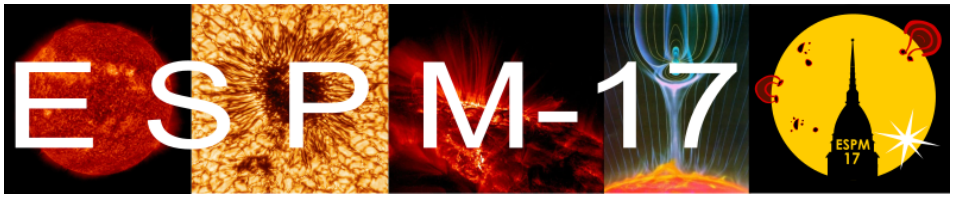

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Estimating the helicity and electromotive force with SolarOrbiter in-situ data of an iCME

During inter-planetary coronal mass ejections we expect faster solar wind to push into slower ambient wind, leading to the formation of super-sonic shocks. This may trigger turbulence to amplify magnetic fields stronger than expected by pure compressional effects, known as turbulent dynamo action. The turbulent nature of iCME fronts can be uncovered by computing the electromotive force. Peaks in the electromotive force reveal the arrival time of such fronts and their following sheath regions at the spacecraft. Since the magnetic helicity is conserved, we expect the same handedness as in the coronal source region of the outbreak. From an asymmetric double peak in the electromotive force, we can find this helicity handedness in an event observed by the MAG and SWA-PAS instruments around November 4, 2021. We compare this particular event with a series of previously recorded events from the Helios missions observed in the inner heliosphere. A scaling law on the magnitude of the electromotive force shows how these events are expected to decay while propagating to 1 au. This knowledge allows to automatically identify iCME shocks in heliospheric mission data with simple means. Future missions may use this technique to automatically switch the instrument observing modes to higher cadence, in order to fully capture dynamic events.

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