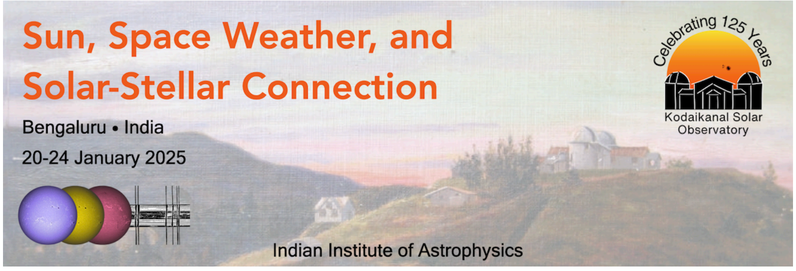


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# Evolution of CME Radial Size and Expansion Speed: 3D Kinematics and Non-conventional Approach to In situ Observations

Coronal Mass Ejections (CMEs) are expulsions of magnetized plasma bubbles from the Sun episodically, and they are the potential candidates for severe space weather impacts on the Earth. However, the impact duration of CMEs on Earth is governed by their radial sizes and speeds upon arrival. In our work, we estimate a CME's radial size and instantaneous expansion speed at different instances during its passage over a single point in situ spacecraft by introducing a non-conventional approach. Using the 3D kinematics of CME substructures, leading edge (LE), center, and trailing edge (TE), we estimate the continuous evolution of a CME's radial size and expansion speed from the Sun to 1 AU. The 3D kinematics of CME substructures are estimated using 3D reconstruction methods, GCS and SSSE, applied on multipoint coronagraphs and heliospheric imagers combined with the drag-based model. For our study, we selected a 2010 April 3 CME, a favorable candidate, to provide a better comparison between remote and in situ observations. We show that our non-conventional approach can better estimate the radial size and expansion speed at different instances than the conventional approach on remote and single-point in situ observations. We also examine the role of the aspect ratio on the continuous evolution of CME's radial size and expansion speed from the Sun to 1 AU. We demonstrate that the value of the aspect ratio is different in the corona and interplanetary medium. Our study highlights the discrepancies in the estimates of arrival time, radial size, and expansion speed of remote and in situ observations, even in the case of a favorable CME. Moreover, multipoint in situ spacecraft and our non-conventional approach can improve our understanding of the CME and its substructure's evolution in the solar wind.

## Contribution Type

## Theme

Connecting Solar Corona to Heliosphere

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