Research on the effect of non-resonant magnetic perturbations on low-q limit in J-TEXT tokamak

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The disruption is one of the biggest challenges for the future fusion device and can occur for a variety of reasons. Among these are well known operating limits related to the plasma pressure and density, and with high plasma current or low edge safety factor (q_a) operation [1,2]. For the low edge q disruptions, they are avoided by rotation transform supplied by the stellarator coils on CTH [3]. And the experimental results on J-TEXT indicate that the applied resonant magnetic perturbations (RMPs) can lower the limit of the edge q. However, RMPs with too large amplitude leads to a higher q_a limit and an earlier disruption [4].

In this paper, we will present the low-q limit at different interval of the central line-averaged electron density. Furthermore, experiments have been carried out in J-TEXT tokamak to study the non-resonant magnetic perturbations (MPs) on low-q limit discharges with the constant density. The coils system is set to produce static non-resonant MPs, dominated by a m/n = -1/1 and 1/3 components. The results indicate that the non-resonant MPs can lower the limit of the edge q from 2.5 to 2.3. Moreover, the removal of non-resonant MP, is followed by fast precursor MHD instability and disruption.

References:

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