Project Details

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Project Title:
A Modular Capability for Community Modeling of Flares, CMEs and their Interplanetary Impacts

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Summary:
NASA Goddard Space Flight Center and the University of Michigan propose a collaborative research program that attacks one of the most important problems in space weather: understanding the giant explosions of solar magnetic field and plasma known as eruptive flares/coronal mass ejections (CMEs). Our strategy is to develop a second- generation Strategic Capability that will enable both our Team and, more importantly, the outside community to test theories of solar eruptions against observed events, and to work towards a predictive capability. The distinguishing feature of our program is that it is modeled after a NASA instrument or NSF facility program in that it will enable the whole community to attack the solar eruptions problem with state-of-art modeling and analysis, just as NASA space and NSF ground-based instruments provide the community with state-of-art observations. As with a hardware program, we will use the Capability to perform a Team science program, but the bulk of the science results ultimately will be obtained by the outside community. Furthermore, our science modeling capability will serve as a prototype for the eventual development of first-principles based operational tools.

The Capability that we will build, the Modular Solar Eruptions Capability (MSEC), is a bold but logical next step in the NASA/NSF Strategic Capability Program. MSEC will consist of a set of interchangeable modules and libraries, including a Training Library, that will enable the user to model a complete solar eruption event, from energy buildup by flux emergence to space weather impact at Earth. All the MSEC components will be delivered to the CCMC and the source code will be made publicly available. We will use MSEC to attack the four central problems in the science of solar eruptions: (1) energy buildup and eruption onset, (2) explosive energy release, (3) the nature of fast coronal reconnection, and (4) Heliospheric impacts.

The proposing team consists of internationally recognized experts in basic solar/heliospheric theory, in the modeling and data analysis of observed events, and in computational physics. The proposed work builds on our recent advances in understanding the physics of flares and CMEs and in modeling space weather. Our team
has developed some of the leading theories for solar activity and has delivered some of the most widely used space weather models to the CCMC.
In addition, the proposed collaboration builds on and greatly strengthens the long partnership between NASA/GSFC and U Michigan. It will provide the opportunity for students of U Michigan to work with leading NASA scientists and have access to the unique resources at GSFC, a national facility.

Publication References:

Summary: no summary

Reference: Masson, S.; Antiochos, S. K.; DeVore, C. R.; (2012), A Model for the Escape of Solar-flare-accelerated Particles, The Astrophysical Journal, Volume 771, Issue 2, article id. 82, 15 pp, doi: 10.1088/0004-637X/771/2/82