Interaction between tearing modes and an ergodic plasma boundary

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The dynamic ergodic divertor (DED) was installed in TEXTOR. It consists of 16 helical coils which are aligned resonant to the $q = 3$ surface in the plasma [1]. The DED allows to be operated with toroidal and poloidal mode numbers $m/n = 12/4$, 6/2, and 3/1. In all of these configurations can be operated statically (with DC current), and dynamically with very low (2Hz), or high frequencies up to 10kHz. The DED is designed to create an ergodic plasma boundary. The investigation of this ergodic layer is ongoing.

Under some plasma conditions the temporal evolution of tearing modes in the plasma is found to depend on the applied perturbation field. At TEXTOR ($R = 1.75$ m, $a = 0.46$ m) we use a neutral beam injector ($P_{NBI} = 1.4$ MW) and low densities ($n_e = 1.5 \cdot 10^{19}\mathrm{m}^{-3}$) to excite large sawtooth crashes, which have a repetition rate of $\Delta t = 80$ ms. It was found, that in some cases after these crashes, an intensive 2/1 tearing mode is excited, which vanishes in most cases within $t = 30$ ms.

If the perturbation field of the DED is applied (DED is used in 12/4 configuration, which has a small radial penetration depth of its perturbation field), there is high probability, that this 2/1 tearing mode grows in amplitude and finally locks. About 30 ms later a disruption occurs. It was found, that there is a strong dependence of this stability limit to the edge safety factor q_a. If the edge safety factor is lower than $q_a = 4$ the mode lock occurs, whereas for higher values the 2/1 tearing modes decays.

[1] Special Issue, Fusion Eng. Design **37** 335 (1997)