Electron holes in the Earth's magnetotail current sheet: role of magnetic field gradients and electron anisotropy

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Electron holes are nonlinear electrostatic structures that are often observed in the vicinity of the magnetotail energy release regions, e.g. magnetic reconnection. In this work we develop 1.5D Vlasov code simulations of the electron hole dynamics in the magnetic field configuration typical of the current sheet of the Earth's magnetotail. We consider the propagation of electron holes along magnetic field lines in the inhomogeneous magnetic field of the current sheet with realistically anisotropic electron distribution function. We demonstrate that electron holes generated near the equatorial plane of the current sheet brake as they propagate toward the boundaries of the current sheets. This effect is stronger for higher magnetic field gradient and larger electron field-aligned anisotropy. These simulations demonstrate that slow electron holes observed in the plasma sheet boundary layer may appear due to that effect of electron hole braking.