Space Science Seminar

Tuesday, 2022 March 15

10:30 a.m.

NASA/MSFC TEAMS

MHD Modeling of Solar Transients

Sushree S. Nayak / Center for Space Plasma and Aeronomic Research / University of Alabama in Huntsville

Host: Dr. Alphonse Sterling (Sponsored by NASA/MSFC/ST13)

Transients like solar flares, coronal mass ejections (CMEs), jets etc. influence the space-weather predominantly. Their imprints are observed in different layers of the solar atmosphere as captured in several passbands of telescopes. Key to these outbursts is a fundamental process called magnetic reconnection; which rearranges the magnetic field topology, liberates stored magnetic energy into heat and kinetic energy and accelerates charged particles in the process. Hence, magnetic field information is highly desirable to understand magnetic reconnection and the involved energetics. However, owing to lack of routine and reliable measurements of magnetic field in the upper atmosphere, particularly for the corona, extrapolation methods are widely practiced by using available photospheric magnetograms. In our study, we have utilized the Non-Force-Free-Field (NFFF) extrapolation model to construct the coronal magnetic field. Relevancy of this model lies in its assumption of existing non-zero Lorentz force on photosphere which is contrary to the force-free models. In addition to the initial field topology, dynamics involved in the transients are also important. Furthermore, reconnection process in three-dimensions is itself a complicated process and still unclear. So, with this backdrop, the talk will present study of different reconnection regimes in multiple variants of transients via MHD simulations initiated with both data and analytical conditions. To track the dynamics of the events, we have used the extrapolated field as an input to the well-established EULAG-MHD model. These data inspired simulations not only corroborate remarkably with the observational features but also showcase the role of complex topologies in magnetic reconnection and hence prove the efficacy of both the extrapolation and MHD model.