



# Workshop on Evolution and Control of Complexity: Key Experiments Using Sources of Hard X-rays

October 11-13, 2010  
Advanced Photon Source  
Argonne National Laboratory

During the past two centuries, much effort has gone into understanding various types of orders in systems obeying the laws of equilibrium thermodynamics as described using linear response theory or the Born-Oppenheimer approximation. On the other hand, the majority of processes in nature involve nonlinear behavior that obeys non-equilibrium thermodynamics from the flow of energy. Nature in its every manifestation exhibits far-away-from-equilibrium processes, leading to complexity of order. This is true from the Big Bang to the coming of humankind, from chemistry and biology to geosciences and medicine, and from materials engineering to energy sciences. In spite of the recurrence of non-equilibrium behavior in nature and, particularly, in every aspect of our daily activities, fundamental research lacks an understanding of the processes involved in the temporal evolution of complex order with precision.

This workshop will identify unexplored opportunities in the emerging field of non-equilibrium science with a focus on the use of hard x-ray spatio-temporal techniques that are available at operating and future x-ray sources, including compact sources, storage rings, energy recover linacs, and x-ray free-electron lasers.

## Focus Areas of the Workshop

Control of Processes in Condensed Systems |  
Controlling the Dynamics of Materials Processing |  
Nonlinear Chemical Reactions: Mimicking Nature |  
Controlling Biological Functions |  
Hydrodynamics of Flowing Fluids: Micro- & Nano-Fluidics |  
Transformational Dynamics in High- Energy & High-Density Matter |  
Nonlinear X-ray Science & Future X-ray Metrology |

## Workshop Chairs

Uwe Bergmann (SLAC)  
Gopal Shenoy (Argonne)  
Edgar Weckert (DESY)

## Workshop Advisory Committee

Gabe Aeppli (LCN London)  
Massimo Altarelli (Euro-XFEL)  
Sam Bader (Argonne)  
Andrea Cavalleri (Oxford/DESY)  
Lin Chen (Argonne/Northwestern U.)  
George Crabtree (Argonne)  
Helmut Dosch (DESY)  
Sol Gruner (Cornell U.)  
Janos Hajdu (Uppsala U.)  
Jerry Hastings (SLAC)  
Rus Hemley (Carnegie Institution of Washington)  
Eric Isaacs (Argonne)  
Ben Larson (Oak Ridge)  
Richard Lee (Livermore)  
Ingolf Lindau (SLAC)  
Denny Mills (Argonne)  
Keith Moffat (U. of Chicago)  
David Moncton (MIT)  
Harald Reichert (ESRF)  
Jo Stöhr (SLAC)  
Lou Terminello (PNNL)  
Linda Young (Argonne)  
Soichi Wakatsuki (KEK)

Workshop Registration Deadline:  
August 13, 2010

Abstract Submission Deadline:  
September 3, 2010

Argonne Guest House Reservation Cutoff:  
September 30, 2010

Workshop website:  
<http://www.aps.anl.gov/complexity>

## Local Contact:

Anne Owens  
Workshop Coordinator (aowens@aps.anl.gov)

Workshop Sponsors: Argonne   