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Simulations of Nonlinear ELM Instabilities in Tokamaks[1] T.E. EVANS, General Atomics, A. WINGEN, K.H. SPATSCHEK, Heinrich-Heine University, C.J. LASNIER, Lawrence Livermore National Laboratory — A model describing the 3D nonlinear evolution of ELMs in DIII-D has been developed. The model invokes field-aligned currents flowing through short flux tubes embedded in the pedestal plasma that connect the outer to the inner target plate. These flux tubes are initially formed by field-errors and a field-error correction coil. Magnetic perturbations due to these currents cause the separatrix topology to evolve which increases the area of the flux tubes and the magnitude of the current. This creates a positive feedback loop. Simulation results are compared to fast IR camera images of ELM heat flux in the divertor. Good agreement between the calculated magnetic structures on the divertor components and camera images during an ELM cycle is found. The simulation predicts a bifurcation from an $n = 1$ homoclinic tangle and an $n = 2$ heteroclinic tangle as the separatrix topology evolves during the growth of an ELM. Implications for suppressing ELMs with external magnetic perturbations are also discussed.

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