Self-generated magnetic fields during nanosecond laser-target interaction

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The interaction of a nanosecond laser pulse with a solid target is one of the most common scenarios appearing in many disciplines, like inertial confinement fusion, X-ray plasma sources, laboratory astrophysics and others. The detailed understanding of the involved physical phenomena is crucial for increasing predictive capabilities of the simulations and achieving a better agreement with the experimental results. One of the challenging parts of the physical modelling is description of the self-generated magnetic fields and their role in the process of interaction. The classical approach to their generation relies on the crossed gradients of density and temperature [1]. However, these conditions can occur also on the fronts of propagating shock waves, where the modelling of the magnetic fields has proved to be challenging and numerical instabilities may arise [2]. We propose a stable high-order numerical method, which is integrated to our recently developed multi-dimensional magneto-hydrodynamic code [3]. Moreover, the non-classical processes, which are predominantly given by the non-local transport of electrons and can substantially contribute to the magnetic field generation, are briefly explored too [4].

References

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