Disruption physics studies at JET

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Disruptions are a major concern for future nuclear fusion experiments such as ITER because the fast release of high thermal and magnetic energies will result in large forces and heat loads. The study of disruption physics has been a major part of the programme at JET, which is presently the tokamak operating at parameters closest to ITER. Following the installation of the ITER-like wall (ILW) at JET, the disruption characteristics have significantly changed: e.g. longer current quench times are leading to larger disruption forces and less radiating impurities during the disruption result in high heat loads and temperature rise of the Be-tiles beyond the melt limit. In light of these findings, JET has imposed the mandatory use of disruption mitigation valves (DMV) and launched a number of experiments to determine the radiation efficiency during disruptions, to assess the reduction of vessel forces and to monitor the appearance of runaway electrons in massive impurity gas injection (MGI) terminated pulses.

In this lecture an overview will be given on the root causes leading to disruptions at JET, mitigation strategies for vessel forces and heat loads, studies of the impact on plasma facing components, generation and avoidance of runaway electrons in an ITER-like all-metal wall environment. Technologies for disruption prediction and detection will be covered in a separate lecture.

*See the Appendix of X. Litaudon et al., Proc. of the 26th IAEA Fusion Energy Conf. 2016, Kyoto, Japan