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MH4D Benchmarking and Atomic Physics Implementation ERIC MEIER, University of Washington, PSI-CENTER COLLABORATION — Two key benchmarks of MH4D have been made: 1) Screw pinch kink and spheromak tilt modes have been simulated in MH4D with non-linear ideal MHD. Linear growth rates are compared to results from linear stability computations. 2) MH4D has been used to simulate the ZaP Flow Z-Pinch experiment, and benchmarked against results from a well-developed 2-D MHD code, MACH2. Periodic boundary conditions are used in MH4D to allow quasi-2D simulation. Resistivity and ohmic heating are included in these simulations. Beyond these benchmarks, the 3-D capability of MH4D has been explored by simulating gas injection in ZaP. Also, the accuracy and utility of the implicit and semi-implicit features of MH4D have been assessed. First order atomic physics have been implemented in MH4D. A cold static neutral fluid is tracked, and the applicable temperature-dependent ionization, recombination, and charge exchange terms are included in each of the MHD equations and in the neutral fluid density equation. A significant background density of neutral fluid is shown to cause the expected slowing of spheromak tilt mode growth. The effect of ionization (delayed plasma generation) on ZaP plasma dynamics is explored.

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