Exploring Extreme States of Matter by time-resolved X-ray Spectroscopy

Initiative: Forschung mit Freie-Elektronen-Lasern: Peter Paul Ewald-Fellowships am LCLS in Stanford

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The physics of matter under extreme conditions, with pressures of several megabars, densities of up to 1000 g/cubic centimeter, and temperatures of several 10 000 K, is of fundamental scientific interest. Applications include laser produced plasmas, shock compression of solid matter, stellar and planetary interiors, as well as conditions in the early stages of the universe. Of particular interest for the diagnostics of extreme matter are femtosecond X-ray free electron lasers. On the one hand they serve to excite the target. On the other hand they provide diagnostics using spectroscopy, scattering, and imaging techniques. Furthermore, the ultra short pulses allow investigating the non-equilibrium dynamics of matter shortly after the excitation. The research focus lies on the dynamical response of dense samples to intense, ultrashort X-ray irradiation. In this project time-resolved X-ray Thomson scattering, X-ray spectroscopy, and Bragg diffraction as diagnostic methods are specially adapted to the requirements at LCLS.

Projektbeteiligte

Dr. Ulf Zastrau
Universität Jena
Physikalisch-Astronomische Fakultät
Institut für Optik und Quantenelektronik
Jena

Prof. Dr. Siegfried Glenzer
SLAC National Accelerator Laboratory
Department for High Energy Density Science
Menlo Park, CA
USA