

P4.1043 Coupled resonant layer responses to rotating 3D fields in the presence of static error fields

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Single and compound helicity tearing mode (TM) responses to a rotating 3D resonant magnetic perturbation (RMP), in the presence of a static error field (EF), have been observed in the partially penetrated regime [1] of the TM unlocking bifurcation process [2] in DIII-D experiments. This regime has been proposed as a stable window over the 3D frequency dependence on simulations with the non-linear resistive reduced MHD code AEOLUS-IT [3,4]. The single helicity structure is formed when the external 3D field rotates with a frequency slightly higher than a critical value, avoiding full-penetration but reaching to a rational surface where the static EF has already formed a magnetic island. The unique standing wave response characteristic of this regime was observed experimentally in high beta, H-mode, DIII-D discharges when the magnitude of the EF was comparable to the rotating 3D field, in qualitative agreement with AEOLUS-IT simulations [1,4]. A similar structure was reported also in ohmic plasmas in J-TEXT [5]. The single helicity perturbation seems resilient to perturbations due to small ELMs. When sufficiently perturbed, however, the response spreads over neighboring rational surfaces through the poloidal coupling inherent to shaped tokamak plasmas. This results in the formation of a compound (double) helicity state. This helicity deterioration will be compared with new simulations including double resonant surfaces at $q=2$ and 3.

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