Alfvén wave excitation by magnetic perturbations at TEXTOR

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At TEXTOR ($R = 1.75$ m, $a = 0.46$ m) new MHD-instabilities have been identified, which typically are excited by large $2/1$ tearing modes[1]. These Alfvén-waves can be detected in ohmic and slightly heated discharges.

TEXTOR is equipped with the Dynamic Ergodic Divertor(DED)[2]. For a controlled excitation of a $m/n = 2/1$ tearing mode, the Dynamic Ergodic Divertor in its $m/n = 3/1$ configuration has been used. Large natural tearing modes are also often accompanied by these new modes. These appear in pairs, rotating in opposite direction at a frequency in the range of $f \approx 20 - 25kHz$. The estimated mode numbers, clearly show the change in their rotation direction. The frequency separation of both modes is exactly twice the frequency of the $2/1$ mode. A rotating perturbation field at $f = 1kHz$ and also $f = 3.75kHz$ can be chosen, which was applied for several seconds to excite the $2/1$ tearing mode. This leads to a frequency splitting of the new modes of $f = 2kHz$ and $f = 7.5kHz$ respectively. During this time, the different discharge parameters were modified. No influence of T_e on the mode spectrum was detected. An inter-machine frequency scaling (FTU[3], TEXTOR[4]) for these modes show a clear dependence on $B_0/\sqrt{n_e}$, indicating an Alfvén-like behaviour. An additional influence on the frequency of these Alfvén-like modes, comes from the island width. Up to now no clear critical island width was identified. An increasing island width leads to a frequency increase of up to 20%.

For the first time, these investigations were performed in discharges with different operating gases. Discharges with a majority gas of Hydrogen, Deuterium and later on Helium were done. The frequency of the Alfvén-like modes show a clear dependency on the ion mass. Considering the averaged Z_{eff}, the frequency of these modes scale with $B_0/\sqrt{mn}$. Latest results for pure ohmic discharges show, that the Alfvén-waves, in case of DED excited 2/1 tearing modes, are detected also up to 200ms before the onset of the 2/1 tearing mode. These results are under current investigation.

[1] O.Zimmermann et al., EPS 2005
[2] Special Issue, Fusion Eng. Design **37** 335 (1997)
[3] P. Buratti et al., Nuclear Fusion **45**, No. 11, 1446-1450 (2005)
[4] P. Buratti, O.Zimmermann, et al., EPS 2005