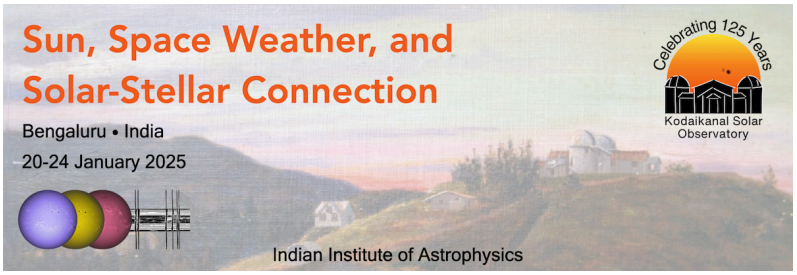

Contribution ID: **10** Type: **Poster**

Dimming Inferred Estimation of CME Direction - DIRECD

Coronal mass ejections (CMEs) are intense solar phenomena where plasma and magnetic fields are ejected from the Sun, playing a significant role in influencing Space Weather. However, traditional coronagraphs struggle to accurately capture the early stages of Earth-directed CMEs due to projection-related distortions. Coronal dimmings, which manifest as localized reductions in extreme-ultraviolet (EUV) and soft X-ray emissions, are key indicators of CMEs in the low corona. These dimmings result from the loss and expansion of mass during a CME eruption. This study presents a novel approach called DIRECD (Dimming InfeRred Estimate of CME Direction), designed to estimate the initial propagation direction of CMEs based on the expansion of these dimmings. The method utilizes 3D CME simulations combined with a geometric cone model, considering parameters such as width, height, source location, and deviation from the radial path. By identifying the primary direction of dimming expansion, the method solves an inverse problem to reconstruct a series of CME cones at various heights, widths, and deviations. The 3D direction of the CME is then determined by matching the CME projections on the solar sphere with the dimming geometry. This approach has been validated through case studies of events on October 1, 2011, September 6, 2011, and May 2024, demonstrating that the initial propagation directions of CMEs closely align with those derived from 3D tie-pointing of the CME bubble observed in the EUV (lower corona) and the GCS 3D modeling of the white-light CME (higher corona). Moreover, these results are consistent with multi-viewpoint coronagraph observations from SOHO and STEREO, underscoring the potential of coronal dimming data for early CME direction estimation.

Contribution Type

Theme

Connecting Solar Corona to Heliosphere

Primary author: JAIN, Shantanu (Skolkovo Institute of Science and Technology)

Co-authors: Dr PODLADCHIKOVA, Tatiana (Skolkovo Institute of Science and Technology); Dr CHIKUNOVA, Galina (University of Zagreb); Dr DISSAUER, Karin (Northwest Research Associates); Prof. VERONIG, Astrid (University of Graz)

Presenter: JAIN, Shantanu (Skolkovo Institute of Science and Technology)