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Electric field effects in a quasisymmetric stellarator[1] MATT LANDREMAN, PETER J. CATTO, MIT-PSFC — It was recently shown [1] that the radial electric field E_r can alter the neoclassical ion flow, heat flux, bootstrap current, and residual zonal flow in a tokamak, even if the ExB speed is small compared to the ion thermal speed. Here we show these calculations can be adapted to a quasisymmetric stellarator. The finite-E_r effects can be understood as finite-orbit-width effects associated with variation in the electrostatic potential over an orbit. The tokamak calculation uses $B_{poloidal}/B$ as a small parameter, and in the stellarator case, we use the fact that an analogous ratio of field components can be small. The quasisymmetry calculation also exploits conservation of the "helical momentum" ψ_*, which is used in place of the toroidal or poloidal flux as the radial variable. The calculations generalize the model collision operator in [1], which keeps only velocity-space derivatives normal to the trapped-passing boundary, even as this boundary is significantly shifted by a large ExB drift. We show E_r in HSX may be sufficient for these effects to be significant.

[1] G Kagan and P J Catto, Plasma Phys. Control. Fusion, 52, 055004 (2010).

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