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**Nonlinear Electrostatic Instability and Electron Hole Growth in the Moon's Solar Wind Wake**[1] I.H. HUTCHINSON, C.B. HAAKONSEN, C. ZHOU, MIT — Velocity distribution function distortions and resulting instabilities arise in the interaction of unmagnetized bodies like the moon with the solar wind. To a good approximation the physics is dominated by cross-field drift (corresponding to the perpendicular-to-B wind speed relative to the moon) and free parallel electron and ion dynamics. Analytic calculations show that the electron velocity distribution in the wake becomes unstable because of a dimple formed by "drift-deenergization" analogous to the "energization" responsible for instability in the earth's bow shock. The much more extreme two-stream distortion of the ion distribution is stable until far downstream. However, high fidelity PIC calculations show that electron holes are spawned by the dimple, and while most accelerate out of the wake without growing much, a few remain at small speeds and grow eventually large enough to disrupt the ion distributions. The nonlinear hole growth mechanism is the same de-energization. It can be reinterpreted as drift into an increasing density region. We show how this growth can be understood analytically, and time permitting will discuss related phenomena concerning ion influence on hole speed and the forewake remnants of "shadowing."

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