Abstracts

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Tokamak disruptions: their physics and mitigation

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Tokamaks such as ITER are currently the most technologically advanced nuclear fusion reactor candidates. Tokamaks require a multi-megaampere toroidal plasma current to maintain the plasma confinement. The better the confinement, the hotter the plasma, and the easier it is to drive said current. This kind of positive feedback cycle is however susceptible to interruptions, such as operational limits, large MHD modes or technical problems. These can lead to the sudden uncontrolled termination of the plasma discharge, called a disruption.

During a disruption the total thermal+magnetic energy content of the plasma is released, which can result in localised heat loads, electromagnetic forces, and runaway electron beam hits. Unmitigated disruptions are therefore not tolerable in a reactor relevant device. Even with advanced prediction and avoidance in place, disruption mitigation is necessary to guarantee the integrity of the reactor chamber.

In this presentation I will give a brief overview of some common disruption causes, methods of prediction and avoidance. I will discuss in larger detail the present and planned future mitigation methods, such as massive gas injection and shattered pellet injection.