Finite Orbit Analysis in Tokamak Plasmas

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Abstract

The orbits of particles in the core region of a rotating tokamak plasma are analyzed. It is found that the phase space topologies of finite orbits differ significantly from those of thin orbit considerations. Specifically, in the absence of rotations, the trapped-passing boundary of co-moving particles has a finite extent in energies and disappear above a critical energy; and the pitch angle of the boundary has a rather strong energy dependence. Rotation and rotation shear cause significant shifts of this boundary in phase space so that above certain thresholds this boundary disappears. The finite orbit analysis also leads to improved analytic formulae for orbit averaged quantities of interest.

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