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Parallel collisionless shocks forming in simulations of the LAPD experiment MARTIN S. WEIDL, FRANK JENKO, CHRIS NIEMANN, Department of Physics and Astronomy, University of California - Los Angeles, DAN WINSKE, Los Alamos National Laboratory — Research on parallel collisionless shocks, most prominently occurring in the Earth's bow shock region, has so far been limited to satellite measurements and simulations. However, the formation of collisionless shocks depends on a wide range of parameters and scales, which can be accessed more easily in a laboratory experiment. Using a kJ-class laser, an ongoing experimental campaign at the Large Plasma Device (LAPD) at UCLA is expected to produce the first laboratory measurements of the formation of a parallel collisionless shock. We present hybrid kinetic/MHD simulations that show how beam instabilities in the background plasma can be driven by ablating carbon ions from a target, causing non-linear density oscillations which develop into a propagating shock front. The free-streaming carbon ions can excite both the resonant right-hand instability and the non-resonant firehose mode. We analyze their respective roles and discuss optimizing their growth rates to speed up the process of shock formation.

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