

Neoclassical Radial Electric Field and Transport with Finite Orbits

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Abstract

Neoclassical transport in a toroidal plasma with finite ion orbits is studied, including for the first time, the self-consistent radial electric field. Using a low noise δf particle simulation, we demonstrate that a deep electric field well develops in a region with a steep density gradient, because of the self-collision driven ion flux. We find that the electric field agrees with the standard neoclassical expression, when the toroidal rotation is zero, even for a steep density gradient. Ion thermal transport is modified by the electric field well in a way which is consistent with the orbit squeezing effect, but smoothed by the finite orbits.

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