Effect of zonal flows and geodesic acoustic modes on flux-driven electrostatic turbulent transport, in a tokamak plasma.

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Zonal flows (self-generated large-scale poloidal ExB flows) are known to efficiently regulate the turbulence level [1]. Recent studies [2, 3] have also addressed the impact on the turbulence of a higher-frequency component of zonal flows, the so–called *geodesic acoustic oscillation* or *GAM* [4], which is introduced in the system by effect of the geodesic part of the curvature which linearly couples the (n=0;m=0) and (n=0;m=1) perturbation components.
The interplay of zonal flows and geodesic acoustic oscillations is studied by means of numerical simulations with a 3D fluid global model describing flux-driven electrostatic plasma turbulence, in the core of tokamak plasmas. The equation system consists of the evolution equations for ion density, parallel velocity and ion temperature, including curvature effects (both interchange and geodesic curvature parts) and models parallel Landau damping and collisional damping of zonal flows.
Previous simulations of electrostatic toroidal Ion Temperature Gradient (ITG) driven turbulence from our group [5-7] were carried out by suppressing the geodesic curvature coupling of (n=0;m=0) and (n=0;m=1) perturbations. Those simulations have shown a strong generation of sheared *zonal flows* and a strong effect of zonal flow damping, which is related to the collisionality ν^*, on turbulent transport. In particular, it was found that the energy content increases at lower ν^*[5-6]. However, as discussed in [2], the geodesic coupling opens up a new channel for zonal flow damping.
In this contribution, we will present the first studies with a new version of the ETAI3D code, aimed at assessing the importance of the geodesic curvature on the zonal flow dynamics in this particular ITG turbulence system.

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