Poloidal velocity of impurity ions in neoclassical theory

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Abstract

A formula for the poloidal velocity of impurity ions in a two-species plasma is derived from neoclassical theory in the banana regime, with corrections from the boundary layer separating the trapped and transiting ions. The formula is applicable to plasmas with toroidal rotations that can approach the thermal speeds of the ions. Using the formula to determine the poloidal velocity of C^{+6} ions in a recently reported experiment [W.M. Solomon et al., Phys. Plasmas **13**, 056116 (2006)] leads to agreement in direction in the central region when it is otherwise from theories without strong toroidal rotations. Comparisons among these theories are made, demonstrating the degree of uncertainty of theoretical predictions.

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