EX/P4-13 · Characterization of Axisymmetric Disruption Dynamics toward VDE Avoidance in Tokamaks

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Abstract: Disruption experiments on Alcator C-Mod and ASDEX-Upgrade tokamaks and axisymmetric MHD simulations using the TSC have explicated the underlying mechanisms of Vertical Displacement Events (VDEs) and a diversity of disruption dynamics. First, the neutral point, which is known as an initial vertical plasma position advantageous to VDE avoidance, is shown to be fairly insensitive to plasma shape and current profile parameters, while the VDE rate significantly depends on those parameters. Secondly, it is clarified that a rapid flattening of the plasma current profile frequently seen at the thermal quench drags a single null-diverted, up-down asymmetric plasma vertically toward divertor, whereas the dragging effect is absent in up-down symmetric limiter discharges. As a consequence, the occurrence of downward-going VDEs predominates over the upward-going ones in bottom-diverted discharges, being consistent with experiments in ASDEX-Upgrade. Together with the attractive force that arises from passive shell currents induced by the current quench and vanishes at the neutral point, the dragging effect explains many details of the VDE dynamics over the whole period of disruptive termination.

EX/P4-14 · Disruption Studies in ASDEX Upgrade

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Abstract: Disruption generate large thermal and mechanical stresses on the tokamak components. For a future reactor disruptions have a significant impact on the design since all loading conditions must be analyzed in accordance with stricter design criteria (due to safety or difficult maintenance). Therefore the uncertainties affecting the predicted stresses must be reduced as much as possible with a more comprehensive set of measurements and analyses in this generation of experimental machines, and avoidance/predictive methods must be developed further. The study of disruptions on ASDEX Upgrade is focused on these subjects, namely on: (1) understanding the physical mechanisms leading to this phenomenon and learning to avoid it or to predict its occurrence (with neural networks, for example) and to mitigate its effects; (2) analyzing the effects of disruptions on the machine to determine the functional dependence of the thermal and mechanical loads upon the discharge parameters. This allows to dimension or reinforce the machine components to withstand these loads and to extrapolate them to tokamaks still in the design phase; (3) learning to mitigate the consequence of disruptions.

EX/P4-15 · Current Ramp-up Experiments in Full Current Drive Plasmas on TRIAM-1M

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Abstract: Four types of plasma current ramp-up experiments were executed on TRIAM-1M in full lower hybrid current drive (LHCD) plasmas; 1) the current start up by the combination between electron cyclotron resonance heating (ECH) and LHCD, 2) the tail heating by additional LHCD, 3) the bulk heating by ECH, 4) the spontaneous ramp up by the transition to enhanced current drive (ECD) mode. The start-up of the plasma current utilizing the combination of plasma production by ECRH and subsequent current drive by LHCD was obtained. The conversion efficiency of RF power to the poloidal magnetic energy reached more than 9% in the tail heating as well as the bulk heating and the values of the estimated effective RF power were ~100%. In fact, the direct loss of energetic electrons measured with thermal input to the movable limiter was less than 1% of the injected RF power in the tail heating discharges with and without ECD mode.