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Modeling High-Energy Density Astrophysical Shock Environments using the Hybrid Code LSP MATTHEW LEVY, LLNL, Rice Univ., SCOTT WILKS, LLNL, MATTHEW BARING, Rice Univ., WOJCIECH ROZMUS, LLNL, Univ. Alberta, HYE-SOOK PARK, NATHAN KUGLAND, JAMES ROSS, DMITRI RYUTOV, CHRISTOPHER PLECHATY, LLNL, ACSEL COLLABORATION — Collisionless shocks are believed to play an important role in numerous high-energy astrophysical scenarios, from gamma-ray bursts to the generation of cosmic rays. The ACSEL collaboration has performed a series of Omega experiments producing and characterizing high velocity counter-streaming plasma flows relevant for the creation of collisionless shocks [1]. Using proton radiography, large, stable electromagnetic field structures have been observed that extend for much larger distances than the intrinsic plasma spatial scales, and persist for much longer than the plasma kinetic time scales. These results suggest that large-scale plasma self-organization can occur within astrophysically relevant plasma flows in the laboratory [2]. Modeling this through cm-scale 1-D fluid-electron kinetic-ion simulations, we observe a correlation with the formation of strong off-center temperature gradients. In this presentation we describe further one- and two-dimensional simulation results relevant to counter-streaming plasma flows using the hybrid code LSP. Both collisional and collisionless scenarios are examined with special emphasis placed on multi-species effects.

[1] J.S. Ross et al, Phys. Plas., 19, 056501 (2012).
[2] N.L. Kugland et al, submitted to Nature-Physics (2012).

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