The influence of a strong external magnetic field on laser-plasma interaction

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The influence of a strong external magnetic fields on the interaction of a laser pulse with plasma has recently gained attention both in connection with new possibilities of generating such very strong field and in connection with potential applications such as the development of innovative sources of energetic particles and radiation or the inertial thermonuclear fusion. For example, the MagLIF concept [**?**] relies on strong external magnetic field of the order of ten Tesla to help reduce the thermal energy transport thus decreasing the required parameters which have to be achieve for ignition of thermonuclear fusion, while a high energy laser is used to preheat the fuel. However, the question of how such strong magnetic field may influence the interaction of the laser beam with the underdense plasma is not fully understood so far. A recent study [2] demonstrates that the magnetic field strength of 12 Tesla has already a significant influence on laser propagation and interaction with underdense plasma.

The interaction of a sub-relativistic multi-picosecond laser beam with the wavelength $\sim 1\mu$m and the intensity $\sim 10^{16}$ W/cm^2 with an underdense plasma is investigated via two-dimensional Particle-in-cell simulations using the code EPOCH [3]. An external magnetic field with the field strength of the order of few tens of Tesla is included in the simulation box. The simulations concentrate in particular on the interaction in front and around quarter critical density and on the laser absorption, filamentation and parametric instabilities. In particular the filamentation process which takes place on the picosecond time scale is influenced by the external magnetic field. This process is indeed important for the long term evolution of the interaction and the coupling of the laser field to hot electrons.

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