Direct measurements of electron energization by parallel electric fields in magnetic reconnection

Regis John[1], Gregory G. Howes[1], Arya S. Afshari[1], and Daniel McGinnis[1]

[1]Department of Physics and Astronomy, University of Iowa, Iowa City, IA 52242, USA

Abstract

Magnetic reconnection converts magnetic energy into particle energy through several mechanisms whose relative importance depends on the guide field strength. Using high-resolution measurements from the Magnetospheric Multiscale (MMS) mission, we analyze a reconnection event with a moderate guide field ($B_g \approx 0.5\ B_0$) and apply the field–particle correlation technique to isolate electron energization channels. We identify localized velocity space signatures of energy transfer from parallel electric field $E_\parallel$ to electrons, concentrated near the electron diffusion region. These results provide direct evidence that $E_\parallel$ play a significant role in electron energization in moderate guide-field magnetic reconnection.