

NSF Science and Technology Centers – The Class of 2013

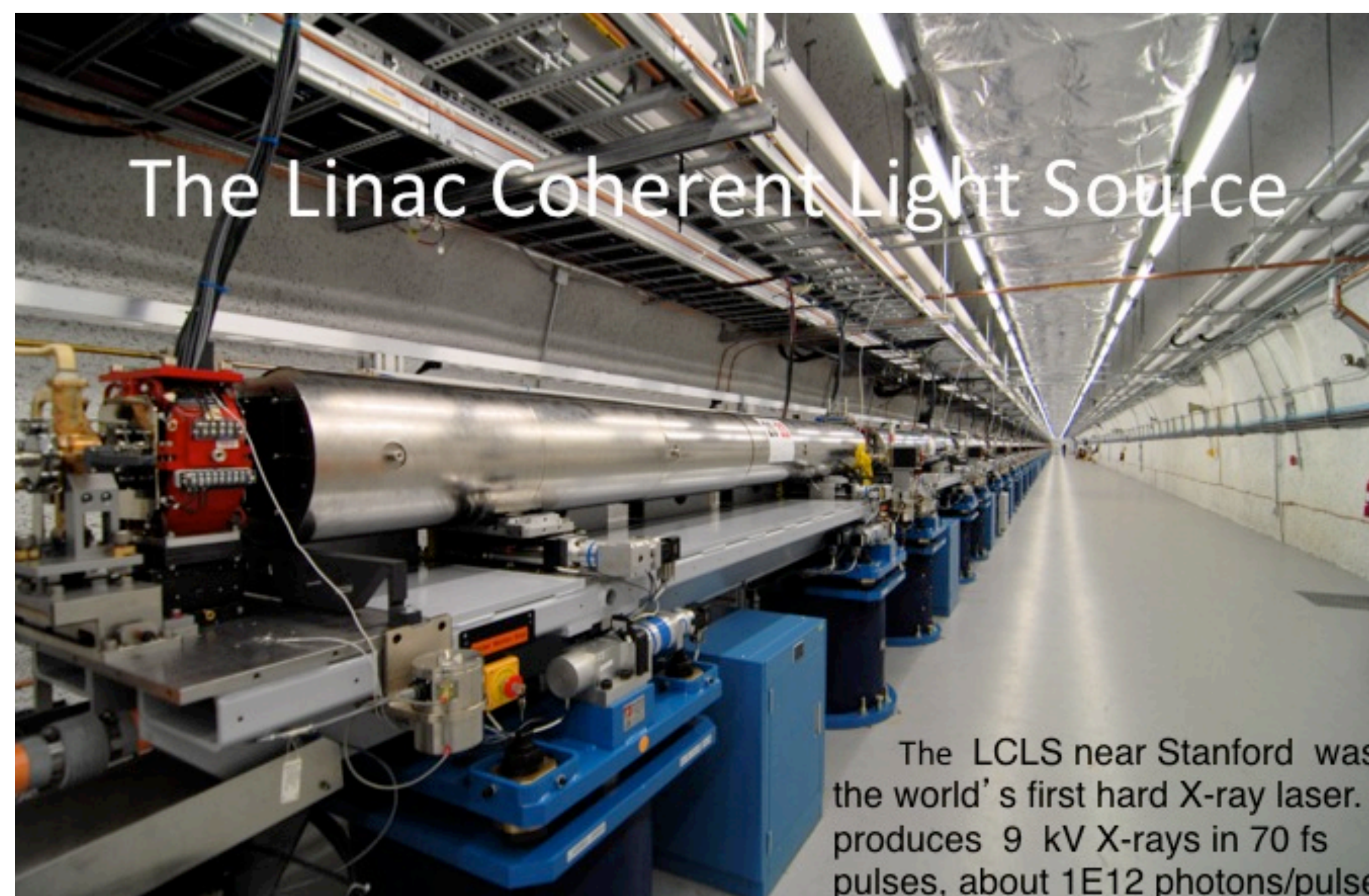
Eaton Lattman, University at Buffalo, SUNY and Hauptman-Woodward Institute

Tomaso Poggio, MIT

Robert Westervelt. Harvard University

The NSF Science and Technology Centers (STCs) program supports innovative, potentially transformative, complex research and education projects that require large-scale, long-term awards. STCs conduct world-class research through partnerships among academic institutions, national laboratories, industrial organizations, and/or other public/private entities, and via international collaborations, as appropriate. STCs may involve any areas of science and engineering that NSF supports. STCs investments support the NSF vision of advancing discovery, innovation and education beyond the frontiers of current knowledge, and empowering future generations in science and engineering. STC Awards are made every few years, and the 2013 class, which has just been announced, is described below. The three Centers are eager to interact with Gender 2013 and related communities in order to provide the most effective and empathetic programs in education, diversity, and outreach.

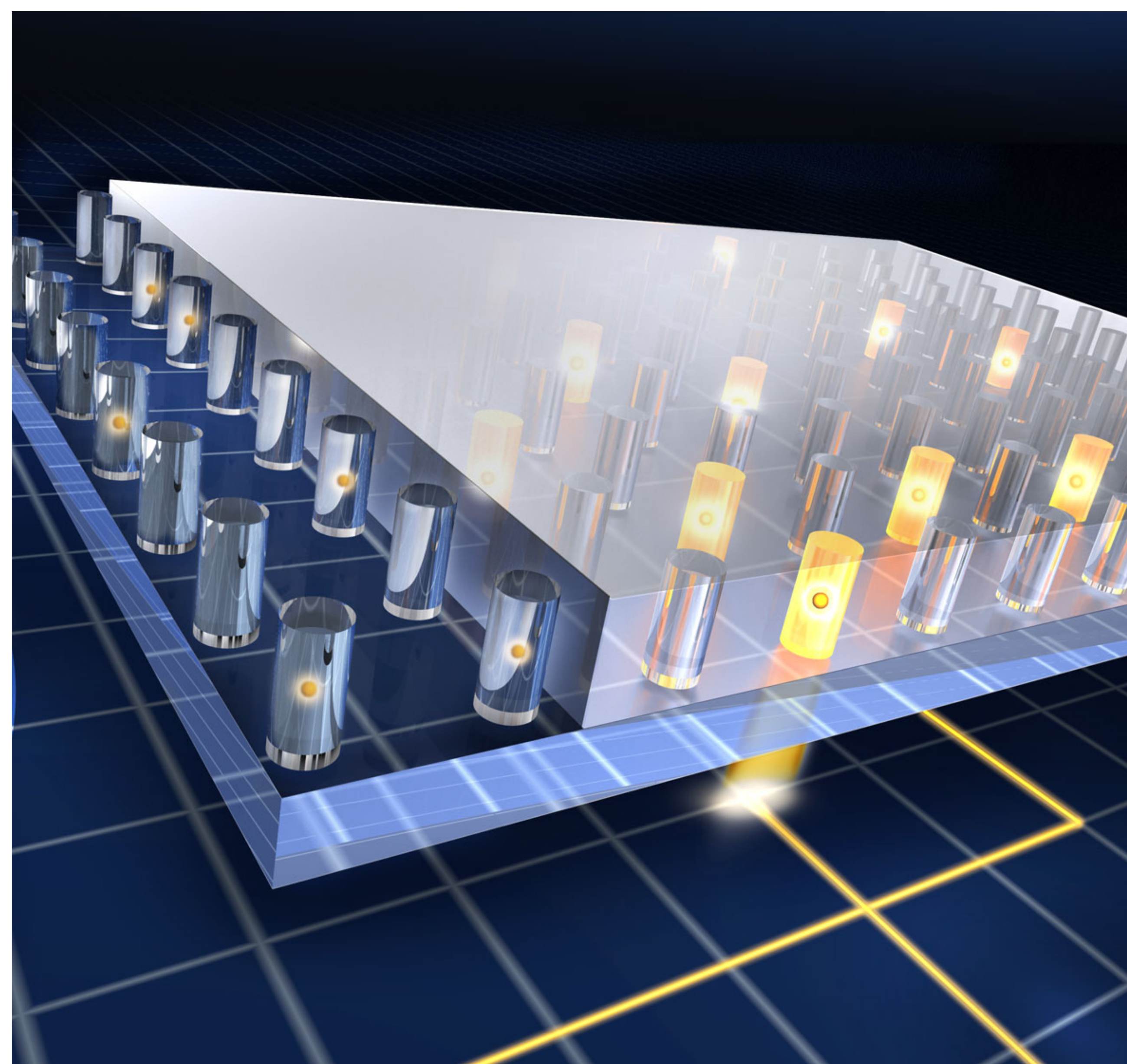
Center for Biology with X-ray Lasers - NSF 1231306: Eaton Lattman, Professor of Structural Biology, University at Buffalo, SUNY, and CEO of the Hauptman-Woodward Institute, will serve as director. The world's first X-ray laser beam (top figure), operating at Stanford, comprises a stream of unimaginably short pulses, less than a millionth of a millionth of a second long. These pulses act as flashbulbs that can freeze molecular motions and allow us to make movies of protein molecules in action. The laser also allow us to probe new classes of specimens, from single molecules to nanocrystals (lower figure).



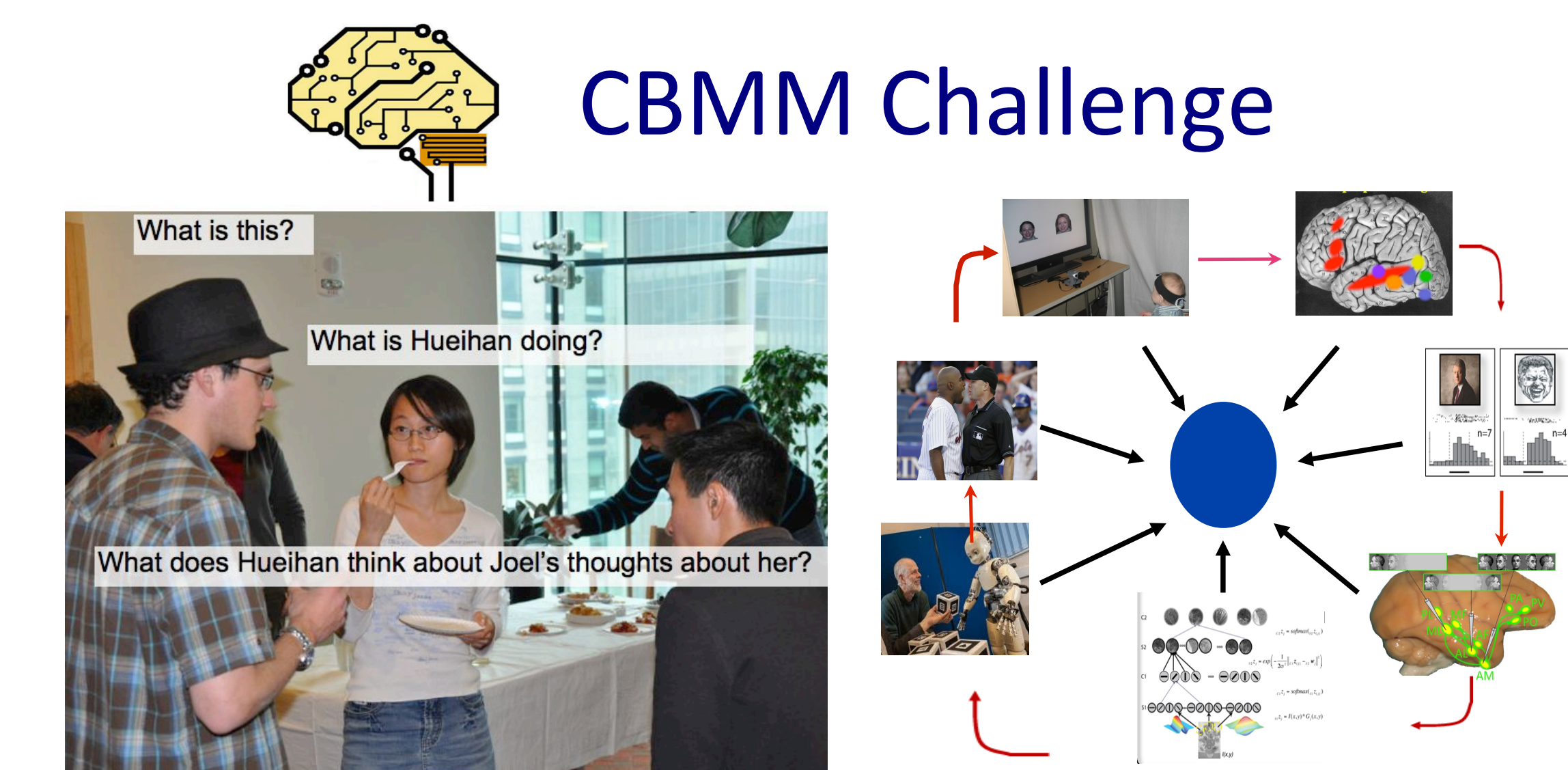
Center of Integrated Quantum Material - DMR-1231319: The Center brings together an outstanding team of faculty and students from Harvard University (PI Robert Westervelt), Howard University (co-PI Gary Harris), the Massachusetts Institute of Technology (co-PI Raymond Ashoori), and the Museum of Science (co-PI Carol Lynn Alpert) with our College Network schools.

The goal of our Center is to transform electronics and photonics to the atomic scale using **Quantum Materials**: Atomic Layers (graphene, BN, MoS2) for ultrafast devices, Topological Insulators for topologically protected data, and Nitrogen Vacancy Center Diamond for atomic memory sites. The center will attract young students to careers in science and engineering, engage public audiences in the quest for new frontiers, and commercialize new technologies and products.

Illustration: Nitrogen vacancy centers in diamond, which can store information written and read out using light, (Marko Loncar, Harvard).



Center for Brains, Minds and Machines - CCF-1231216: Tomaso Poggio, Eugene McDermott Professor at the Department of Brain Sciences at MIT, will serve as Director. Watson, Siri and MobilEye, are impressive yet still confined to a single domain or task. Imagine how truly intelligent systems --- systems that actually understand their world --- could change our world. The work of scientists and engineers could be amplified to help solve the world's most pressing technical problems. To build truly smart, world-changing machines, researchers must understand how human intelligence emerges from brain activity.

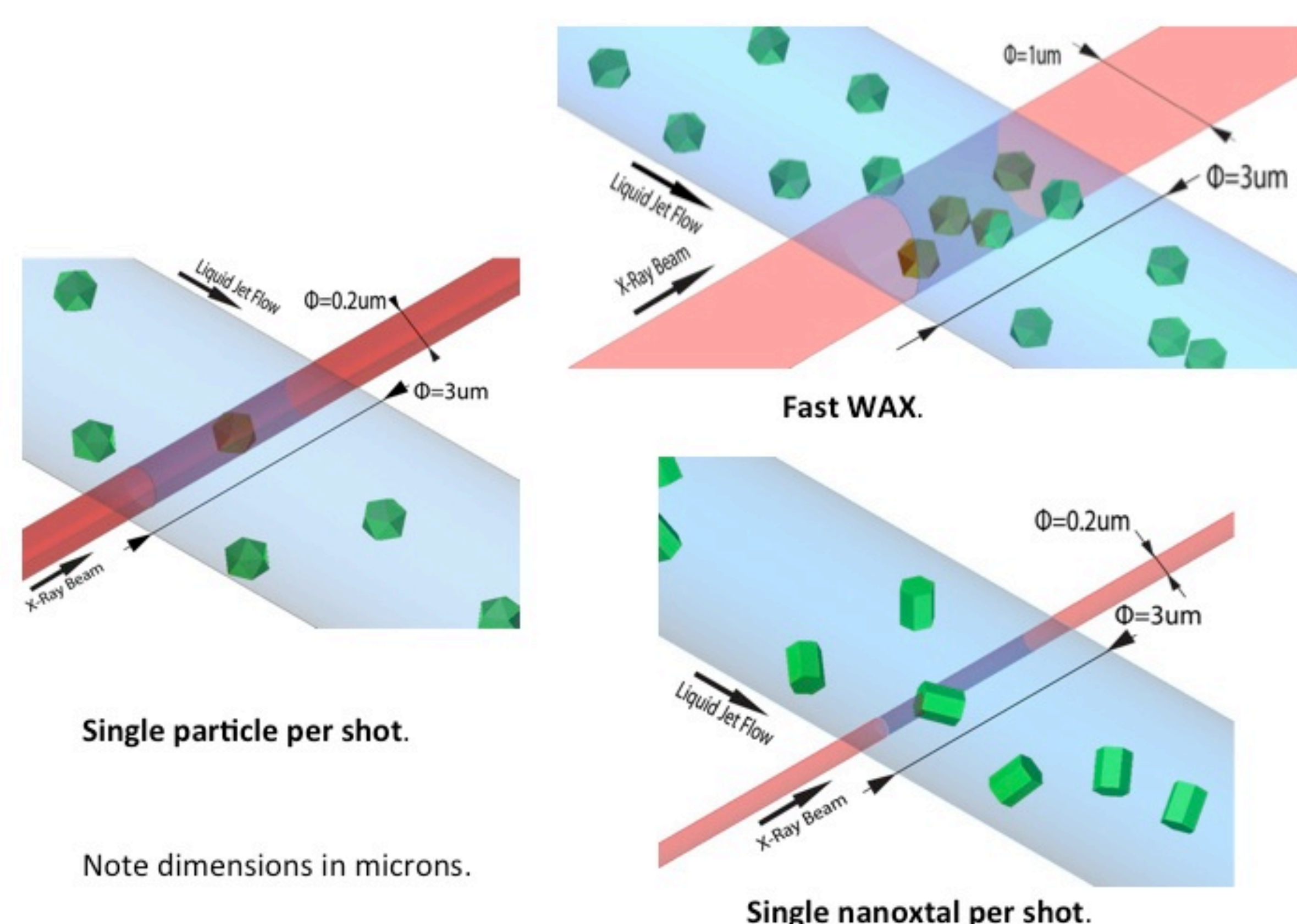


The core challenge is to develop computational models from experiments that answer questions about images and videos such as:

- ◆ what is there / who is there / what is the person doing and eventually more difficult questions such as
- ◆ who is doing what to whom?
- ◆ what happens next?

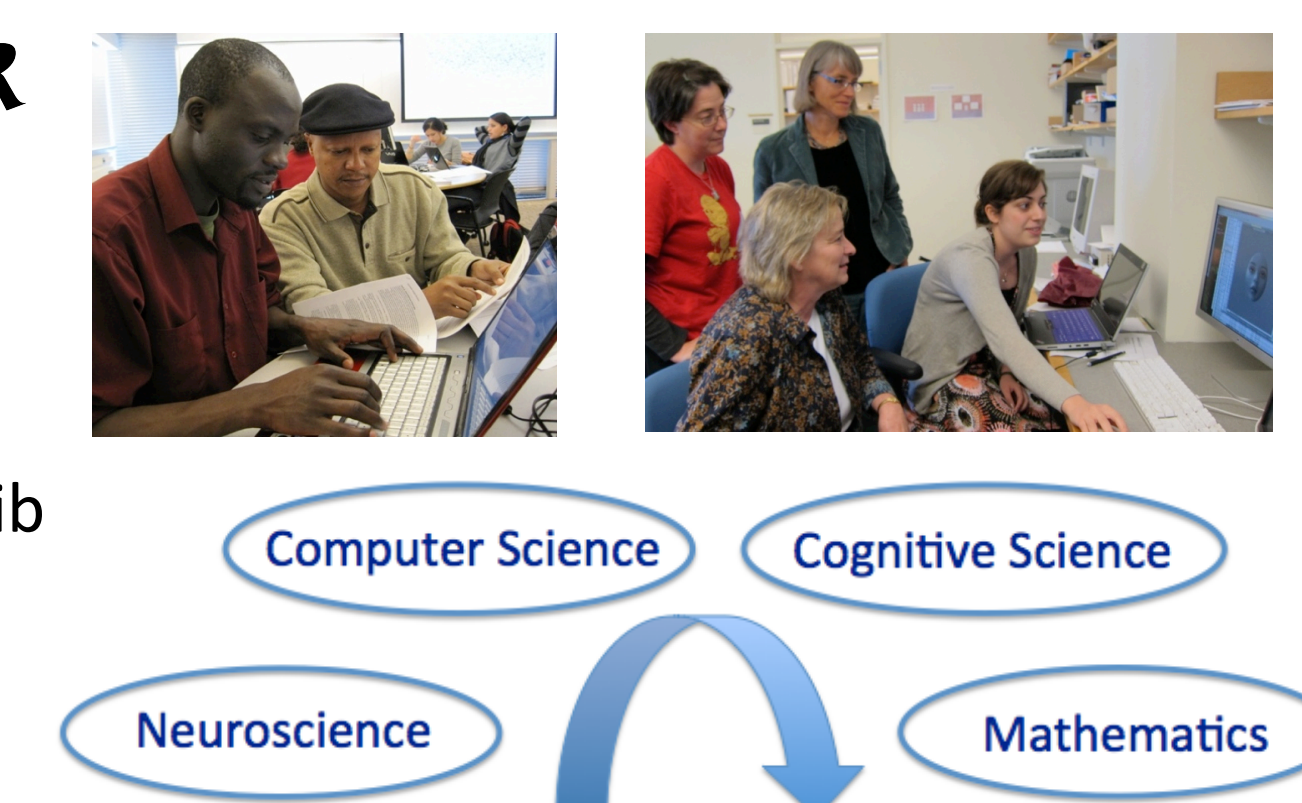
at the computational, psychophysical and neural level.

The three kinds of BioXFEL snap-shot diffraction experiments.



Broadening Participation

- ◆ HOWARD UNIVERSITY
- ◆ HUNTER College
- ◆ UNIVERSITY OF PUERTO RICO
- ◆ UNIVERSIDAD CENTRAL DEL CARIB
- ◆ WELLESLEY College



Interdisciplinary academic training and research experiences for graduate and undergraduate students (courses, summer school, workshops, summer REU program)

Research and teaching collaborations between faculty at partner institutions (summer faculty sabbatical, research seminars, curriculum development, workshops)