

Atomic and Collisional Processes in XFEL Plasma Generation

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It has been theoretically demonstrated recently [1] that X-ray free-electron-laser (XFEL) pulse-nuclear interactions are predominantly governed by a secondary mechanism. This indirect photoexcitation involves electron capture from the laser-induced plasma. Since the cross section of nuclear excitation by electron capture depends directly on the dynamics of the formed plasma we describe the relevant microscopic processes that occur when an XFEL beam of photon energy in the vicinity of 10 keV irradiates a solid-state material and removes electrons from the target atoms. Insights into the evolution of the charge state distribution of the system, the electron density and temperature, and the timescales of collisional processes are given.

References

- [1] Jonas Gunst, Yuri A. Litvinov, Christoph H. Keitel, and Adriana Palffy, *Phys. Rev. Lett.* **112** (2014) 082501.