Modeling of Electro-Magnetic Pulses generated by high intensity lasers


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Interaction of high-intensity laser pulses with solid targets results in generation of large quantities of energetic electrons that are the origin of various effects such as intense x-ray emission, ion acceleration, and so on. Some of these electrons are escaping the target, leaving behind a significant positive electric charge and creating a strong electromagnetic pulse (EMP) long after the end of the laser pulse, which can be dangerous for the electronic circuits in the interaction chamber.

We proposed recently a detailed model of the target electric polarization induced by a short and intense laser pulse and an escaping energetic electrons [1]. A specially designed experiment provided direct measurements of the target polarization and the discharge current in the function of the laser energy, pulse duration, and target size. Large-scale numerical simulations describe the energetic electron generation and their emission from the target. The model, experiment, and numerical simulations demonstrate the accumulation of the polarization charge and its relation with the EMP characteristics.

In this presentation we will describe the model of the target polarization along with recent improvements providing a more accurate description of the target potential. Several possible target designs allowing to control the intensity and the spectral contain of the EMP will be discussed.

References