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Electron Gyroradius Scale Electric Field Enhancements in Space: Sites for Demagnetization? JACK SCUDDER, WILLIAM DAUGHTON, University of Iowa, F.S. MOZER, U.C. Berkeley — Intense (>100mV/m), ms, quasi-perpendicular Electric Field Enhancements (EFEs) are surveyed from 3 years of NASA's Polar data. EFEs are 2-D, quasi-stationary with spatial scales $\lambda_{de} \rightarrow d_e$, with one measured scale of $7\lambda_{De} \approx \rho_e$. EFEs from this sample occur exclusively with $10^{-8} < \beta_e < 3 \times 10^{-2}$, with a distribution of peak electric to magnetic force on a thermal electron ($\Gamma = cE_\perp / w_e B$) that breaks sharply at $\Gamma = 0.11$. For a given B this threshold corresponds to a ρ_e scale EFE with $E_\perp$ sufficient to stretch $P_{\perp e}$ by 50%. All EFEs with $\Gamma \geq 0.1$ were considered possible agents for demagnetization of the electron fluid, or DEFEs. Although EFEs are found at all magnetic local times, magnetic latitudes and radial distances of the Polar orbit, they were confined within 10° of the invariant latitudes of the Earth's cusps. By contrast DEFEs are strongly concentrated near local magnetic noon and at Polar's apogee, invariably in magnetopause current layers. DEFEs are only found in $10^{-4} < \beta_e < 3 \times 10^{-2}$ and where $\lambda_{De} \leq \rho_e$. DEFEs are consistently understood as sites where electrons can be demagnetized by strongly inhomogeneous electric fields and are found at historically identified locales for magnetic reconnection. Simulations from Harris sheet equilibria are used to test the properties of fully resolved, analogue PIC EFEs for their (i) thickness along their normal; (ii) Γ distribution; and (iii) ability to demagnetize electrons.

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