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Laboratory observations of electron phase-space holes driven during magnetic reconnection W. FOX, M. PORKOLAB, J. EGEDAL, N. KATZ, A. LE, MIT PSFC — We report studies of electrostatic turbulence during spontaneous reconnection events on the Versatile Toroidal Facility reconnection experiment [1]. Electrostatic fluctuations are observed by small, high-bandwidth, impedance-matched Langmuir probes. Fluctuations observed include broadband lower-hybrid fluctuations and large-amplitude, positive potential spikes, identified as electron phase space holes [2,3]. The properties of the holes are studied with cross-correlation techniques between closely spaced probes. For the holes, the parallel and perpendicular sizes are roughly equal, approximately 1–2 mm (50–100 λ_D, or 5–10 ρ_e), and the holes are observed to travel equal or faster than the electron thermal speed. Based on the observations and scaling arguments, the holes can be shown to be predominantly electrostatic. Finally, holes are observed to be confined to highly localized regions (1–2 cm, $\sim \rho_i$). These observations will be connected to recent space observations and theory. This work was funded in part by DOE Grant DE-FG02-06ER54878 and CMPD Grant DEFC02-04ER54786.

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[2] W. Fox, et al., PRL 101, 255003 (2008).
[3] W. Fox, et al., Phys. Plasmas 19, 032118 (2012).

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