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Plasma sheath and presheath in the presence of a finite plasma current into the wall JUN LI, XIANZHU TANG, Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM 87545, USA, THEORETICAL DIVISION, LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NM 87545, U.S.A. TEAM — During tokamak disruptions, a current-carrying magnetized plasma will inevitably scrape off the first wall. A well-known example is the vertical displacement event (VDE). During such process a large plasma current can enter the wall, resulting in a halo current inside the vessel wall. More generally, in a broad range of low-temperature plasma applications, a plasma current can be driven by electrical biasing using end plates. Here we perform particle-in-cell kinetic simulations using the VPIC code to understand the detailed sheath and presheath physics when the wall-bound plasma current is substantial. The impact of this current on plasma profile (including the plasma potential), Bohm criterion and Bohm speed, sheath energy transmission, etc, is analyzed and elucidated from the simulation data. Of particular interest is the cathode region, in which the plasma sheath can greatly expand in size and the electron distribution are strongly non-Maxwellian. We will go over both steady-state cases and the dynamical evolution of a rapidly cooling plasma. This work was supported by the Office of Fusion Energy Sciences and Office of Advanced Scientific Computing Research through the base theory and SciDAC program.

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