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2D Te patterns of various disruptive events and retardation of turbulence-associated disruption with the non-resonant magnetic field

In KSTAR experiments, various disruptive events are identified by a local 2D electron temperature (Te) fluctuation diagnostics known as the electron cyclotron emission imaging diagnostics. We will introduce distinct 2D Te patterns of different disruptive events to elucidate the importance of 2D measurements for early detection of the events. Observations include off-normal sawtooth crashes, ballooning fingers during a density limit disruption, external kink driven disruptions, single and multi-mode minor disruptions, a major disruption by coalescence of cold bubbles, and Te turbulence-associated fast minor disruption. Among the various cases, the last two are thought to be driven by the interaction between the ambient turbulence and a magnetic island. In particular, for the last case, the Te turbulence level near the X-point of the 2/1 magnetic island becomes significantly enhanced just before disruption. In order to avoid such an explosive disruption, we applied the non-resonant magnetic field to change the flow/pressure profile which can affect the turbulence level. We observed that the poloidal flow is increased with the non-resonant field and the disruption is retarded with the reduced turbulence level. Comparing the cases with and without significant turbulence, the time scale of the turbulence-associated disruption is about 5—10 times shorter. Anomalous dissipation by the turbulence may be responsible for this difference.

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