



INSTITUTE FOR PURE AND APPLIED MATHEMATICS  
Los Angeles, California

# Materials for a Sustainable Energy Future

September 9 – December 13, 2013

**ORGANIZING COMMITTEE:** Martin Bazant (MIT), Giulia Galli (UC Davis), Graeme Henkelman (University of Texas at Austin), Keith Promislow (Michigan State University), Matthias Scheffler (Fritz-Haber-Institut der Max-Planck-Gesellschaft)

## Scientific Overview

A secure and sustainable energy future that is not based on a fossil-fuel based infrastructure requires the design of new materials for efficient energy conversion, transport, and storage. Indeed, materials development is a rate limiting step in many potential new energy conversion strategies, impacting the efficiency of photovoltaic solar cells, the storage capacity and power density of batteries for automobile applications, the synthesis of liquid fuels, and the catalysis and durability of energy conversion in fuel cells. A key bottleneck in this historic transition is the wide range of length scales present in the morphology and time scales in the transport phenomena. Serious progress in the development of new materials requires predicative modeling which surmounts the particle-continuum divide. Recent developments in macro-micro modeling, incorporating machine and manifold learning, combined with new classes of continuum models and increases in computational resources, provide a new framework with which to develop a fundamental understanding of complex materials. This program is part of the international initiative "Mathematics of Planet Earth."

## Workshop Schedule

- Materials for a Sustainable Energy Future Tutorials. September 9 - 13, 2013
- Workshop I: Solar Cells. September 23 - 27, 2013
- Workshop II: Fuels from Sunlight. October 14 - 18, 2013
- Workshop III: Batteries and Fuel Cells. November 4 - 8, 2013
- Workshop IV: Energy Conservation and Waste Heat Recovery. November 18 - 22, 2013
- Culminating Workshop at Lake Arrowhead (by invitation only). December 8 - 13, 2013



## Participation

This program will bring together researchers from mathematics, physics, materials science, engineering, chemistry, biology, computer sciences, and other sciences with the goal to understand the mathematical structure of continuum models governing material properties as well as the electronic, atomic, and molecular structure of such new materials.

Full and partial support for long-term participants is available. We are especially interested in applicants who intend to participate in the entire program, but will consider applications for shorter periods. Funding is available to participants at all academic levels, though recent PhDs, graduate students, and researchers in the early stages of their careers are especially encouraged to apply. Encouraging the careers of women and minority mathematicians and scientists is an important component of IPAM's mission and we welcome their applications. More information and an application is available online.

[www.ipam.ucla.edu/programs/mse2013](http://www.ipam.ucla.edu/programs/mse2013)

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