Initiation of CMEs by Magnetic Flux Emergence

http://www.firstlight.cn 2010-09-16

The initiation of solar Coronal Mass Ejections (CMEs) is studied in the framework of numerical magnetohydrodynamics (MHD).The initial CME model includes a magnetic flux rope in spherical, axisymmetric geometry. The initial configuration consists of a magnetic flux rope embedded in a gravitationally stratified solar atmosphere with a background dipole magnetic field. The flux rope is in equilibrium due to an image current below the photosphere. An emerging flux triggering mechanism is used to make this equilibrium system unstable. When the magnetic flux emerges within the filament below the flux rope, this results in a catastrophic behavior similar to previous models. As a result, the flux rope rises and a current sheet forms below it. It is shown that the magnetic reconnection in the current sheet below the flux rope in combination with the outward curvature forces results in a fast ejection of the flux rope as observed for solar CMEs.We have done a parametric study of the emerging flux rate.

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