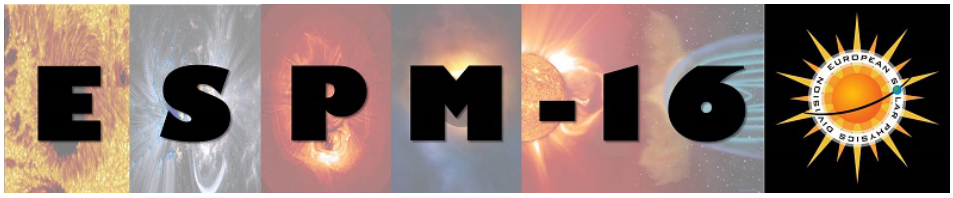

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Implementing new techniques to constrain the spheromak model in EUHFORIA and assessing the model results

Wednesday 8 September 2021 14:26 (13 minutes)

Coronal mass ejections (CMEs) are one of the major sources for space weather disturbances. If the magnetic field inside an Earth-directed CME or its associated sheath region has a southward-directed component (Bz), then it interacts effectively with the Earth's magnetosphere, leading to severe geomagnetic storms. Therefore, it is crucial to predict the strength and direction of Bz inside Earth-impacting interplanetary CMEs (ICMEs) in order to forecast their geo-effectiveness. However, due to lack of realistic inputs and the complexity of the Sun-Earth system, it is difficult to perform reliable forecast of Bz at 1 AU.

In this work, using the observational properties of CMEs, we implement new techniques to constrain the kinematic and magnetic parameters of the analytical force-free flux rope model (spheromak) to mimic the magnetic structure of a CME and simulate its evolution from Sun-to-Earth using the "European heliospheric forecasting information asset"(EUHFORIA). In order to validate our tool, we simulate an Earth-directed CME event on 2013 April 11 and compare the simulation results with the in-situ observations at 1 AU. Both the field-strength and orientation of the ICME magnetic field vectors as obtained from the model show good agreement with that obtained from the in-situ observations. From the simulation results, we could also capture the overall magnetic structure of the associated sheath region ahead of the CME flux rope. The new techniques implemented in this study show promising results towards the forecasting of Bz in near real time.

Author: Dr SARKAR, Ranadeep (University of Helsinki)

Co-authors: POMOELL, Jens (University of Helsinki); KILPUA, Emilia (University of Helsinki); ASVESTARI, Eleanna (Department of Physics, University of Helsinki, Finland); Dr WIJSEN, Nicolas (Centre for mathematical Plasma Astrophysics, KU Leuven, Belgium); MAHARANA, Anwesha (PhD student); POEDTS, Stefaan (KU Leuven); RODRIGUEZ, Luciano (Solar-Terrestrial Centre of Excllence-SIDC, Royal Observatory of Belgium); Dr MIERLA, Marilena (Royal Observatory of Belgium)

Presenter: Dr SARKAR, Ranadeep (University of Helsinki)

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