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Largescale Long-term particle Simulations of Runaway electrons in Tokamaks[1] JIAN LIU, HONG QIN, YULEI WANG, University of Science and Tech of China — To understand runaway dynamical behavior is crucial to assess the safety of tokamaks. Though many important analytical and numerical results have been achieved, the overall dynamic behaviors of runaway electrons in a realistic tokamak configuration is still rather vague. In this work, the secular full-orbit simulations of runaway electrons are carried out based on a relativistic volume-preserving algorithm. Detailed phase-space behaviors of runaway electrons are investigated in different timescales spanning 11 orders. A detailed analysis of the collisionless neoclassical scattering is provided when considering the coupling between the rotation of momentum vector and the background field. In large timescale, the initial condition of runaway electrons in phase space globally influences the runaway distribution. It is discovered that parameters and field configuration of tokamaks can modify the runaway electron dynamics significantly. Simulations on 10 million cores of supercomputer using the APT code have been completed. A resolution of 10^7 in phase space is used, and simulations are performed for 10^{11} time steps. Largescale simulations show that in a realistic fusion reactor, the concern of runaway electrons is not as serious as previously thought.

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