Geophysical Research Abstracts,
Vol. 11, EGU2009-6412, 2009
EGU General Assembly 2009

The Helical Fields of CMEs and the Paths of Near-Relativistic Electrons into the Heliosphere

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Wavelet processing of the LASCO images of the solar corona brings out many subtle details that are easily missed in the intensity images. Specifically, wavelet processing can enhance the edges of large and small scale structures making it easier to detect and define motions. We used the processed LASCO images obtained during the period 1998 - 2001, of maximum activity of the last sunspot cycle, to study the structure and motions of the CME legs and the nearby fields. Many CMEs show large-scale latitudinal leg displacements that resemble screw threads leaving the Sun. The helical fields extend into the heliosphere after, and sometimes before, the associated CME has left the LASCO C2 field of view.
We focused our attention on the CMEs that were analyzed by Simnett et al., Ap. J. 579, 854, 2002. They linked those CMEs to beams of near-relativistic electrons detected at 1 AU with the ACE spacecraft. Our study shows that the electron beamsťypical delay of about 10 min in arriving at 1 AU may be due to their following a longer, helical path from Sun to Earth than the usually assumed Parker spiral length of 1.2 AU. The study implies that the escaping electrons may be accelerated at the same time as the trapped electrons that produce hard X-ray flare emissions. When that is the case, there is no need to invoke acceleration in the CME fronts.