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Kinetic effects on the transition to relativistic self-induced transparency in laser-driven ion acceleration[1] EVANGELOS SIMINOS, BENJAMIN SVEDUNG WETTERVIK, Department of Physics, Chalmers University of Technology, Gothenburg, Sweden, MICKAEL GRECH, LULI, CNRS, UPMC, Ecole Polytechnique, CEA, 91128 Palaiseau, France, TÜNDE FÜLÖP, Department of Physics, Chalmers University of Technology, Gothenburg, Sweden — We study kinetic effects responsible for the transition to relativistic self-induced transparency in the interaction of a circularly-polarized laser-pulse with an overdense plasma and their relation to hole-boring and ion acceleration. It is shown, using particle-in-cell simulations and an analysis of separatrices in single-particle phase-space, that this transition is mediated by the complex interplay of fast electron dynamics and ion motion at the initial stage of the interaction. It thus depends on the ion charge-to-mass ratio and can be controlled by varying the laser temporal profile. Moreover, we find a new regime in which a transition from relativistic transparency to hole-boring occurs dynamically during the course of the interaction. It is shown that, for a fixed laser intensity, this dynamic transition regime allows optimal ion acceleration in terms of both energy and energy spread.

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Evangelos Siminos
Chalmers Univ of Tech

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