16th European Solar Physics Meeting

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Deriving CME volume and density from remote sensing stereoscopic data

Friday 10 September 2021 09:00 (15 minutes)

Using combined STEREO-SOHO white-light data, we present a method to determine the volume and density of a coronal mass ejection (CME) by applying the graduated cylindrical shell model (GCS) and deprojected mass derivation. Under the assumption that the CME mass is roughly equally distributed within a specific volume, we expand the CME self-similarly and calculate the CME density for distances close to the Sun (15–30 Rs) and at 1 AU. The procedure is applied on a sample of 29 well-observed CMEs and compared to their interplanetary counterparts (ICMEs). Specific trends are derived comparing calculated and in-situ measured proton densities at 1 AU, though large uncertainties are revealed due to the unknown mass and geometry evolution: i) a moderate correlation for the magnetic structure having a mass that stays rather constant (cc $\approx 0.56 - 0.59$), and ii) a weak correlation for the sheath density (cc ≈ 0.26) by assuming the sheath region is an extra mass - as expected for a mass pile-up process - that is in its amount comparable to the initial CME deprojected mass. High correlations are derived between in-situ measured sheath density and the solar wind density (cc ≈ -0.73) and solar wind speed (cc ≈ 0.56) as measured 24 hours ahead of the arrival of the disturbance. This confirms that the sheath-plasma stems from piled-up solar wind material. While the CME interplanetary propagation speed is not related to the sheath density, the size of the CME may play some role.

Student poster?

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