Chaotic Transport in Reverse-Shear Tokamaks

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We present results of transport in reverse-shear tokamaks. First, we discuss the topology of chaotic magnetic field with reversed shear near the tokamak wall. Examples are presented by investigating magnetic configurations created by different perturbing ergodic limiter currents. For these configurations, we obtain exit basins, or sets of points in the chaotic region with field lines hitting the wall in some indicated area, and areas in the wall with equal poloidal angular lengths. The results are obtained by using a properly introduced nontwist mapping. For a perturbing resonant magnetic field with a fixed helicity, the observed escape pattern changes with the perturbation intensity. Thus, for a small amplitude perturbation, the field line escape spreads over the studied regions, but increasing the amplitude the escape concentrates on the external equatorial region. Second, to estimate the anomalous particle transport caused by the observed electrostatic turbulence, we adopted a model that describes the trajectory of the guiding center of a particle in a uniform magnetic field perpendicular to a radial reverse-shear electric field perturbed by drift waves. The integrable drift produced by the radial electric field is modified by periodic perturbations representing the fluctuations of the electric field associated to the drift waves. In this way we obtain chaotic orbits that determine the particle radial transport. Thus, we obtain diffusion coefficients with the same order of magnitude of those obtained for plasma discharges in tokamaks.