[SE-05] Magnetic Clouds and Pseudo-Magnetic Clouds

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The interplanetary magnetic clouds have a structure of nested helical magnetic fields which can be well described by a magnetic flux rope. Observationally, they are characterized by smooth rotations of magnetic field vectors in the plane perpendicular to the Sun-Earth line. We tried to select as many events as possible which exhibit such characteristic rotations by surveying the solar wind data obtained by ACE for one year of 1999, and identified more than 80 cases with durations ranging from 1 to 10 hours (typically 2-3 hours). Then, we investigated characteristic solar wind structures of those selected events. It has been revealed, as a result, that there are two distinct kinds of structures. One is described by a magnetic flux rope structure, and the other is a bunch of magnetic flux tubes along which torsional Alfvén waves are propagating. We call this latter structure a pseudo-magnetic cloud, noting that they can be easily but incorrectly taken as a magnetic cloud. The distinction of the two is clearly seen by investigating the solar wind velocity vectors. Typically, in the Alfvén wave cases, the wave components of the velocity show clear planar rotations similar (or in opposite directions) to the rotations of magnetic field vectors as expected from MHD theory. In the magnetic flux rope cases, on the other hand, no strong correlations are seen between magnetic fields and velocity fields, with clear planar rotations being seen only in the magnetic fields.

[SE-06] Emergence of a Diamagnetic Flux Rope in the Solar Corona and Its Significance in Coronal Mass Ejections

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The evolution of a coronal magnetic field system in response to emergence of a diamagnetic flux rope is investigated by numerical magnetohydrodynamic (MHD) simulations in relation to escape of a CME structure from the sun. The toroidal magnetic field of the emerging flux rope is set to be either parallel (case 1) or antiparallel (case 2) to the toroidal field of the overlying arcade. In case 1, magnetic reconnection between the emerging field and the overlying arcade field creates a new paramagnetic flux rope. Although the presence of this paramagnetic flux rope slows down reconnection between the overlying field and the emerging field in the early stage, the flux rope gathers more and more flux, expands, and rises with time. In case 2, magnetic reconnection efficiently progresses from the beginning between the emerging diamagnetic flux rope and the overlying arcade field. This reconnection process removes not only the closed field barrier surrounding the diamagnetic flux rope, but also the poloidal flux in this flux rope. Thus, the flux rope can eventually become free to go indefinitely away, but with only a small flux in it. These two types of flux rope ejections may account for the different types of CMEs.