Ultrafast time-resolved nanoscale imaging and in-depth examination of matter under extreme conditions

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Free-electron-lasers are capable to produce ultrashort X-ray pulses with extremely high peak intensities. Understanding the interaction of these pulses with matter is of fundamental importance. Any sample exposed to such pulses will ultimately suffer complete destruction but not before going through a transient and highly non-thermal equilibrium stage. Recent studies tried to shed light onto the dynamics of this plasma stage but great uncertainties on the underlying mechanisms remain. Moreover, unexpected phenomena have been observed. The project aims at a complete description of the plasma dynamics in matter under such extreme conditions. Coherent diffraction imaging (or holography) is combined with an extensive investigation of changes in the optical properties. To this end, time-delayed pulses generated in a high-harmonic source are used to probe the plasma. The plasma evolution is monitored using different diagnostics like wavefront sensing, transmission and time of flight spectrometry. Extensive computational modeling will complete this experimental approach.

Projektbeteiligte

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