Investigation of Particle Acceleration in Dense Plasmas Using Ultra High Intensity Few Cycles Shortwave Laser Pulses

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It is now possible to generate few cycles high intensity laser pulses in a broad range of wavelengths making these pulses promising for applications requiring high repetition rates. Moreover, several setups have recently been proposed to generate few cycles ultra high intensity attosecond pulses. The corresponding photon energy range is from 10 eV to 1 keV allowing to propagate even inside solid density targets. Such pulses will allow to explore new regimes of laser-matter interaction with strong application potential.

We have investigated the interaction of high intensity attosecond pulses with solid targets and the associated electron acceleration, ion acceleration, and radiation generation supported by Particle-In-Cell simulations. We have analysed the influence of the laser and target parameters to optimize ion acceleration and high energy radiation generation. For higher laser wavelengths, lower density targets can be used to obtain similar interaction conditions. We therefore compared the feasibility of efficient ion acceleration and radiation generation using few cycles pulses for various laser wavelengths.