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Probing ELM Triggers in ASDEX Upgrade with Conventional Reflectometry

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Edge Localized Modes (ELMs) have been associated with precursor oscillations that grow in amplitude leading to the ELM crash. However, the presence and characteristics of these precursors vary significantly across different tokamaks, ELM types, and plasma conditions. In ASDEX Upgrade, for example, the conditions for detecting magnetic precursors remain unclear. Nevertheless, signatures of ELM precursors have been reported in the edge electron temperature and electron density.

Recent research employed a synthetic framework to analyze the response of conventional O-mode reflectometry (simulated using the REFMUL code) during a Type-I ELM cycle reproduced by non-linear magnetohydrodynamic simulations (JOREK code). These simulations identified growing non-axisymmetric perturbations as ELM precursors, which were also linked to density fluctuations detectable by the synthetic reflectometer operating in a fixed-frequency mode. Building on this work, we investigate further the characteristics of the ELM triggering mechanisms and their link to density fluctuations. Additionally, we report on experimental efforts to use the conventional O-mode diagnostics at ASDEX Upgrade in probing ELM triggers.

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