Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Formation of High Mach-Number Magnetized Collisionless Shocks in Laser-Produced Plasmas Z WANG, J PARK, A SPITKOVSKY, Department of Astrophysical Sciences, Princeton University, C HUNTINGTON, H.-S. PARK, B POLLOCK, H RINDERKNECHT, S WILKES, D RYUTOV, B REMINGTON, Lawrence Livermore National Laborotary, F FIUZA, SLAC National Accelerator Laborotary, ACSEL COLLABORATION — Magnetized collisionless shocks commonly occur in the heliosphere and interstellar medium. Collective collisionless processes mediating such shocks can now be studied in the laboratory. We carry out an experiment to observe the formation of a high Alfven Mach number (Ma) magnetized collisionless shock on OMEGA-EP facility. In the experiment, a laser-produced plasma flow penetrates into a pre-existing magnetized plasma. Proton radiography shows a moving region of proton deficit followed by a caustic enhancement of proton density. These features are produced by a propagating front of compressed magnetic field. We use a particle tracing code to model the proton radiography and determine the speed of the compressed field from a series of proton radiographs. Modeling of the shape of the proton deficit region allows us to constrain the amount of magnetic compression. When compared to particle-in-cell simulations of magnetized shocks, we find that the amount of observed magnetic compression is well explained by a magnetized perpendicular collisionless shock propagating with Ma=4. These experiments create a platform for further study of physical processes in the transition region of collisionless magnetized shocks.

Zhenyu Wang
Department of Astrophysical Sciences, Princeton University

Date submitted: 14 Jul 2017 Electronic form version 1.4