Contribution ID: **375** Type: **Poster**

TH/P3-23: Behavior of Magnetohydrodynamics Modes of Infernal Type at H-mode Pedestal with Plasma Rotation

Wednesday, 10 October 2012 08:30 (4 hours)

Magnetohydrodynamics instabilities of high-mode (H-mode) pedestal are investigated in this paper with the inclusion of bootstrap current for equilibrium and rotation for stability. This may help clarify the physics of edge localized modes (ELMs) and edge hormonic oscillations (EHOs) or outer modes (OMs). The equilibrium of an H-mode discharge at the Jointed European Torus (JET) is reconstructed numerically using VMEC code. It is found that with bootstrap current taken into account, a safety-factor reversal or plateau can be generated near plasma edge. This confirms previous results of numerical equilibrium reconstructions using other types of codes. The low n magnetohydrodynamic instabilities, where
n is toroidal mode number, are investigated numerically in this type of equilibria using the AEGIS code. It is found that infernal type harmonic can prevail at safety-factor reversal or plateau region. The toroidal plasma rotation effect related to continuum damping is investigated. The numerical results show that the frequency of marginally stable modes is close the value of rotation frequency at pedestal top, when the value of safety factor at plateau is slightly above a rational number. This mode frequency seems to coincide with experimental observation of the frequencies of edge harmonic oscillations (or outer modes) at quiescent H-mode. We also find that MHD instabilities of such a type of equilibria are sensitive to how close to a rational number the q value at q-plateau is and the distance of the q-plateau to plasma edge. Comparison with experimental observations will also be discussed.

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Session Classification: Poster: P3

Track Classification: THS - Magnetic Confinement Theory and Modelling: Stability