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EX/P4-32: Triggerless Onset and Effect of "Natural" Rotation on Neoclassical Tearing Modes in the TCV Tokamak

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Plasma rotation affects significantly the performance and stability of tokamak plasmas and is a major object of research both for first principles physics and applications.In the TCV tokamak spontaneous plasma toroidal rotation in absence of external momentum is observed and it is found experimentally that central electron cyclotron heating (ECH) and current drive (ECCD) can modify the rotation profile. The presence of MHD modes is known to produce magnetic viscosity that flattens the toroidal rotation profile over the whole central region,up to the rational surface of the corresponding mode. This work presents new experimental evidence of the interplay of plasma rotation and the onset of of m/n=3/2 and 2/1 tearing instabilities the neoclassical regime in absence of sawteeth or other trigger event, such as ELMs and fishbones. The evolution of these modes seems to be characterized, initially,by a conventional growth rate, driven by the ECH induced modification of the plasma current density profile followed by an NTV flattening of the core rotation profile,and then,by a neoclassical behaviour during the EC power ramp. During this stage the rotation is forced below the ion diamagnetic velocity and it may change the sign of the ion polarization current. This genuinely triggerless mechanism for NTM onset is investigated here experimentally for the first time with obvious relevance to ITER. The experiments, carried out on the TCV tokamak, give a direct measurement of the association of the change of the plasma rotation frequency and NTM onset in absence of other trigger events, which can be compared with theoretical expectations and related to the instability tearing parameter and other terms in the modified Rutherford equation.

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