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Theory and simulation of the fishbone burst cycle FULVIO ZONCA, SERGIO BRIGUGLIO, Associazione EURATOM-ENEA sulla Fusione, Frascati, Italy, LIU CHEN, Institute for Fusion Theory and Simulation, Zhejiang University, Hangzhou, China, CLAUDIO DI TROIA, GIULIANA FOGACCIA, VALERIA FUSCO, GREGORIO VLAD, Associazione EURATOM-ENEA sulla Fusione, Frascati, Italy, XIN WANG, Institute for Fusion Theory and Simulation, Zhejiang University, Hangzhou, China — Numerical simulation results show that both ion [1] and electron [2] fishbones are characterized by nonlinear dynamic evolutions that are strongly interlinked with supra-thermal particle transport, which occurs because of secular particle loss from the region inside the $q = 1$ surface. We present a theoretical model of the nonlinear burst cycle, revisiting that originally proposed in [3] and comparing the predicted behavior of nonlinear mode dynamics and energetic particle redistributions with numerical simulation results. In particular, we derive the renormalized solution of the nonlinear particle distribution function and show that frequency sweeping is dictated by phase-locking in the wave-particle resonance condition and show that secular particle losses are consistent with the mode-particle pumping process, originally described by [4].

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