Contribution ID: **112** Type: **Oral contribution**

Probing ultrafast laser plasma processes inside solids with resonant small-angle X-ray scattering

Wednesday 17 March 2021 15:55 (20 minutes)

The development of second-generation short-pulse laser-driven radiation sources requires a mature understanding of the relativistic laser-plasma processes such as heating and transport of relativistic electrons as well as the development of plasma instabilities. Accessing these dynamic effects occurring on femtosecond and nanometer scales experimentally is very difficult but it is crucial to understand the behavior of matter under the extreme conditions, which follow the interaction of solids with ultra-intense laser irradiation.
In a first experiment in 2014 at the Matter of Extreme Conditions facility at LCLS we demonstrated that Small Angle X-ray Scattering (SAXS) of femtosecond x-ray free electron laser pulses is able to make these fundamental processes accessible on the relevant time and length scales in direct in-situ pump-probe experiments [Kluge et al., Phys. Rev. X 8, 031068 (2018)]. Here we report on a follow-up experiment with significantly higher pump intensity reaching the relativistic intensity domain, improved targetry, XFEL shaping, and particle diagnostics. We give an overview of the new capabilities in combining a full suite of particle and radiation diagnostics and SAXS. In particular, probing at resonant x-ray energies has shown to give new insight into the ionization process, plasma opacity and density by studying asymmetries in SAXS patterns from nanostructured grating targets [Gaus et al., arXiv: 2012.07922 (under review)].

Primary author: Mr GAUS, Lennart (HZDR)

Presenter: Mr GAUS, Lennart (HZDR)

Session Classification: Extreme/non-ambient conditions

Track Classification: Extreme/non-ambient conditions