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Nonlinear MHD Modeling of the Effect of Resonant Magnetic Perturbation on Pedestal in KSTAR SANGKYEUN KIM, YONGSU NA, SNU, STANISLAS PAMELA, CCFE, OHJIN KWON, DU, MARINA BECOULET, GUIDO HUIJSMANS, CEA, JONGKYU PARK, NIK LOGAN, PPPL, YONGKYOON IN, UNIST, JAEHYUN LEE, MINWOO KIM, NFRI, JOREK TEAM —
To fully suppress edge-localized-modes (ELM) via resonant magnetic perturbation (RMP) is essential to reach and sustain high-performance steady-state H-mode plasmas. Using the nonlinear 3D MHD code JOREK [1], we have simulated a recent RMP-driven ELM-crash-suppression in KSTAR. In this study, we have found that the pedestal degradation by RMP can be explained to some extent by the radial transport from the combined effects of the kink-peeling response, tearing response [2], and neoclassical toroidal viscosity (NTV) [3]. Interestingly, ELM-crash-suppression was not only attributable to the degraded pedestal but also to direct coupling between peeling-ballooning mode (PBM) and RMP-driven plasma response [4]. While the linear stability of PBM improved owing to the degraded pedestal, it was not a sole contributor to ELM-crash-suppression, in that the coupling between PBM and RMP increased the spectral transfer between edge harmonics preventing catastrophic growth and crash of unstable modes. In addition, the locking of PBMs has been numerically reproduced during the ELM suppression phase, which supports the experimentally observed importance of $V_{ExB} \approx 0$ on the onset of ELM-crash-suppression. [1] G. Huysmans et al., PPCF (2009) [2] F. Orain et al., Phys. Plasma (2019) [3] N. Logan et al., Phys. Plasma (2016) [4] M. Becoulet et al., PRL (2014)

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