Abstract Submitted
for the DPP05 Meeting of
The American Physical Society

Creation of Barriers Inside Chaos in Tokamaks with Mixed Symplectic Representation JOSHUA MOLONEY, HALIMA ALI, ALKESH PUNJABI, Hampton University — The simplest map that represents the topology of one and a half degree of freedom Hamiltonian and near Hamiltonian systems is the Simple Map (SM), given by

$$x_{n+1} = x_n - k\partial S(x_{n+1}, y_n)/\partial y_n, \quad y_{n+1} = y_n + k\partial S(x_{n+1}, y_n)/\partial x_{n+1}.$$

Behavior of such systems near the hyperbolic fixed point is generic. The unperturbed generating function for the SM is $S_0 = \frac{1}{2}x_{n+1}^2 + \frac{1}{2}y_n^2 - \frac{1}{3}y_n^3$. Here we derive the perturbed Simple Map that includes the effects of resonant modes (m,n)={(4,3),(4,2)} in single-null divertor tokamaks with q_{edge} =3 corresponding to the map parameter k=0.6. We show that the perturbed map is symplectic. We calculate generation of chaos due to the resonant modes. We derive the perturbed map with a barrier inside the chaos by addition of a term of the order δ^2 to create an invariant torus at the location of the barrier. We show that the perturbed map with barrier is also symplectic. It is already shown that an invariant torus can be created inside chaos when the unperturbed generating function S_0 is pure, i.e., it depends only on momentum (see previous two posters). Here we examine whether it is possible to create an invariant torus inside chaos when the unperturbed geometry is mixed, i.e., when S_0 depends on both the generalized momentum and position. This work is supported by the US DOE OFES and NASA.

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Date submitted: 19 Jul 2005 Electronic form version 1.4