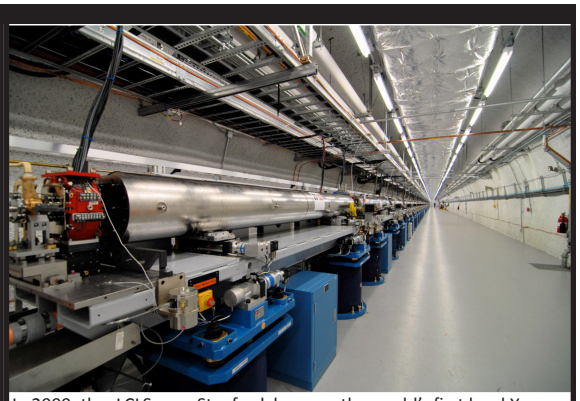
3:30 pm • Friday February 1, 2013 • 2241 Chamberlin Hall • Coffee at 4:30 pm

John C.H. Spence

Arizona State Univerisity
and LBNL



In 2009, the LCLS near Stanford became the world's first hard X-ray laser. It produces < 10 kV X-rays in 70 fs pulses, ~ 1E12 photons/pulse.

Femtosecond hard X-ray lasers for atomic structure and biodynamics.

Department of Physics Colloquium

WISCONSIN

Since the Linac Coherent Light Source (LCLS) started operation in late 2009 at SLAC we have collected femtosecond pulsed coherent X-ray scattering from many molecular systems. It has been found that sufficiently brief X-ray pulses terminate before radiation damage commences, opening up many opportunities for new experiments in time- resolved imaging with atomic spatial resolution at room temperature, in condensed matter physics, materials science and biology.

I will review some of these, including pump-probe experiments on the large molecular complexes involved in photosynthesis, and on a drug target molecule for sleeping sickness. A new approach to disentangling orientational disorder will also be demonstrated, aimed at reconstructing the image of one molecule, using the scattering from many in random orientations in solution, without modeling, based on angular correlation functions. Prospects for the formation of "molecular movies" which track chemical reactions will be outlined. I'll also describe the new approaches to the phase problem which these experiments suggest. A review of all this work can be found in Rev Mod Phys. 75, 102601 (2012).

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