Calculation of Liapunov lengths for the simple map for divertor tokamaks

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The fraction $f_{20}$ of field lines starting inside the last good surfaces for which the ratio $l/l_L > 20$ before striking the collector plate in divertor tokamaks is calculated as a function of magnetic asymmetries and radial diffusion of guiding centers. $l$ and $l_L$ are the length travelled by the field line and the Liapunov length corresponding to the largest Liapunov exponent for the field line. Magnetic topology of divertor tokamaks is represented by the simple map \cite{1}. Simple map is the simplest symplectic map that has the generic magnetic topology of divertor tokamaks. Radial diffusion of particles is represented by the radial expansion coefficient $D$. Magnetic asymmetries are represented by map parameter $k$, as in the standard map. $f_{20}$ is calculated as a function of $k$ and $D$. For magnetic perturbations of $10^{-3}$ or higher and $D$ around $10^{-6}$, $f_{20}=1$. This is in agreement with Boozer prediction \cite{2}. Magnetic perturbations of $10^{-3}$ and radial diffusion of $10^{-6}$ can be critical for plasma confinement. This work is supported by the US DOE grants DE-FG02-01ER54624 and DE-FG02-04ER54793. This research used resources of the NERSC, supported by the Office of Science, US DOE, under contract DE-AC02-05CH11231.
