Project Details

ROSES ID: NRA-01-OSS-01
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Project Title:
Geospace Modeling with Adaptive Mesh Refinement

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Summary:
This project aims at the development of an efficient and versatile adaptive mesh refinement (AMR) code to solve the three-dimensional, time-dependent equations of ideal magnetohydrodynamics (MHD). This code will be based on the Structured Adaptive Mesh Refinement Applications Infrastructure (SAMRAI) developed at the Center for Applied Scientific Computing (CASC) of the Lawrence Livermore National Laboratory (LLNL). This project will implement a conservative integrator for Faraday's law along with with conservative integration schemes for the hydrodynamic equations, the coupling terms, and different boundary conditions. The code will be extensively tested, various flux-limiting algorithms will be evaluated in the context of AMR, mesh refinement strategies will be developed, and AMR specific data analysis and visualization tools will be developed. The ultimate goal is to allow for simulations with sufficiently high resolution in current sheets that numerical dissipation is suppressed to the point that magnetic reconnection ceases. This would constitute a quantum-leap in the simulation capabilities of solar, heliospheric, planetary, and astrophysical plasmas, which at present cannot be modeled without introducing reconnection due to numerical effects. Although the development is primarily targeted at magnetospheric simulations, including space weather applications, the codes will be made freely available and likely find applications in various fields that are concerned with the large-scale modeling of collisionless plasmas.

Publication References:

no references