"The Physics of Runaway Electrons in a Tokamak Disruption," Xianzhu Tang (Los Alamos National Laboratory)

Date:
Thursday, December 5, 2019 - 1:00pm to 2:00pm
Series:
Plasma Seminars

Tokamak disruption is a rapid termination of the plasma discharge, either due to plasma instabilities or by design (e.g. fast shutdown of the reactor for operational safety). It begins with a rapid loss of the plasma thermal energy, known as the thermal quench, and is followed by a more gradual dissipation of the plasma current, known as the current quench. For ITER, thermal quench is anticipated to be on millisecond time scale, while the current quench lasts 100 milliseconds or so. The most outstanding challenge of disruptions to tokamak fusion is the formation of relativistic electrons, as a result of runaway acceleration by the inductive electric field. Here we explain the fascinating physics of how quantum electrodynamics and quantum mechanics come together with classical statistical mechanics and Maxwell equations to conjure a fearsome scenario in which a relativistic electron beam of many mega-amperes can naturally arise inside the plasma from the initial seed of even a single rebellious electron. An emphasis will be placed on the fundamental physics that lay out both the options and constraints on disruption mitigation.

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Location:
PAB 4-330