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Gyrokinetic studies of neoclassical poloidal rotation with finite orbits. R.A. KOLESNIKOV, W.X. WANG, PPPL, F.L. HINTON, UCSD, R.E. BELL, S.M. KAYE, W.M. TANG, W.W. LEE, PPPL — A significant discrepancy of impurity poloidal rotation from local theoretical predictions is found in tokamak experiments. The amplitude of carbon poloidal velocity is observed to be smaller in NSTX [1] and larger in DIIID [2] and JET [3] devices compared to appropriate neoclassical estimates. We performed global neoclassical simulations of toroidal plasmas using GTC- NEO particle-in-cell delta-f code [4] with a new multiple ion- species capability. In case of large-aspect ratio tokamak with sharp toroidal flow profile, the difference between simulated carbon poloidal flow and neoclassical estimate is found to be due to presence of finite ion orbits. The dominant mechanisms underlying this nonlocal effect are identified to be due to ion orbit shearing and orbit squeezing. Such finite orbit mechanisms result in generation of additional parallel ion flow due to shear in the toroidal rotation and shear in the radial electric field accordingly. We also compare simulations as well as theoretical estimates based on identified nonlocal effects with some experimental data from NSTX as well as other magnetic configurations to clarify the role the nonlocal effects might have on observed poloidal velocity. [1] R.E. Bell, this meeting. [2] W. Solomon, Physics of Plasmas 13, 056116 (2006). [3] K. Crombe, EPS, Sopfia (2009). [4] W.X. Wang, Physics of Plasmas 13, 082501 (2006).

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