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[ ] Theory [X] Experiment

Ion Loss as Intrinsic Momentum Source in Tokamaks,* J.A. Boedo, *UCSD* – Measurements of D^+ parallel velocity at the DIII-D edge are consistent with the kinetic loss of thermal ions as the mechanism for edge momentum generation. Edge velocity profiles exhibit a co-I_p peak velocity of 40-60 km/s in OH, L- and H-mode. The flow layer acts as a robust boundary value not affected by NBI injection. D^+ velocity measurements are compared to a first-principles, collisionless, kinetic model predicting the existence of a loss-cone distribution in velocity space resulting in a co-I_p directed velocity. A fine E_r structure, found by probes, has 10–20 kV/m peaks in the scrape-off layer (SOL) and LCFS and when incorporated in the kinetic model, results in: 1) ~30%-50% increase in the peak parallel velocity over the zero field case and, 2) broadened rotation profile into the SOL. The model-data agreement shows this mechanism is important, competing with pre-sheath acceleration and Pfirsch-Schluter drives. Computations with XGC0, a full-f particle-in-cell drift-kinetic solver with collisional kinetic ions and electrons, confirms the relevance of the ion orbit loss in L-mode, a growing influence of the Pfirsch-Schluter drive in H-mode, and impact of kinetic effects on E_r. NEO computations, a drift kinetic code with multiple species and linearized F-P collisions, agrees with measured C^{6+} and D^+ velocities inside the LCFS.

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