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Symplectic homoclinic tangles of the ideal separatrix of the DIII-D from type I ELMs ALKESH PUNJABI, HALIMA ALI, Hampton University — The ideal separatrix of the divertor tokamaks is a degenerate manifold where both the stable and unstable manifolds coincide. Non-axisymmetric magnetic perturbations remove the degeneracy; and split the separatrix manifold. This creates an extremely complex topological structure, called homoclinic tangles. The unstable manifold intersects the stable manifold and creates alternating inner and outer lobes at successive homoclinic points. The Hamiltonian system must preserve the symplectic topological invariance, and this controls the size and radial extent of the lobes. Very recently, lobes near the X-point have been experimentally observed in MAST [A. Kirk et al, PRL 108, 255003 (2012)]. We have used the DIII-D map [A. Punjabi, NF **49**, 115020 (2009)] to calculate symplectic homoclinic tangles of the ideal separatrix of the DIII-D from the type I ELMs represented by the peeling-ballooning modes (m,n)=(30,10)+(40,10). The DIII-D map is symplectic, accurate, and is in natural canonical coordinates which are invertible to physical coordinates [A. Punjabi and H. Ali, POP **15**, 122502 (2008)]. To our knowledge, we are the first to symplectically calculate these tangles in physical space. Homoclinic tangles of separatrix can cause radial displacement of mobile passing electrons and create sheared radial electric fields and currents, resulting in radial flows, drifts, differential spinning, and reduction in turbulence, and other effects. This work is supported by the grants DE-FG02-01ER54624 and DE-FG02-04ER54793.

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