

Laser Inverse Compton Scattering on Relativistic Electrons in a Tokamak*

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During a disruption in a tokamak plasma, current carrying electrons can be accelerated to multi-MeV energies, which can cause severe damage to wall components. Conventional ways to study these relativistic electrons include observation of synchrotron and bremsstrahlung radiation. But these measurements are line integrated, and it is difficult to unfold the original runaway electron source distribution. However, just as Thomson scattering is used to measure the thermal electron distribution properties, one can use Inverse Compton Scattering (1) to measure the relativistic electron distribution properties, pointwise in space, and with excellent time resolution. Progress in the design and component testing this new (never before attempted on a fusion experiment) diagnostic using Laser Inverse Compton Scattering to measure runaway electrons in the range of 3-30 MeV in the DIII-D tokamak during triggered disruptions is reported (2). An 80 picosecond, 2-5 Joule, rep-rated (100 Hz) Nd:Yag laser is being developed at Voss Scientific. A LANL gated soft x-ray imager (developed for NIF) has been tested on the synchrotron Advanced Photon Source at Argonne. A synthetic diagnostic model has been developed in Matlab. Finally, a suitable tangential port has been identified on the DIII-D tokamak, and a diagnostic design package is being prepared.

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(1) G. A. Wurden, J. A. Oertel, T. E. Evans, Rev Sci. Instr. 85(11), 11E111, (2014)

(2) G. Wurden, T. Archuleta, J. Coleman, J. Oertel, Z. Wang, T. Weber, T. Evans, S. Woodruff, P. Sieck, E. Hollmann, D. Offermann, APS-DPP 2019, poster, Ft. Lauderdale, Florida.

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