Abstract Submitted
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Orbit Modulation and Plasma Boundary Losses[1] T. STOLTZFUS-DUECK, PPPL — Ion orbit loss has long been invoked to explain mysterious near-separatrix observations including the L-H transition and edge intrinsic toroidal rotation. The basic idea is sound: Within about one poloidal gyroradius of the last closed flux surface (LCFS), some ions' drift orbits will intersect the divertor plate or vessel wall, causing those ions to be lost. However, orbit-loss models often struggle to maintain self-consistency: In steady state, the outgoing flux of ions on any given loss orbit should be restricted to the rate at which ions are supplied to that loss orbit, by turbulence, collisions, or otherwise. In this work, a general conservative gyrokinetic framework explicitly gives the steady-state orbit-loss boundary fluxes as a function of upstream transport (turbulent and collisional) and upstream sources. The details of the equilibrium orbits contribute only by modulating upstream transport and sources. The explicit reformulation of the orbit-loss terms facilitates their evaluation via numerical diagnostics or reduced models. For example, the orbit-modulation reformulation presents self-consistent avenues to determine the orbit-loss contribution to the edge toroidal rotation and E_r, and thereby to address questions like the L-H power threshold asymmetry.

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