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Nonlinear simulation of the fishbone instability MALIK IDOUAKASS, MATTEO FAGANELLO, Aix-Marseille Université, HERBERT BERK, University of Texas, XAVIER GARBET, Comissariat à l'Energie Atomique, SADRUDDIN BENKADDA, Aix-Marseille Université, PIIM TEAM, IFS TEAM, IRFM TEAM — We propose to extend the Odblom-Breizman precessional fishbone model [1] to account for both the MagnetoHydroDynamic (MHD) nonlinearity at the $q = 1$ surface and the nonlinear response of the energetic particles contained within the $q = 1$ surface. This electromagnetic mode, whose excitation, damping and frequency chirping are determined by the self-consistent interaction between an energetic trapped particle population and the bulk plasma evolution, can induce effective transport and losses for the energetic particles, being them alpha-particles in next-future fusion devices or heated particles in present Tokamaks. The model is reduced to its simplest form, assuming a reduced MHD description for the bulk plasma and a two-dimensional phase-space evolution (gyro and bounce averaged) for deeply trapped energetic particles. Numerical simulations have been performed in order to characterize the mode chirping and saturation, in particular looking at the interplay between the development of phase-space structures and the system dissipation associated to the MHD non-linearities at the resonance locations.

[1] Odblom et al., Phys. Plasmas, 9, 155 (2002).

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