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Generalized Causes and Consequences of Sheath Instability in Hall Thruster Simulations[1] MICHAEL CAMPANELL, ALEXANDER V. KHRABROV, IGOR D. KAGANOVICH, Princeton Plasma Physics Laboratory, DMYTRO SYDORENKO, University of Alberta — A generalized sheath instability condition is presented for low collisionality planar plasmas bounded by walls with secondary electron emission (SEE). It is shown that the sheath becomes unstable when the SEE coefficient of the trapped electrons bordering the depleted loss cone reaches unity. Instability causes a large potential drop, allowing an intense flux of previously trapped electrons to reach the wall. This produces an intense emitted beam flux. In the first incidence of instability, the system restores to a state in which the sheath potential is much lower than before instability. The new state has much larger beam fluxes and the beams become the dominant component of the wall flux and axial conductivity. Once the beam flux is already large, further instabilities return the system roughly to its pre-instability potential, performing relaxation sheath oscillations (RSO). The periodic feature of RSOs is found to be caused by velocity space diffusion of electrons from the hot bulk towards the loss cone, driven by two-stream instability.

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