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Topological Depedendence of Runaway Avalanche Threshold in Momentum Space[1] CHRISTOPHER MCDEVITT, ZEHUA GUO, XIAN-ZHU TANG, Los Alamos National Laboratory — A detailed study of the physics responsible for the formation of an avalanche instability of runaway electrons is carried out. A set of large-angle collision operators of varying complexity, ranging from a simple source term to a novel energy-momentum conserving form, are developed and implemented. The use of a conservative form allows for the back reaction of the secondary electrons onto the primary electrons to be accounted for. The incorporation of this feedback process requires the modification of the Coulomb logarithm in order to avoid double counting collisions. A systematic procedure for delineating small and large angle collisions, and thus avoiding the double counting of collisions, is developed. It is found that the avalanche threshold is tightly linked to the merger of an O and X point in the momentum space of the primary electrons. Such a close correlation is shown to be largely independent of the details of the large-angle collision operator employed, and thus provides a robust indicator of an avalanche instability.

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