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**3-D magnetic reconnection in laser-driven plasmas: novel modeling provides insight into laboratory and astrophysical current sheets**[1]

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Magnetic reconnection is a fundamental process throughout plasma physics that allows for the rapid conversion of magnetic energy into kinetic energy and particle flows. While a major challenge in studying reconnection has been bridging the gap between small-scale experiments and large astrophysical scenarios, high energy density (HED) plasma experiments driven by long pulse lasers have demonstrated magnetic reconnection between colliding plasma plumes, recently achieving reconnection current sheets significantly larger than any previous experiments (as normalized by the ion skin depth). In this talk, we present newly developed fully kinetic 3-D simulations,[1] which are able to directly compare to such HED experiments, and in turn give insight to reconnection dynamics in larger astrophysical reconnection scenarios. In particular, we have observed a novel, inherently 3-D reconnection mechanism where the Biermann battery effect plays a direct role in reconnection process.[2] Based on scaling laws, we find that this mechanism can also play a non-trivial role during turbulent reconnection in the Earths magnetosheath. Our simulations shed light on significant differences in 2-D versus 3-D reconnection, transitions of quiescent current sheets to a sea of plasmoids, as well as various magnetic field generation mechanisms in the presence of large temperature and density gradients. [1] W. Fox, J. Matteucci, C. Moissard, et al., Physics of Plasmas **25**, 102106 (2018) [2] J. Matteucci, W. Fox, A. Bhattacharjee, et al., Phys. Rev. Lett. **121**, 095001 (2018)

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