The Effects of Energetic Ions on Magnetic Islands in Toroidal Plasmas

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A kinetic theory for the interaction of an energetic 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 energetic ion gyro radius but smaller than the energetic ion banana width. In this regime, the energetic ion response to the island has a non-local feature. When solving the drift kinetic equation for the energetic ions, a change in radial coordinate to the drift orbit is used to account for this behavior. After bounce averaging a kinetic equation for the ions, a lowest order distribution function is found. By considering the quasineutrality relation, the parallel current ($J_{//}$) in response to the energetic ions is calculated. Using this current in the "dispersion relation", 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 those for large island width so as to yield a description of magnetic island width evolution from sub-banana width to macroscopic scale lengths.

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