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MHD instabilities in Versatile Experiment Spherical Torus

Recent research on MHD instabilities in VEST (Versatile Experiment Spherical Torus) has focused on the tearing mode during current ramp up phase and the so-called IRE (Internal Reconnection Event) known to occur frequently in spherical torus. The tearing mode at the current ramp-up phase, known to be related to the hollow current density profile with fast ramp-up rate, seems to be suppressed when the operating gas pressure is sufficiently low. Also, the fluctuation asymmetry is observed in the internal magnetic probe measurements as well as in external Mirnov coil signals. This asymmetry is thought to be due to the coupling between two adjacent islands such as the $m=2/n=1$ and $m=3/n=1$ modes. After the current ramp-up phase, two kinds of IREs are frequently observed in VEST. Both have similar characteristics such as a large spike in plasma current, loop voltage, Mirnov signal and H-alpha emission during the IRE. However, they show significant difference in their rotation characteristics measured by ion Doppler spectroscopy. Toroidal rotation of the first kind IRE decreases to zero and becomes locked to the wall, resulting in disruption-like evolution. On the other hand, the other kind of IRE shows significant toroidal rotation acceleration in the counter- I_p direction during the IRE. Increased rotation looks like recovering the plasma current after the IRE, indicating stabilizing effect.

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