M30b The Modeling of Solar Coronal Field associated with Flare-CMEs

WANG Tongjiang, YAN Yihua, and WANG Jialong

It is widely recognized that the coronal mass ejections (CMEs) are large-scale disruptions of a quasi-equilibrium between the coronal plasma and magnetic field. However, due to a great deal of difficulties in direct measurements and limited resolution for the calculated fields to the date, we are still very lack of the knowledge on the large-scale coronal field structures and what roles they play in CME-associated phenomena.

In this study a new method called boundary element method (BEM) is applied to develop a potential field model with the spherical surface boundary. This model allows us to extrapolate the high-resolution large-scale coronal magnetic field from a single SOHO/MDI full-disk magnetogram, so giving chances to explore the origin of a special category of CMEs – the Earth-directed CMEs, which are prime sources of "Space Weather" effects.

Using this method, we calculate the large-scale potential fields for two cases of flare-CMEs, one associated with X1.1/3B flare in NOAA 8210 on May 2, 1998 and the other with X2.1/2B in NOAA 8100 on November 4, 1997. The comparison of the projected field lines with SOHO/EIT 195Å and Yohkoh/SXT observations show that the transequatorial magnetic loop systems interconnect the flare-CME source region and the other major active region, and just cover the EIT dimmings in both the events. This suggests that the coronal mass ejection may result from a further destabilization of the large-scale loop system by strong disturbances of the flare. Furthermore, we estimate the released magnetic energy and ejected mass in the CMEs as the energy of the potential field and the mass of the coronal plasma contained in the column of dimming regions of a height range, 1.01-1.5 solar radius, which have the values about 10^{31} erg and 10^{16} g, in good agreement with typical values estimated for the limb CMEs in general.