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Simulation of runaway electrons in tokamak ZEHUA GUO, XIANZHU TANG, CHRIS MCDEVITT, Los Alamos National Laboratory — Runaway electrons with relativisitc energy (>Mev) are generated in tokamaks when the acceleration by parallel electric field exceeds the drag due to Coulomb collisions with the bulk plasma. Carrying about 70% of the ITER thermal current (15MA), they can possibly cause severe damage to tokamak facing components. Here we report the development of a solver for computing the evolution of runaway electron distribution in tokamak geometries. Essential effects from Coulomb collisions, radiation losses, toroidal effects and the radial transport are included on the same footings. Numerical techniques (implicit-explicit time-stepping, KT/NT central schemes) to overcome the difficulties arising from the wide spread of time scales in runaway electron dynamics and the hyperbolic nature of the relativistic Fokker-Planck equation will be discussed. We will use the solver to study two important physics: 1) the presence of stable point in the phase space and its relation to the electric field threshold [1]; 2) the radial transport of runaways in tokamak geometry [2] and its effects on the distribution function. Work supported by DOE via LANL-LDRD.

[1] P. Aleynikov & B. Breizman, Phy. Rev. Lett. 114, 155001 (2015).
[2] X. Guan, H. Qin, N. Fisch, Phy. Plasmas 17, 092502 (2010).

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