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Fully kinetic simulation of thermal quench in an open field line plasma JUN LI, XIANZHU TANG, Los Alamos National Laboratory, LOS ALAMOS NATIONAL LABORATORY TEAM — The thermal quench in a class of tokamak disruptions is tied to plasma transport in 3D magnetic fields that have open field lines connecting the core to the wall surface. The parallel electron heat flux is thought to be the primary culprit for a core thermal collapse from 10 keV to 100 eVs over a ms. When the magnetic connection length becomes comparable to electron mean free path, one can have a thermal collapse dominated by parallel transport of extreme kinetic character. These bring considerable challenges not only in the physics itself but also in the choice of proper physics models. Here we performed fully kinetic 1D VPIC simulations to study thermal collapse in open field lines intersecting cold walls. We found that the electron flux is dominated by the parallel component, while the ion perpendicular flux can contribute significantly to the net ion flux towards the wall, hence has an important role in maintaining the ambipolarity. We also found that the electron and ion parallel heat fluxes deviate greatly from the collisional theory due to the non-Maxwellian distributions. This research used resources of NERSC, and was supported by DOE OFES and OASCR through the base theory and Tokamak Disruption Simulation (TDS) SciDAC project.

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