

Neoclassical Plateau Regime Transport in a Tokamak Pedestal

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In subsonic tokamak pedestals the radial scale of plasma profiles can be comparable to the ion poloidal Larmor radius [1], thereby making the radial electrostatic field so strong that the $\mathbf{E} \times \mathbf{B}$ drift has to be retained in the ion kinetic equation in the same order as the parallel streaming when $B_{pol} \ll B$, with B_{pol} the poloidal magnetic field. The modifications of neoclassical plateau regime transport are evaluated in the presence of a strong radial electric field by using canonical angular momentum as the radial coordinate instead of the poloidal flux [2]. The ion heat flux is reduced for large values of the normalized electric field $U = v_{\mathbf{E} \times \mathbf{B}} B / (v_i B_{pol})$, where v_i is the ion thermal speed, as the resonance causing plateau transport is shifted towards the tail of the distribution, but it is enhanced if $U \approx 1$. Moreover, the poloidal ion and impurity flows are modified. The altered poloidal ion flow leads to a substantial increase in the bootstrap current in the pedestal where the spatial profile variation is strong because of the enhanced coefficient of the ion temperature gradient term near the electric field minimum. Unlike the banana regime [3], orbit squeezing does not affect the plateau regime results.

References

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