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Comparing Reduced Fluid Models to the Two-Fluid Plasma System BHUVANA SRINIVASAN, URI SHUMLAK, Aerospace and Energetics Research Program, University of Washington — The two-fluid plasma model is studied and compared to reduced fluid models such as Hall-MHD. Three asymptotic approximations are independently applied to the full two-fluid plasma model to obtain the reduced models which include charge neutrality, infinite speed of light and negligible electron inertia. Hall-MHD is pursued because it captures additional physics as compared to ideal MHD. The additional physics takes into account two-fluid effects by using the Hall and the diamagnetic drift terms believed to be important in Hall accelerators, Z-pinches, Field Reversed Configurations, and other such applications. Two-fluid effects become significant when the characteristic spatial scales are small compared to the ion skin depth and the characteristic time scales are short compared to the inverse ion cyclotron frequency. The motivation here is to compare Hall-MHD to the two-fluid model to study the physics that is lost or captured by applying the approximations in addition to comparing the simplicity of implementation of the models. Simulations of electromagnetic plasma shock, and current sheets with in-plane magnetic fields (i.e. collisionless reconnection) and out-of-plane magnetic fields are performed and the results are compared between the models.

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