Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Driving Weibel-mediated collisionless shocks with NIF FREDERICO FIUZA, Lawrence Livermore National Laboratory, ANATOLY SPITKOVSKY, Princeton University, DMITRI RYUTOV, STEVEN ROSS, CHANNING HUNTINGTON, Lawrence Livermore National Laboratory, WARREN MORI, UCLA, LUIS SILVA, GoLP - Instituto de Plasmas e Fusao Nuclear, Instituto Superior Tecnico, Portugal, HYE-SOOK PARK, BRUCE REMINGTON, Lawrence Livermore National Laboratory — Collisionless shocks are ubiquitous in astrophysical plasmas and are known to be responsible for particle acceleration; however, the microphysics underlying shock formation and particle acceleration is not yet fully understood. High-power lasers are bringing the study of collisionless shocks into the realm of laboratory experiments. In particular, the National Ignition Facility allows for the generation of collisionless plasma flows that are hundreds of ion skin-depths long and provides ideal conditions for the study of Weibel-mediated shocks. We have performed detailed 2D and 3D particle-in-cell simulations with OSIRIS to explore the laboratory conditions associated with counter-streaming high-velocity plasma flows for realistic profiles. We have modeled the proton radiography of the interaction for self-consistent fields and determined the experimental signatures of the generation of Weibel B-fields and collisionless shocks. We will discuss the importance of modeling realistic ion to electron mass ratios and of taking into account Biermann battery B-fields. Our work identifies the conditions for the formation of collisionless shocks in laboratory, both in unmagnetized and magnetized scenarios, showing the possibility of observing for the first time Weibel-mediated shocks in near future experiments.

Frederico Fiuza
Lawrence Livermore National Laboratory

Date submitted: 11 Jul 2013 Electronic form version 1.4