X-Ray Summer School on Ultrafast Science Using FELs

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The first Ultrafast X-ray Summer School, organized and chaired by Nora Berrah (WMU), was held June 18-22, 2007 at the Stanford University's PULSE Center, located at the Stanford Linear Accelerator Center (SLAC). With the advent of 4th generation X-rays light sources, and in particular, the Linac Coherent Light Source (LCLS) under construction at SLAC, it was timely to begin the process of building a competitive community of scientists. It was also primordial to communicate to everyone the excitement many of us have about these new tools and to help raise awareness of the opportunities in ultrafast x-ray research.

The five day residential program at SLAC (using the on-site housing and cafeteria) attracted over 122 registered attendees: 88 students, postdocs and junior and senior scientists, 24 invited speakers and 10 special guests. It was truly an international event since we had people from 11 different countries attending the meeting.

The goal of the school was to bring together two communities, the synchrotron and the ultrafast laser scientists to disseminate information about scientific opportunities in ultrafast science and train students and postdocs on the new FEL facilities that will probe inner-shell electrons. It was also important to provide an interdisciplinary and intellectually stimulating environment for new and experienced researchers involved with synchrotron radiation or ultrafast lasers who were interested in learning about the new scientific areas which will be possible with the use of the LCLS.

We were fortunate to have attracted as lecturers some of the pioneers and deepest thinkers in the represented scientific fields. The lectures were 45 minutes long with 15 minutes for discussion to allow interactive debates. An open forum at the end of the meeting also stimulated interaction between lecturers, students and postdoctoral participants.

An exciting program covered both fundamentals of soft x-ray, hard x-ray FEL and their use in spectroscopy and diffraction. Science applications were given in physics, chemistry, material science and biology. Lectures were presented by expert scientists in the various aforementioned fields.

The summer school started with a warm welcome given by SLAC director, Jonathan Dorfan (SLAC) and was followed by a brief summary of the summer school goals given by Nora Berrah (WMU).

The first session, chaired by John Galayda, director of LCLS, started with a description of the physical properties of FELs given by Claudio Pelligrini (UCLA) which was followed by John Arthur (LCLS) who brought everyone up to date on the status of the LCLS project at Stanford. The LCLS will produce ~100 fsec long pulses of x-rays with a 120 Hz repetition rate and is scheduled to be ready for operations in 2009. Cecile Limborg-Deprey (LCLS) ended the "nuts and bolts" session by describing in detail the production of a high brightness electron beam in the LCLS.

Attosecond physics was discussed in several presentations. Lou DiMauro (OSU) discussed strong field physics fundamentals, while Pierre Agostini (OSU) described the characterization of XUV femto-and atto- second pulses. These experimental presentations were followed by a theoretical discussion by Ken Schafer, (LSU) on attosecond pulses and strong field physics.

Recent vuv FEL results were highlighted by several speakers. Joseph Feldhaus (DESY, Hamburg) presented the status of the FLASH facility as well as showcased some of the scientific results. Tom Möller (TU, Berlin, Germany) described his group's recent experimental accomplishment using the FLASH FEL in Hamburg. In particular, he lectured on atomic and cluster physics while Jan-Michael Rost (Max Planck Institute, Dresden, Germany) discussed the theory of cluster physics. In addition, John Corlett (LBNL) presented a novel scheme for ultrafast vuv-soft x-ray FELs that will provide attosecond pulses, and Bob Schoenlein described the ALS-LBNL slicing photon source that delivers fs photons in the vuv and x-ray range at low intensity as well as presented recent results using the newly commissioned beam line.

Planned research using the LCLS was presented by several scientists. Henry Chapman (LLNL) presented recent imaging measurements using the FLASH facility and discussed the future single molecule imaging research planned at LCLS using x-ray scattering. Richard London (LLNL) presented planned ultrafast x-ray-matter interactions while Roger Falcone (ALS, LBNL) discussed time-resolved x-ray scattering from warm materials. Furthermore, Dick lee (LLNL) described high energy density science using the LCLS and powerful lasers. Other highlights included presentations by David Reis (UM) describing his plans for materials science using x-FEL and by Phil Bucksbaum (PULSE, SLAC) discussing AMO science at the LCLS.

Ultrafast science carried out with lasers or FELs was also presented by several speakers. Margaret Murnane (UC) discussed attosecond non-linear optics, while David Villeneuve (US, Canada) presented their work on imaging molecular structure. Robin Santra (ANL) ended the formal presentations by discussing x-rays, lasers and molecules.

An open forum panel discussion at the end of the workshop provided a place and time to discuss any topic relevant to the workshop as well as to bring up any questions that were not answered during the formal presentation discussion time. The panelists, John Galayda (SLAC), David Fritz (SLAC), Peter Lambropoulos (U. Crete) and Alfred Maquet (UPMC, France) answered many experimental and theoretical questions. The debate

session was especially animated, exciting and very successful. The workshop ended with a banquet and an after-dinner presentation given by Eric Rohlfing, Director of DOE, Office of Science, BES, Chemical Sciences, Geosciences and Biosciences Division.

On the last day of the summer school, SSRL and LCLS tours, coordinated by Aaron Lindenberg and John Bozek respectively, offered the attendees an opportunity to see the the SSRL photon source and experimental stations as well as the construction site of the LCLS.

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