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Axial Transport with free plasma-neutral end-boundary in Enormous Toroidal Plasma Device (ETPD): "The End of the Plasma" CHRIS COOPER, WALTER GEKELMAN, PATRICK PRIBYL, UCLA — Axial transport of particles, momentum, and heat in a magnetized, quiescent (δn/n <5%), current-free plasma with a free end-boundary terminating on a neutral gas are studied. The experiment is done on the ETPD at UCLA, a large toroidal device (major radius = 5 m, 2 m wide, 3 m tall) with a pulsed (1 Hz) DC plasma discharge (t_d < 100 ms) with a toroidal (B_t < 320 G) and a vertical (B_v < 8 G) magnetic field. An 18 cm x 18 cm LaB_6 plasma source creates a helical plasma with length L < 120 m, n_e < 3x10^{13} cm^{-3}, T_e < 20 eV, and T_i < T_e. The LaB_6 source injects heat and momentum in a beam of primary electrons (energy < 400 eV) that ionize a neutral gas and thermalize in the plasma. The plasma length is set by the primary electron energy and flux, neutral fill pressure, and B_t with the plasma able to be fully "detached" axially from any wall. Radial plasma profiles and losses are measured, compared to models, and balanced against the input power to predict the plasma length. Also, the properties of the axial plasma-neutral boundary as a sink for particles by 3-body recombination, heat loss by thermalization with neutrals, and momentum loss by ion-neutral collisions are investigated. Work funded by the Department of Energy and National Science Foundation.

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