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Physics Understanding with NIMROD Simulation of Slowly Rotating 3D Field for Locked Mode Avoidance[1] MICHIO OKABAYASHI, DYLAN P. BRENNAN, PPPL, SHIZUO INOUE, QST, EDWARD J. STRAIT, GA, NIKOLAS LOGAN, PPPL, ROBERT J. LA HAYE, GA, LINDA SUGIYAMA, MIT, PPPL COLLABORATION, GA COLLABORATION, QST COLLABORATION, MIT COLLABORATION — Nonlinear, resistive NIMROD simulations show stable edge tearing layers are critical to the observed core locking avoidance when applying a slowly rotating 3D external field. DIIID discharges avoiding locking this way have been observed to exhibit an edge localized tearing layer synchronized with the 3D field. The amplitude of the observed tearing layer suggests that the perturbed current density must be comparable to the equilibrium current density. In contrast, at q=2 and 3 the response to the 3D external field is minimal. A hypothesis is that the stable Hmode edge tearing layers reduce the influence of both the static, intrinsic error field (EF) and the rotating applied 3D field on the core tearing layers (S. Inoue PPCF 2018, IAEA 2018). Initial NIMROD simulations have been carried out based on experimental profiles. The results suggest the observed effect can be explained by taking into account the velocity of the rotating external 3D field relative to the EF and the mode moving in the plasma frame and show the relative drift velocity must be large enough to induce the screening effect to the mode from both magnetic fields.

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