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PIC modelling of laser-solid interactions

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The study of the interaction of high power laser pulses with over-dense plasmas (obtained from the ionisation of solid targets) is of great interest to develop techniques for the acceleration of ions or electrons. Besides the use of flat foils, structured target (e.g. nano-structured surfaces, multilayer targets) are now considered for experiments as a mean to obtain more efficient coupling of the laser light with the plasma. The role of the numerical simulations, typically Particle In Cell simulations, is essential to model the effects of such configurations or to study the rise of instabilities in extreme conditions. Thin solid foils (1mm) covered with a nano-structured carbon foams having a mean density of few mg/cm³ have been used as target in experiment of laser-driven ion acceleration. The modelling of this regime was performed with PIC simulation where the plasma was initialised as an open structure of dense clusters distributed with a Diffusion Limited Aggregation (DLA) algorithm. These simulations allowed to catch some essential features of the laser-foam interaction such as the weak role played by the light polarisation, not found for a uniform low density plasma.

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