# SPACE AND COSMIC RAY PHYSICS SEMINAR

University of Maryland
Computer & Space Sciences Building, Room 2400
4:30 PM Monday, September 20, 2004
Tea & cookies 4:00-4:30 PM


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University of Maryland, College Park


## Production of Energetic Electrons During Magnetic Reconnection Events


The energization of electrons during magnetic reconnection is explored. The production of energetic electrons has been documented in observations of solar flares, reconnection in the Earth's magnetosphere and in laboratory experiments, yet the understanding of these widespread observations remains poor. The parallel electric field that develops during reconnection controls the acceleration of electrons in situations with an ambient guide field. The structure of this parallel electric field differs greatly from earlier ideas: during reconnection a deep cavity in the electron and ion density forms that extends through the x-line along one of the magnetic separatrices. This density cavity enables the parallel reconnection electric field to remain finite over an extended region, forming an acceleration cavity that controls the strength of the current layer that defines the dissipation region. The acceleration of electrons in a single pass through this cavity, however, does not explain the observed powerlaw spectra of energetic electrons seen in some data. In particle simulations a distinct high energy tail, extending well above the rest energy, forms on the electron energy distribution. These very energetic electrons are found to arise from multiple encounters with acceleration cavities. The simulations provide evidence that reconnection with a guide field is dominated by the formation of many islands and that electron energization results from multiple accelerations. In this picture the surprising amount of energy going into electrons in comparison with ions is, first, because of the significant length of the acceleration cavities (large numbers of electrons enter the cavities) and, second, because of their high mobility – they can rapidly interact with many cavities to reach high energy.


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