Eric Greenfield A Model of Coronal Helmets with Prominences

ABSTRACT
The process by which coronal mass ejections are accelerated from the surface of the sun is not well understood. A possible explanation is that a solar prominence may serve to anchor the magnetic field associated with a coronal helmet allowing magnetic energy to grow beyond the open field limit. Once this limit is surpassed the helmet may relax to a less energetic open field state and be expelled as the CME. In order to analyze this situation, a partially open magnetic field representing an idealized 2D coronal helmet is constructed based on the conditions required of a potential magnetic field. A prominence is then introduced as a vertical sheet along the equator extending from the surface to some height rsh. Some amount of magnetic flux is then set to thread through the prominence sheet. The magnetic energy resulting from this partially open magnetic field configuration is then calculated using the Virial Theorem. The amount of flux set to thread through the prominence is directly related to the energy of the overall field as well as the mass contained along the prominence. The calculated energy is then compared to the energy of the completely open field. If the ratio E/Eopen is greater than 1, the helmet may open completely. If the mass required to meet the condition E/Eopen > 1 is within observational limits, we can conclude that this is a viable mechanism for storing the magnetic energy needed to drive a CME.