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Numerical Simulation of the Hot-Tail Runaway Electron Production Mechanism Using CQL3D and Comparison with Analytical Methods[1] YU. V. PETROV, CompX, P. B. PARKS, GA, R. W. HARVEY, CompX
— The hot tail mechanism of runaway electron (RE) production [1] is the primary source of RE in the case of rapidly cooling tokamak plasma. Quantifying this mechanism is very important as it can provide most of the post-thermal-quench (TQ) current, or a seed current for the secondary source of RE through the avalanche mechanism. An analytic model which omits pitch-angle scattering is often used in literature for estimating the hot tail RE density [2], though a thorough numerical verification of its validity has not been performed. In the present study, we use the CQL3D bounce-averaged Fokker-Planck code [1,3] to test the limits of validity of the model. In particular, we examine the cases of Z=1 and Z=18 ions, for sets of different initial temperature, density, electric field and the characteristic time of temperature decay. This is a more extensive comparison than in [4]. We show that for Z=1 plasma, CQL3D results closely match the model with spherical critical-speed boundary in phase space. For Z=18 case, the model over-estimates the RE density by factor of 2-10, comparing to CQL3D runs that include pitch-angle scattering. [1] R.W. Harvey, V.S. Chan, S.C. Chiu et al., Phys. Plasmas **7**, 4590 (2000). [2] H.M. Smith and E. Verwichte, Phys. Plasmas **15**, 072502 (2008). [3] R.W. Harvey and M.G. McCoy, www.compxco.com/cql3d.html. [4] A. Stahl, O. Embreus, et al., Nucl. Fus. **56**, 112009 (2016).

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