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Two-fluid (plasma-neutral) Extended-MHD simulations of spheromak configurations in the HIT-SI experiment with PSI-Tet D.A. SUTHERLAND, C.J. HANSEN, T.R. JARBOE, University of Washington — A self-consistent, two-fluid (plasma-neutral) dynamic neutral model[1] has been implemented into the 3-D, Extended-MHD code PSI-Tet. A monatomic, hydrogenic neutral fluid reacts with a plasma fluid through elastic scattering collisions and three inelastic collision reactions: electron-impact ionization, radiative recombination, and resonant charge-exchange. Density, momentum, and energy are evolved for both the plasma and neutral species. The implemented plasma-neutral model in PSI-Tet is being used to simulate decaying spheromak configurations in the HIT-SI experimental geometry, which is being compare to two-photon absorption laser induced fluorescence measurements (TALIF) made on the HIT-SI3 experiment. TALIF is used to measure the absolute density and temperature of monatomic deuterium atoms. Neutral densities on the order of 10^{15} m^{-3} and neutral temperatures between 0.6-1.7 eV were measured towards the end of decay of spheromak configurations with initial toroidal currents between 10-12 kA. Validation results between TALIF measurements and PSI-Tet simulations with the implemented dynamic neutral model will be presented. Additionally, preliminary dynamic neutral simulations of the HIT-SI/HIT-SI3 spheromak plasmas sustained with inductive helicity injection will be presented. Lastly, potential benefits of an expansion of the two-fluid model into a multi-fluid model that includes multiple neutral species and tracking of charge states will be discussed. [1]E.T. Meier, U. Shumlak, *Phys. Plasmas* **19**, 072508 (2012).

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