Research in Mathematics (ICERM)

In January 2013, the jury for the MPE2013 competition to design virtual or physical museum-quality exhibits met at ICERM to determine the award recipients. The jury was made up of Tom Banchoff, Ehrhard Behrends, Ana Eiró, George, Oh Nam Kwom and Adrian Paenza.

There were twenty-nine entries submitted for the competition.

First prize ($5,000) was awarded to “Sphere of the Earth”, by the team of Daniel Ramos (Spain). Second prize ($3,000) was awarded to “Dune Ash”, by the team of Tobias Malkmus (Germany). Third prize ($2,000) was awarded to “How to predict the future of glaciers?”, by the team of Guilleaume Jouvet (France/Switzerland/Germany).

The prize ceremony took place at the UNESCO Headquarters Paris in the morning of March 5. More details can be found at: http://mpe2013.org/2013/03/06/news-from-the-mpe2013-competition/

During one week in July 2013, ICERM hosted its first annual early career researcher “IdeaLab.” One of the topics dealt with the mathematics of climate. “Tipping Points in Climate Systems”, led by Christopher K.R.T. Jones of the University of North Carolina, was based on the following abstract:

The climate is changing and it is due to anthropogenic sources of carbon-that is agreed upon by the scientific community. But is there a possibility of abrupt change? On the whole, the large climate models do not predict such occurrences, but they also do not include the physical mechanisms that might trigger these tipping points in the modeling. So, how do we try to predict abrupt transitions? Is it even feasible?

There has been a considerable amount of mathematics devoted to rapid changes, dating back to catastrophe theory, and also to systems that enjoy varying time-scales. This has laid the groundwork for an emerging area of tipping points in climate. But can we account for the potential climate tipping points with what amount to low-dimensional bifurcations? And, if we can, what are ways that this mathematical technology can be factored into the construction of large models?

There have, of course, been abrupt changes in the past, such as rapid warming after ice-ages. Can we learn from these? The technical approach here might be to assimilate the data into models. But the current techniques of data assimilation do not accommodate abrupt transitions. This can be viewed as the same issue arising in modeling: both modeling and data assimilation require relatively smooth evolution. But we must still be able to say something when it is not so smooth.

The IdeaLab organizers created a team of about 10 participants who discussed, in depth, this research topic. At the end of the week, the team prepared a presentation outlining problems and possible solutions. These were shared with a broad audience including invited program officers from various funding agencies. More details can be found at: http://icerm.brown.edu/idealab_2013

ICERM was invited to host one of nine worldwide public lectures celebrating MPE2013 (Mathematics of Planet Earth) sponsored by the Simons Foundation, a private foundation with a mission to advance research in mathematics and the basic sciences.

Dr. L. Mahadevan, professor of applied mathematics, physics, and biology at Harvard, gave a lecture titled "On Growth and Form: Mathematics, Physics and Biology" on Tuesday, Sept. 24, 2013, at 6:30 p.m. in Brown University's Salomon Center for Teaching.

Dr. Jill Pipher, ICERM Director, welcomed the audience of close to 500, including 40 students bussed-in from a local public high school. Dr. Peter Jones, Yale University, introduced Dr. Mahadevan. Dr. Mahadevan's talk lasted one hour, with a Q&A session afterwards.

Dr. L. Mahadevan gives his Simons Foundation talk "On Growth and Form: Mathematics, Physics and Biology" at Brown University.

A reception was held for 50 people at Brown University President Christina Paxson's home immediately following the lecture.

Talk Abstract:
The diversity of living forms led Darwin to state that it is "enough to drive the sanest

man mad". How can we describe this variety? How can we understand the origin and evolution of these "endless forms most beautiful?" And how do these forms link to function and physiology at the organismic level and beyond? Mathematics, and geometry in particular, provides a natural language to express these questions and answer them. Motivated by biological observations on different scales from molecules to organisms to swarms, I will show how a combination of quantitative experiments, physical analogies, mathematical theories and computational models allow us to begin to unravel the mechanistic basis for aspects of morphogenesis and thence towards physiology, pathophysiology and biomimetics.

Dr. Mahadevan received his Ph.D. from Stanford and was on the faculty at the Massachusetts Institute of Technology and the University of Cambridge before moving to Harvard in 2003. Among his awards are a Guggenheim Fellowship (2006) and a MacArthur Fellowship (2009-14). More details can be found at: http://icerm.brown.edu/simonslecture.