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Probability and critical electric field for electron runaway CHANG LIU, DYLAN BRENNAN, Princeton University, ALLEN BOOZER, Columbia University, AMITAVA BHATTACHARJEE, Princeton University — It is very important that we understand the physics of the runaway electron avalanche, both due to the need for runaway mitigation in disruptions in ITER, and the pure scientific merit. In this work we developed a new method to obtain the probability of an electron in momentum space to run away, by solving a time-independent PDE, alleviating the need for Monte-Carlo simulation. This PDE turns out to be adjoint to the electron kinetic equation. The new method is applied to calculate the avalanche growth rate and the threshold electric field. The results show that in the presence of synchrotron radiation and pitch angle scattering, the threshold electric field for the avalanche growth will increase to a value that is higher than the Connor-Hastie electric field. A series of kinetic simulations are conducted which confirms the findings. We also did a time-dependent simulation with increasing plasma density to simulate the gas-puffing runaway electron experiments in DIII-D, and the hard X-ray signal result shows qualitative agreement with the experiments for the threshold electric field.

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