

Short-pulse high-intensity laser-plasma science using an x-ray free electron laser

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The High Energy Density Science instrument at the European X-ray Free-Electron Laser Facility is dedicated to the investigation of a wide range of materials at extreme conditions of pressure, temperature, ionization or electro-magnetic field. Several separate optical laser systems (~5J/25fs, ~100J/ns, ~2mJ/15fs and ~45mJ/1ps) will be available for warm- to hot-dense-matter creation, dynamic compression, relativistic laser-plasma interaction and more.

The instrument is designed to enable applications of various x-ray probing techniques including spectroscopic, scattering, diffraction and imaging methods with 3 up to 25 keV photon energies. Being one of the 6 baseline instruments of the European XFEL, first user experiments are planned for the beginning of 2019. The installation of several high-power lasers, a dedicated diamond anvil cell setup and of the ~60T pulsed magnets will be available through contributions by the Helmholtz International Beamline for Extreme Fields (HIBEF) User Consortium.

I will discuss an overview of the experimental capabilities and selected science cases particularly using short-pulse high-intensity lasers.

References:

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- [2] M. Nakatsutsumi et al., Plasma Phys. Control. Fusion 59, 014028 (2017).
- [3] www.hibef.de