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Oral
(Invited Talk)
Understanding the three-dimensional (3D) structure and kinematic evolution of coronal mass ejections (CMEs) is essential for constraining their physical nature, eruption mechanisms, and impact throughout the heliosphere. Polarization-based diagnostics, such as the polarization ratio technique (PRT), provide quantitative information on the distribution of coronal plasma along the line of sight, enabling the reconstruction of CME topography and propagation relative to the plane of the sky. When combined with multi-vantage observations, these methods offer a powerful framework to study CME morphology and dynamics.

We present a multi-mission analysis of two co-temporal CMEs observed on 28 October 2021, which were associated with the first X-class flare of Solar Cycle 25 and a preceding quiet-Sun eruption beyond the north-western limb. During this period, Solar Orbiter was aligned with the Sun–Earth line, allowing the Metis coronagraph to observe both CMEs in visible light (VL) and H I Ly-? ultraviolet (UV) emission. By combining Metis VL and UV observations with data from multiple remote-sensing instruments, we reconstruct the 3D geometry and evolution of both CMEs using tie-point triangulation, Graduated Cylindrical Shell modeling, and, in particular, the PRT.

In the context of PUNCH 7, this work motivates the application of polarization-based and kinematic diagnostics to a broader sample of CMEs observed by Metis and by PUNCH, and we will present some candidates for analysis from the first year of PUNCH data. Such synergistic studies will enable systematic investigations of CME structure and evolution across the middle corona, strengthening the connection between coronal and heliospheric imaging.
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