A 1: Atomic clusters / Collisions, scattering, correlation

Time: Monday 10:45–11:45 Location: H1

Invited Talk A 1.1 Mon 10:45 H1

Time-resolved X-ray Imaging of Anisotropic Nanoplasma Expansion — •Christian Peltz[1], Christoph Bostedt[2], Mathias Kling[3], Thomas Brabec[4], Eckart Ruehl[5], Artem Rudenko[6], Tais Gorkhover[7], and Thomas Fennel[1] — [1]Institute of Physics, University of Rostock, Germany — [2]Paul Scherrer Institute, Villigen, Switzerland — [3]Faculty of Physics, LMU Munich, Germany — [4]Department of Physics and Centre for Photonics Research, University of Ottawa, Canada — [5]Physical Chemistry, FU Berlin, Germany — [6]Department of Physics, Kansas-State University, USA — [7]LCLS, SLAC National Accelerator Laboratory, Menlo Park, USA

We investigate the time-dependent evolution of laser-heated solid-density nanoparticles via coherent diffractive x-ray imaging, theoretically and experimentally. Our microscopic particle-in-cell calculations for R = 25 nm hydrogen clusters reveal that infrared laser excitation induces continuous ion ablation on the cluster surface. This process generates an anisotropic nanoplasma expansion that can be accurately described by a simple self-similar radial density profile. It's time evolution can be reconstructed precisely by fitting the time-resolved scattering images using a simplified scattering model in Born approximation [1]. Here we present the first successful high resolution reconstruction of corresponding experimental results, obtained at the LCLS facility with SiO2 nanoparticles (D=120 nm), giving unprecedented insight into the spatio-temporal evolution of the nanoplasma expansion.

[1] C. Peltz, C. Varin, T. Brabec and T. Fennel , Phys. Rev. Lett. **113**, 133401 (2014)

Invited Talk A 1.2 Mon 11:15 H1

Scattering of twisted x-rays from a crystal — •Anton Peshkov[1,2], Stephan Fritzsche[3,4], and Andrey Surzhykov[1,2] — [1]Technische Universität Braunschweig, Germany — [2]Physikalisch-Technische Bundesanstalt, Braunschweig, Germany — [3]Helmholtz-Institut Jena, Germany — [4]Friedrich-Schiller-Universität Jena, Germany

The elastic scattering of x-rays by bound atomic electrons is known to be an excellent probe of the structure of matter. One of the most intriguing example here is x-ray crystallography used to determine the arrangement of atoms in a crystal. The essential physics of this process has been known and understood for many years for the incident plane-wave radiation. However, this is not the case for twisted light beams that carry a nonzero projection of the orbital angular momentum (OAM) onto their propagation direction and whose intensity pattern has an annular character. In order to understand how the scattering from crystals depends on the "twistedness" of incident x-rays, we present here a theoretical analysis of the elastic scattering of Bessel beams from a single crystal of lithium. Our numerical calculations show that the scattering cross section is sensitive to the OAM projection of twisted beams and differs from the standard plane-wave case when the size of the crystal is reduced to the nanometer scale.

[1] A. A. Peshkov *et al.*, Phys. Scr. 94, 105402 (2019).