



Measurement of electromotive force in the inner heliosphere

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Electromotive force plays an essential role in solar dynamo mechanism. We address the question if the electromotive force ever operates in the inner heliosphere when a magnetic cloud passes by, such as a coronal mass ejection (CME). In this work, we use the magnetic field data and plasma data from the Helios-2 spacecraft in the year 1978, where the spacecraft is at a radial distance of about 0.4 AU from the Sun, to perform first-time measurements of the electromotive force in the inner heliosphere.

We compare between two cases under which the electromotive force is likely in operation: one in a quasi-stationary solar wind and the other in a transient solar wind with a magnetic cloud. Our measurements show a short-time enhancement of the electromotive force from roughly 10^{-4} V/m to several 10^{-3} V/m after the shock. These results indicate that the electromotive force is in operation in the inner heliosphere and is enhanced when a magnetic cloud or CME occurs. Our measurements open a door to systematically investigate the electromotive force and its modeling with the kinetic helicity effect (the so-called alpha term), the turbulent diffusion effect (beta term), and the cross helicity effect (gamma term) in the mean-field dynamo theory.