Role of Non-resonant Modes in Zonal Flows and Intrinsic Rotation Generation

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Plasma rotation plays an important role in regulating macroscopic stability, anomalous transport, and forming transport barriers. From previous gyrofluid and gyrokinetic simulations, qualitatively different transport phenomena were observed for different non-resonant mode configurations in the fluctuation spectrum, i.e. modes with non-vanishing $m - nq(r)$. In this work, we perform a gyrokinetic simulation study to investigate the role of non-resonant modes in driving zonal flows and intrinsic plasma rotation. Gyrokinetic particle in cell code *gKPSP* is used for the study, which allows equilibrium profile relaxation without any ad-hoc profile control. Based on the quasi-ballooning representation for fluctuating potential, we vary the excitation of non-resonant modes by adjusting the poloidal extent of the potential function and investigate how the zonal flow and intrinsic rotation generation patterns change. We find that stronger intrinsic flow is generated by suppressing the non-resonant mode excitation and this flow persists longer into the nonlinear phase, as well. When more non-resonant modes are included, we observe that parallel wave number asymmetry in the fluctuation spectrum weakens, since fluctuation energy is transferred to the non-resonant modes so intrinsic rotation decays more rapidly in the nonlinear phase. We also discuss the effect of q-profile structure on the non-resonant modes.