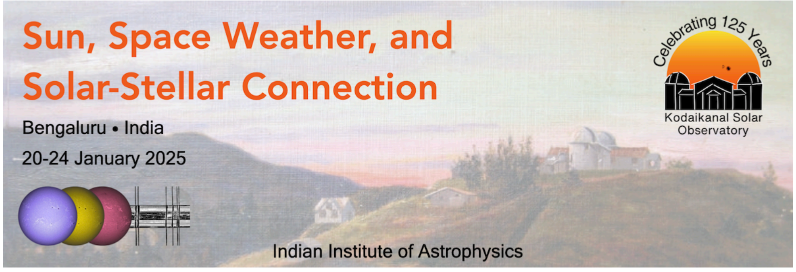

Contribution ID: **205** Type: **Contributed talk**

Multi-spacecraft Exploration of the Formation Stages of a Coronal Mass Ejection During a Composite Flare: heating, Particle Acceleration, and Hot-channel Eruption

Friday, January 24, 2025 4:40 PM (15 minutes)

In this paper, we present a multi-spacecraft view of the activation of a large magnetic flux rope (MFR) which accompanies a composite flare that evolved into a halo CME. The composite flare consists of an impulsive event during which GOES flux peaked up to C6.3 level and a subsequent long-duration M1.0 event. The term 'composite'refers the collective roles of two distinct events of large-scale reconnection in triggering the activation and eruption of an MFR. The eruption occurred in solar active region NOAA 12975 and observed from a suite of instruments including two solar X-ray telescopes: Solar X-ray Monitor (XSM) on board Chandrayaan-2 (Ch-2) and the Spectrometer Telescope for Imaging X-rays (STIX) on board Solar Orbiter (SO). During our observing period, the SO-Sun-Earth angle was 85.2 degree, making it possible to address the relationship between emission from different segments of the flare loops, viz. coronal loop-tops and foot-points sources. A comparison between the imaging observations from Atmospheric Imaging Assembly (AIA) on board Solar Dynamics Observatory (SDO) in extreme ultraviolet (EUV) channels and X-ray time profiles at multiple energy bands clearly reveal the physical connection between the two events as the rising EUV hot channel (i.e. MFR in low corona) attains eruptive motions around the transition period between the two flaring episodes. Our observations indicate that the MFR initially ascended with a projected speed of ≈80 km s-1 while the corresponding halo-CME expanded with a speed of ≈900 km s-1 within ≈3−11 $R_{\odot}$. The analysis of high-resolution X-ray spectra at 1-15 keV energies from XSM/Ch-2 reveal that the highest plasma temperature was attained at the peak C6.3 flare which did not show significant increase during the subsequent M1 event; on the other hand, the emission measure (EM) almost doubled during the peak of M-class event in comparison to that at the peak of the preceding event. The observations provide new insights on the role of precursor emission toward the destabilization of MFR. A distinct C6.3 event happening as a precursor to M1.0 flare clearly points toward a feedback relationship between large-scale, two-phase magnetic reconnection and corresponding step-wise evolution of the MFR.

Contribution Type

Theme

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