Nonresonant stellarator divertor with broken stellarator-symmetry

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Recently a new and efficient method for simulation of stellarator divertors [1] was developed. The plasma interaction with the fixed magnetic field of a divertor is diffusive but is far more efficiently studied by adding a small radial velocity to an integration of the magnetic field lines. This method was used to study nonresonant stellarator divertors [2]. It was found that when the velocities are high, the diffusing field lines go into two families of magnetic turnstiles; and when the velocities are small, the field lines go into only a single family of magnetic turnstiles. The footprints are stellarator-symmetric and have fixed locations on wall for all radial velocities [2]. Here a new stellarator-symmetry breaking term is added to the Hamiltonian for the trajectories of magnetic field lines in nonresonant stellarator divertor. The simulation method developed in [1] is used. Except for the addition of the new term, all the other parameters are kept same as in the study reported in [2]. Magnetic field lines are given an artificial radial velocity in the toroidal flux space. This is done to allow the field lines to explore the magnetic topology of the stochastic region outside the outermost confining surface. Trajectories of radially diffusing magnetic field lines and footprints on wall in nonresonant stellarator divertor with broken stellar symmetry are calculated. The results of this study of the effects of broken stellarator symmetry in nonresonant stellarator divertor will be presented. This work is supported by the U.S. DoE Grant No. DE-FG02-01ER54624 to Hampton University and DE-FG02-95ER5433 to Columbia University. The research used NERSC resources, supported by the Office of Science under Contract No. DE-AC02-05CH11231.

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