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**Simulations of magnetic reconnection in partially ionized plasmas with a reacting multi-fluid model** VYACHESLAV S. LUKIN, Naval Research Laboratory, JAMES E. LEAKE, George Mason University, MARK G. LINTON, Naval Research Laboratory, ERIC T. MEIER, Lawrence Livermore National Laboratory — We present the first ab initio reacting multi-fluid simulations of magnetic reconnection in a partially ionized plasma, where the ionized and neutral fluids are treated as coupled but distinct. Partially ionized plasma environments where magnetic reconnection is known or conjectured to take place range from highly collisional, e.g. interstellar medium and lower solar chromosphere with ionization fraction below $10^{-3}$, to weakly collisional, e.g. in the upper solar chromosphere with ionization fraction of 1%-10%. Different plasma processes, such as ionization and recombination, ion-neutral interaction via Coulomb and charge-exchange collisions, Hall currents, and radiative losses can become the dominant factors in determining the reconnection rate and the structure of the reconnection region in different parameter regimes. The HiFi multi-fluid modeling framework has been used to implement all of the above processes in a single self-consistent model and to perform 2D simulations of magnetic reconnection under a variety of plasma conditions. We observe the formation of previously predicted non-LTE current layers, as well as explore the associated early onset of the secondary plasmoid instability and the effects of guide field and Hall currents on the dynamics.

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