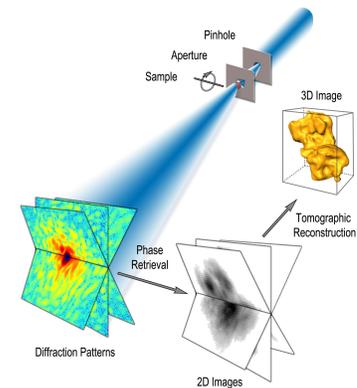


Computational Microscopy

September 12 - December 16, 2022



Scientific Overview

The goal of this long program proposal is to bring together senior and junior applied mathematicians, physicists, chemists, materials scientists, engineers and biologists to discuss and debate on the current status and future perspectives of modern microscopy using computation, mathematics and modeling. Cryo-EM has revolutionized biology and life science (including very recently solving the 3D atomic structure of COVID-19, which has been greatly facilitating the development of the vaccines) and aberration-corrected electron optics and high brightness X-ray sources have transformed physical science imaging. The next steps in these fields will advance by orders of magnitude the temporal resolution and energy resolution, while maintaining atomic spatial resolution, in a variety of sample environments from near zero Kelvin in vacuum to temperatures of a thousand degrees in a highly corrosive atmosphere. These advances will transform research in macromolecules, materials, energy technologies, quantum devices, and other fields. However, they all result in multidimensional, multimodal, big and extremely noisy data. Therefore, sophisticated mathematical and computational methods to derive the maximum possible useful scientific information from the minimum possible quanta of radiation are urgently needed. The four workshops will bring together leading applied mathematicians, physicists, data scientists and computational scientists to discuss strategies to tackle these major scientific challenges through a combination of advanced algorithms, mathematical modeling, computational tools, big data processing and deep learning.

Long Program Schedule

- Computational Microscopy Opening Day : September 12, 2022
- Computational Microscopy Tutorials : September 13-16, 2022
- Workshop I: Diffractive Imaging with Phase Retrieval : October 10-14, 2022
- Workshop II: Mathematical Advances for Multi-Dimensional Microscopy : October 24-28, 2022
- Workshop III: Cryo-Electron Microscopy and Beyond : November 14-18, 2022
- Workshop IV: Multi-Modal Imaging with Deep Learning and Modeling : November 28 - December 2, 2022
- Computational Microscopy Culminating Retreat at Lake Arrowhead : December 11-16, 2022

Organizers

Peter Binev (University of South Carolina), **Angus Kirkland** (University of Oxford), **Gitta Kutyniok** (Technische Universität Berlin), **John Miao** (UCLA), **Margaret Murnane** (University of Colorado, Boulder), **Deanna Needell** (UCLA), **Stanley Osher** (UCLA), **Zineb Saghi** (CEA), **Amit Singer** (Princeton University), **Paul Voyles** (University of Wisconsin-Madison), **Laura Waller** (UC Berkeley),

Participation

This long program will involve senior and junior researchers from several communities relevant to this program. You may apply for financial support to participate in the entire fourteen-week program, or a portion of it. We prefer participants who stay for the entire program. Applications will be accepted through May 16, 2022 but offers may be made up to one year before the start date. We urge you to apply early. Mathematicians and scientists at all levels who are interested in this area of research are encouraged to apply for funding. Supporting the careers of women and minority researchers is an important component of IPAM's mission and we welcome their applications. More information and an application is available online.

