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Lifetime and Universal Distribution of the Seed Runaway Electrons ADRIAN FONTANILLA, BORIS BREIZMAN, Institute of Fusion Studies, University of Texas at Austin — The lifetime (LT) of pre-existing runaway electrons (RE) determines how likely the RE will undergo avalanche multiplication. We calculate the LT of RE via the kinetic equation (KE). We show that the rate of thermalization of RE depends on the value of the parameter $\alpha \equiv (Z+1)/\sqrt{\tau_{rad}}$ (where τ_{rad} is the synchrotron time scale normalized to the collisional and Z is the ion charge) compared to the electric field. We identify two cases where the rate is slow enough to enable a transformation of the KE into an eigenequation; the eigenfunction typifies the shape of the distribution function and the eigenvalue is the LT. In one case, $\alpha^2 \ll 1$: the field required to sustain the pre-existing runaways is barely larger than the Connor-Hastie field, E_C. In the same manner as Aleynikov and Breizman[1] we solve the KE perturbatively but extend the work to demonstrate that the LT grows exponentially with the field at a rate that depends on α. In the second case, $\alpha^2 \gg 1$: the requisite field is much greater than E_C. The largeness of the field in this case enables us to universalize the KE via rescaling procedure.

[1]P. Aleynikov and B.N. Breizman *PRL 114*, 155001 (2015)

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