Abstract Submitted
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Finite Ion Orbit Effects on Magnetic Islands in Toroidal Plasmas[1]

XINZHENG LIU, CHRIS HEGNA, UW-Madison — A kinetic theory for the interaction of an ion population with an isolated magnetic island in a tokamak plasma is presented. In this work, we examine islands whose characteristic widths are larger than the ion gyro radius but smaller than the ion banana width. In this regime, the ion response to the island has a non-local feature due to the curvature and B drifts. When solving the drift kinetic equation for the energetic ions, a change in coordinates is used to account for this behavior. A bounce averaging procedure is developed to separate out and solve the lower order distribution function. Constraint relationships found from transport equations and collision operators are used to determine the distribution function, which is treated in different velocity regions and rotation frequency values. The contribution to the perturbed current is composed of the helically flux surface-averaged bootstrap current and the perpendicular current, the neoclassical enhanced ion polarization current. The parallel current ($J_{\|}$) in response to the ions is calculated and compared with some recent numerical results [1]. Using this current in the "dispersion relation" found from asymptotic matching, the island width evolution equation is determined. A pair of self-consistent equations for the islands' width, w, and its propagation frequency, ω, is to be derived. The results are to be compared with calculations valid for large island width. [1] E. Poli et al., Nuclear Fusion **45**, 384 (2005).

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