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**A Comparison between the Two-fluid Plasma Model and Hall-MHD for Captured Physics and Computational Effort** BHUVANA SRINIVASAN, URI SHUMLAK, Aerospace and Energetics Research Program, University of Washington — The two-fluid plasma model is studied and compared to Hall-MHD. Three asymptotic approximations are applied to the full two-fluid plasma model to obtain Hall-MHD namely, charge neutrality, infinite speed of light and negligible electron inertia. Two-fluid effects become significant when the characteristic spatial scales are on the order of the ion skin depth and the characteristic time scales are on the order of the inverse ion cyclotron frequency. Hall-MHD, which is becoming more common among plasma physicists studying fluid models of plasmas, is compared to the full two-fluid plasma model for the physics that is captured as well as the computational effort. Artificially increasing the electron-to-ion mass ratio in the two-fluid plasma model captures all the Hall-MHD physics while using less computational effort. Likewise, artificially decreasing the ratio of the speed of light to the Alfven speed in the two-fluid plasma model also captures Hall-MHD with less computational effort. The two-fluid model provides the solution obtained by Hall-MHD using less computational effort and without the need for artificial dissipation. Simulations of the Rayleigh-Taylor instability, collisionless magnetic reconnection, axisymmetric Z-pinch and field reversed configuration are explored and the results are compared between the models.

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