Atomphysik-Seminar

Wednesday, July 4, 13.15, KBW Lecture Hall - Side Room

Laser-driven shock acceleration of ions in collisional and ultra-relativistic regime

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The effect of collisions and quantum electrodynamic effects like radiation reaction and pair production on shock formation and subsequent ion acceleration from laser-plasma interaction are explored by means of particle-in-cell simulations. In this setup, the incident laser pushes the laser-plasma interface inside the plasma target through the hole-boring effect and generates hot electrons. The propagation of these hot electrons inside the target excites a return plasma current, leading to filamentary structures caused by the Weibel/filamentation instability. The collisional weakening of the space-charge effects results in the formation of a shock with a higher density jump than in a collisionless plasma. This stronger shock leads to stable quasi-monoenergetic acceleration of ions. In the ultra-relativistic regime, both radiation reaction and pair plasma formation tend to slow down the shock velocity which makes the quasi-monoenergetic ion acceleration lasting on longer timescales.