Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Capturing speckle-scale beam-bending in ray-tracing schemes for nanosecond-class RPP-beam propagation modeling CHARLES RUYER, ARNAUD DEBAYLE, MICHEL CASANOVA, PASCAL LOISEAU, PAUL-EDOUARD MASSON-LABORDE, CEA de Bruyeres-le-Chatel — In the context of inertial confinement fusion (ICF), laser-plasma interaction (LPI) refers mainly to the study of ponderomotively driven phenomena that affects the laser propagation and the subsequent laser energy deposition. Due to the multi-millimeters extent and the nanoseconds duration of ICF experiments, the full numerical resolution of the LPI requires strong simplifications. In particular, the complex speckle dynamics of a random phase plate (RPP) laser beams is neglected. Hence, aiming at improving our realistic modeling of laser beams, we will show that the advection of ponderomotive-induced density fluctuations by a flow may result in the significant deflection of the laser pulse. This phenomenon, often called beam-bending [Hinkel et. al., Phys. Rev. Lett. 1996], can be modeled in the kinetic framework [Drake et. al., Phys. Fluids 1974; Vu, Phys. Plasmas 1997]. The validation of the analytical deflection angle with PIC simulations pinpoints the importance of kinetic damping of the acoustic perturbations. The speckle-scale beam-bending physics will then be included in ray tracing schemes, often used to model RPP-beam in hydrodynamic codes. A successful comparison between the resulting ray tracing and PIC simulations of RPP-beam propagation validates our modeling.

Charles Ruyer
CEA de Bruyeres-le-Chatel

Date submitted: 28 Jun 2019 Electronic form version 1.4