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Implementation of An Implicit Unsplit Staggered Mesh MHD Solver in FLASH[1] G. XIA, D. LEE, ASC DOE/NNSA Flash Center, University of Chicago — FLASH is a publicly available community code designed to solve highly compressible multi-physics reactive flows. We have been adding capabilities to FLASH to make it an open science code for the academic HEDP community. A key need is to provide a computationally efficient time-stepping integration method that overcomes the stiffness that arises in the equations describing a physical problem when there are disparate time scales. To address this problem, we are developing a fully implicit solver based on a Jacobian-Free Newton-Krylov implicit formulation. The method has been integrated into a robust, efficient, and high-order accurate Unsplit Staggered Mesh MHD (USM) solver. We are also integrating this solver into an anisotropic Spitzer-Braginskii conductivity model to treat thermal heat conduction along magnetic field lines, and into a treatment of the Biermann Battery effect that accounts for spontaneous generation of magnetic fields in the presence of non-parallel temperature and density gradients.

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