Effects of plasma elongation on Geodesic Acoustic Modes

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Drift waves turbulence is known to self-organize to form axisymmetric macroscopic flows. The basic mechanism for macroscopic flows generation is called inverse energy cascade. Essentially, it is an energy transfer from the short wavelengths to the long wavelengths in the turbulent spectrum due to nonlinear interactions. A class of macroscopic flows, the poloidally symmetric zonal flows, is widely recognized as a key constituent in nearly all cases and regimes of microturbulence, also because of the realization that zonal flows are a critical agent of self-regulation for turbulent transport. In tokamaks and in many other systems, the zonal flows are coupled with another class of macroscopic flows, induced by the geometry of the system. These poloidally asymmetric flows are named geodesic acoustic modes (GAMs), the coupling coming through the geodesic curvature. There is a growing body of evidence that suggest strong GAM activity in most devices. Theoretical investigation of the GAMs is still an open field of research. Part of the difficulty of modelling the GAMs stems from the requirement of running global codes. Another issue is that one cannot determine a simple one to one relation between turbulence stabilization and GAM activity. We focus on the study of ion temperature gradient (ITGs) turbulence in realistic tokamak magnetohydrodynamic equilibria. Analytical and numerical analyses are applied to the study of geometrical effects on zonal flows oscillations. In particular, we show results on the effects of the plasma elongation on the GAM amplitude and frequency and on the zonal flow residual amplitude.