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Transport in a field-aligned magnetized plasma and neutral gas boundary: the end of the plasma[1] CHRISTOPHER COOPER, WALTER GEKELMAN, University of California, Los Angeles — A series of experiments at the Enormous Toroidal Plasma Device (ETPD) at UCLA study the Neutral Boundary Layer (NBL) between a magnetized plasma and a neutral gas in the direction of the confining field. A lanthanum hexaboride (LaB_6) cathode and semi-transparent anode create a current-free, weakly ionized (n_e/n_n <5%), helium plasma (B∼250 G, R_{plasma}=10cm, n_e <10^{12}cm^3, T_e <3eV, and T_i ∼T_n) that terminates on helium gas without touching any walls. Probes inserted into the plasma measure the basic plasma parameters in the NBL. The NBL begins where the plasma and neutral gas pressures equilibrate and the electrons and ions come to rest through collisions with the neutral gas. A field-aligned electric field ($\Delta\phi/kT_e$ ∼1) is established self-consistently to maintain a current-free termination and dominates transport in the NBL, similar to a sheath but with a length L∼$10\lambda_{ei}$ ∼$10^2\lambda_{en}$ ∼$10^5\lambda_D$. A two-fluid weakly-ionized transport model describes the system. A generalized Ohm's Law correctly predicts the electric field observed. The pressure balance criteria and magnitude of the termination electric field are confirmed over a scaling of parameters. The model can also be used to describe the atmospheric termination of aurora or fully detached gaseous divertors.

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