Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

High order Finite difference Constrained Transport Method for Ideal Magnetohydrodynamic Equations[1] QI TANG, ANDREW CHRISTLIEB, YAMAN GUCLU, Michigan State University, JAMES ROSSMANITH, Iowa State University — A new algorithm will be used to simulate the ideal MHD equations based on AMR algorithm and a high order finite difference WENO reconstruction method [Shen, C., Qiu, J.M., Christlieb, A. J., Adaptive mesh refinement based on high order finite difference WENO scheme for multi-scale simulations, JCP (2011)]. The base framework of the algorithm will be the magnetic potential advection constrained transport method (MPACT), which was originally a 2nd-order finite volume type solver for ideal MHD equations by Rossmanith, J. [An unstaggered, High-Resolution Constrained Transport Method For Magnetohydrodynamic Flows, SIAM (2006)], but the treatment is significantly different. The important feature of the new algorithm will be (1) the method is finite difference type, (2) all quantities are treated as cell-centered, (3) high order (higher than 2nd) in both time and space, (4) all the quantities are non-oscillatory, (5) AMR will be used as the base framework. Convergence study will be done on the smooth problem. More 1D/2D/2.5D benchmark problems such as Brio-Wu shock tube, Rotor problem and Cloud-shock interaction will be simulated. We expect our algorithm is robust, non-oscillatory and good at resolving solution structures, due to the very low numerical diffusion of high order scheme.

[1]NSF, AFOSR

Qi Tang
Michigan State University

Date submitted: 12 Jul 2012 Electronic form version 1.4