

Distinguished Lectures at HZB

Prof. Joachim Stöhr

SLAC National Accelerator Laboratory and
Stanford University, Stanford, California, USA

The Light Fantastic: Birth of the X-Ray Laser and a New Era of Science

09.12.2013 14:00 o'clock

Lecture Hall Wilhelm-Conrad-Röntgen-Campus

My talk will describe the evolution of modern x-ray sources, culminating in the construction of the worlds first x-ray free electron laser (X-FEL), the Linac Coherent Light Source, LCLS at Stanford. I will describe the principles underlying x-ray lasers and how they differ from conventional lasers and synchrotron radiation sources. My talk will also outline why the x-ray pulses produced by an X-FEL are so different from conventional synchrotron pulses and why they are useful for addressing scientific challenges in various fields. I will present selected scientific examples, illustrating the unique capabilities of X-FELs to probe matter on its fundamental atomic length scale and the intrinsic time scales of motion of its atomic and electronic building blocks. In structural biology, X-FELs enable the determination of the atomic arrangement in proteins that are difficult to crystallize, are easily radiation damaged or need to be in their natural state.

In chemistry, the structure and function of chemical reaction centers can be studied, such as the life-enabling photosynthesis of oxygen from water by a Manganese complex. In technology, x-ray laser pulses reveal how to extend the present speed of electronic devices limited by self-induction in wires to the intrinsic speed of electrons. Finally, X-FELs overcome the one-photon-at-a-time probing of matter, and open the unexplored field non-linear x-ray science.