

Expanding Magnetic Clouds in the inner heliosphere

A. M. Gulisano^{1*}, M. E. Ruiz^{1*}, S. Nakwacki¹ S. Dasso^{1,2} & P. Démoulin³

¹ Instituto de Astronomía y Física del Espacio, CONICET-UBA, Buenos Aires, Argentina

² Departamento de Física, FCEyN, UBA, Buenos Aires, Argentina

³ Observatoire de Paris, Meudon, LESIA, France.

* Fellow of Universidad de Buenos Aires

Magnetic Clouds (MCs) are usually flux rope structures of magnetized plasma expelled from the sun, that transports large amounts of mass, magnetic fluxes and magnetic helicity from its origin to the heliosphere. The dynamics, the detailed magnetic structure and some times even the boundaries of the MCs are not fully known yet. As they travel these flux ropes interact with the solar wind (SW) and when the surrounding total pressure is lower than the internal structure pressure they became expanding objects. We have studied the reported MCs (by different authors) observed by the satellites Helios 1 and 2 during the time while these missions were operational. We have performed a Minimum Variance study of the MC magnetic field (B) to find B in the local cloud coordinates and assuming a cylindrical symmetry we have calculated the Flux in the azimuthal coordinate (F_{azim}) and from the flux cancellation and the MV we have chosen the borders of the clouds and study the presence of 'open backs' that formed part of a closed flux rope structure near the sun. From the bulk velocity profile, according to some studies, it is possible to infer the 'local' expansion rate of a MC, we perform that analysis for the MCs that were at different distances from the sun in the inner heliosphere (from 0.3 to 1 AU) and study the variability of that rate.