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PD/P8-07: Progress in the Understanding of the Neo-classical Tearing Mode through Nonlinear Gyro-kinetic Simulations

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Islands in the magnetic field topology generated by the Neoclassical tearing mode (NTM) represent a serious concern for a tokamak reactor as they can act as a trigger of disruption events and limit the achievable plasma pressure and, therefore, the achievable fusion power. It has been experimentally observed that the NTM exhibits a threshold behaviour, with magnetic islands having to achieve a specic size before the mode becomes unstable. Two theoretical explanations for such a threshold mechanism have been widely discussed in the literature. Firstly the effect of the polarisation current connected with the island rotation, and secondly, the finite radial transport across the island that can prevent the attening of the pressure inside the island and, therefore, prevent the bootstrap drive of the NTM to form. In this paper signicant new contributions to the understanding of both mechanisms is presented. The nonlinear gyro-kinetic simulations that have been undertaken for these studies have furthermore uncovered several new physics phenomena that occur in the presence of the modifed magnetic topology.

Country or International Organization of Primary Author

Germany

Primary author: Mr HORNSBY, William (Germany)

Presenter: Mr HORNSBY, William (Germany)

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