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Ion Acceleration via Magnetic Reconnection

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Magnetic reconnection is an important driver of energetic particles in a variety of astrophysical phenomena, and may play a key role role in pre-heating and accelerating Solar Energetic Particles during events. Recently, we developed a guiding-center model that successfully described the fundamental electron energization mechanisms that operate during reconnection. The most efficient mechanism was a first-order Fermi process driven by field-line contraction inside magnetic islands.

We present an extension of this model to treat proton energization. The out-of-plane 'guide field' plays an important role, controlling the energization efficiency of Fermi-type acceleration relative to heating via parallel electric fields. We examine the roles of parallel electric fields and a 'slingshot' mechanism in pre-heating ions. We discuss limitations of the model, which does not capture non-adiabatic processes such as ion pick-up in the reconnection exhaust.

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