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Fast ignition by collisionless shock accelerated ions ELISABETTA BOELLA, Lancaster University, ROBERT BINGHAM, STFC Rutherford Appleton Laboratory, ALAN CAIRNS, University of St Andrews, PETER NORREYS, University of Oxford, RAOUL TRINES, STFC Rutherford Appleton Laboratory, MARIJA VRANIC, NITIN SHUKLA, LUIS SILVA, Instituto Superior Tecnico —
Fast ignition driven by ions [1] constitutes a valid alternative to the more conventional fast ignition scheme, which leverages relativistic electrons [2]. In this work, we demonstrate that ion beams with charge and energy suitable to trigger the ignition spark could be generated via collisionless shocks in the expanded corona surrounding the compressed pellet. Performing two-dimensional simulations using the Particle-In-Cell code OSIRIS [3], we modelled the interaction of an intense laser pulse with the long scale-length corona plasma. Numerical results indicate that an electrostatic shock is launched as a consequence of the hole bored by the laser. The shock propagates upstream and accelerates protons to energies between 8 and 30 MeV. Considering a compressed Deuterium-Tritium pellet with density of 400 g/cm^3 and temperature of 5 keV, such protons can deposit the bulk of their energy in the core within a range of 0.3 - 1.2 g/cm^2. Finally, we show that for large enough laser spot-sizes, the proton beam contains a number of ions sufficient to create the hot spark that will drive the thermonuclear burn wave. [1] Roth et al., Phys. Rev. Lett. 86, 436 (2001). [2] Tabak et al., Phys. Plasmas 1, 1626 (1994). [3] Fonseca et al., Lect. Notes Comp. Sci. 2331, 342 (2002).

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