**Measurements of the seed of runaway electrons and its core transport and growth using a novel multi-energy SXR pin-hole camera**

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Abstract

New observations of the seed formation and dynamics of the birth conditions of runaway electrons (REs) have recently been carried out at the Madison Symmetry Torus (MST). The use of a newly developed versatile multi-energy soft x-ray (SXR) pinhole camera provides unprecedented improvement in throughput and signal-to-noise-ratio thus enabling early-detection, imaging (Dr/a~2%, Dt~1 ms) and energy discrimination at Ephoton~20-300×Te,0; the latter is of great advantage over conventional REs studies conducted in large tokamaks with electron temperatures of few keV and electron energies up to 1-60 MeV with Ephoton~(1-60)×103 ×Te,0. The formation of an off-axis seed with an initial linear growth at Ef/ED~0.1-0.2 (ED being the Dreicer field) has been clearly resolved for photon energies Ephoton~20-40×Te,0; the emergence of the seed population in the plasma periphery instead of that in at the magnetic axis is consistent with a lower electron-density and Dreicer fields. Spatially dependent exponential growth rates have also been resolved for the first time and are consistent with a “hot-component” increasing its characteristic energy up to 103×Te,0. Seed calculations using a newly developed Backward Monte Carlo code computing the RE generation in space- and time-dependent dynamic scenarios including radial transport - with a forward synthetic ME-diagnostic capability - will also be presented. New data will also showcase the radial time-history effects of resonant magnetic perturbations (RMPs) with poloidal mode number *m*=3 in the suppression of runaway electrons.