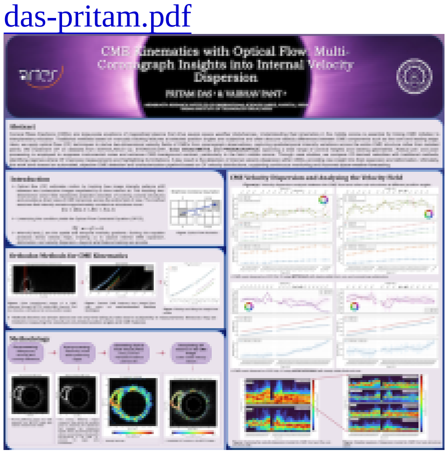
Pritam
Das
Aryabhatta Research Institute of Observational Sciences (ARIES)
Vaibhav Pant, Indian Institute of Technology Delhi (IIT Delhi)
Poster
Understanding CME kinematics in the middle corona is essential for linking eruption initiation with interplanetary evolution. Traditional tracking methods, limited to discrete position angles or the CME front, often obscure internal velocity dispersion between CME substructures such as the core and leading edge.

We apply an advanced optical-flow (OF) technique to derive two-dimensional velocity fields of CMEs from coronagraph observations, capturing their continuous spatiotemporal evolution. The method was validated using SOHO/LASCO C2 and STEREO/COR1 data, showing good agreement with conventional height–time measurements despite their lower spatial and temporal resolution. It was subsequently applied to METIS/SolO and ASPIICS/PROBA3 observations. Extensive image processing was performed to remove the quiescent coronal background and isolate CME structures, and a Fourier-domain filtering technique was implemented to mitigate the brightness-flickering artifact near the occulter present in current PROBA-3 Level-2 data.

The OF framework reveals detailed velocity distributions across CME substructures. The CME core exhibits a compact velocity distribution centered near the median, while the leading edge shows a broad and highly dispersed distribution. Lower-velocity contributions to the front primarily arise from CME flanks. We find that kinematic coupling between the core and front breaks down during impulsive acceleration phases, indicating the onset of internal dynamical decoupling. For prominence-associated CMEs, this dispersion first develops within a critical height range of 2.0–2.4 R?.

Finally, the temporal evolution of velocity distributions enables automated detection of CME entry into coronagraph fields of view, a capability well-suited for future observations by the PUNCH mission.
Poster PDF
das-pritam.pdf

YouTube link
View recording
Meeting homepage
PUNCH 7 Science Meeting
Download Abstract