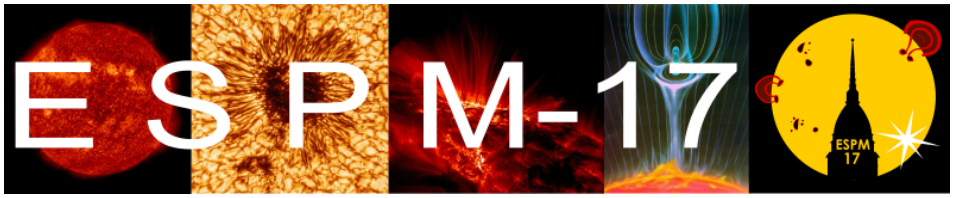

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Understanding the magnetic field evolution of the 10 March 2022 Coronal Mass Ejection

Understanding the magnetic field evolution of Coronal Mass Ejections (CMEs) is crucial for space weather research. We examined the 10 March 2022 CME, focusing on its magnetic field evolution from the near-Sun space to L1. The Solar Orbiter's in-situ measurements, 7.8 degrees east of the Sun-Earth line at 0.43 AU, provided a unique vantage point, along with the WIND measurements at L1.

We analysed the temporal evolution of the magnetic helicity budget of the source Active Region (AR), NOAA AR 12962. By estimating the helicity budget of the pre- and post-eruption phase in the AR, we estimated the helicity transported to the CME. Assuming a Lundquist flux-rope model and geometrical parameters (length and radius of the flux rope) obtained through the Graduated Cylindrical Shell (GCS) CME forward-modelling technique, we determined the CME magnetic field at a GCS-fitted height of 0.03 AU to be 2067 ± 405 nT. Combining this estimated magnetic field with in-situ measurements at 0.43 AU and 0.99 AU, we could fit the CME's axial magnetic field decrease with heliocentric distance as a single power law with index -1.23 ± 0.18. Extending previous studies on inner-heliospheric intervals from 0.3 AU to ~1 AU, we refer to estimates from 0.03 AU to measurements at ~1 AU. Our findings suggest a less steep decline in the magnetic field strength with distance compared to previous studies. However, our results align with studies incorporating near-Sun magnetic field measurements, such as those from the Parker Solar Probe mission.

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