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Modeling and Interpretation of Laboratory Experiments of Magnetized Collisionless Shocks ZHENYU WANG, ANATOLY SPITKOVSKY, Princeton University, CHANNING HUNTINGTON, HYE-SOOK PARK, Lawrence Livermore National Laboratory, FREDERICO FIUZA, SLAC National Accelerator Laboratory, BRADLEY POLLOCK, STEVEN ROSS, DMITRI RYUTOV, Lawrence Livermore National Laboratory — We present the modeling and interpretation of laser experiments designed to generate high Mach number magnetized collisionless shocks on OMEGA-EP facility. In the experiment, a laser-produced high velocity plasma collides with a magnetized, pre-ablated plasma. Proton radiography shows a moving region of proton deficit followed by a sharp enhancement of proton density. These features are produced by gradients in propagating compressed magnetic field. We compare the data to the results of 3D PIC simulations, explain the oblique moving features introduced by density gradients in expanding plasma and by curvature of the imposed magnetic field, and identify the narrowing of proton deficit region width with a signature of strong magnetic overshoot. We determine the boundary of pre-ablated background plasma by comparing with radiography of laser shots with only background plasma present. We measure the strength of MIFEDS field by magnetic deflection. We conclude that our experiments have reproducibly achieved magnetized shocks with Alfvenic Mach number 3 to 9 in laboratory conditions.

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