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# Nonlinear dynamics of energetic-particle driven geodesic acoustic modes in ASDEX Upgrade

I. Novikau[1], A. Biancalani[1], A. Bottino[1], P. Manz[1], G. D. Conway[1], A. Di Siena[1], Ph. Lauber[1], E. Poli[1], E. Lanti[2], L. Villard[2], N. Ohana[2], ASDEX Upgrade Team[1]

[1] Max Planck Institute of Plasma Physics, Garching, Germany,

[2] École polytechnique fédérale de Lausanne, Swiss Plasma Center, Switzerland

e-mail (speaker): ivan.novikau@ipp.mpg.de

Turbulence in tokamaks generates radially sheared zonal flows (ZFs). Their oscillatory counterparts, geodesic acoustic modes (GAMs), appear due to the action of the magnetic field curvature. The GAMs can be driven by an anisotropic energetic particle (EP) population leading to the formation of global radial structures, called EGAMs. The EGAMs might play a role of an intermediate agent between the fluctuating fields and thermal plasma, by redistributing fluctuating field energy to the bulk plasma through the collisionless wave-particle interaction. In such a way, the EGAMs might be a crucial component in tokamak plasma stabilisation and be significantly helpful in the plasma heating. Thus, investigation of EGAMs characteristics, especially in the velocity space, is necessary for precise understanding of the transport phenomena in fusion reactors.

In this work, the dynamics of EGAMs is investigated with the help of a Mode-Particle-Resonance (MPR) diagnostic recently implemented in the global gyrokinetic (GK) particle-in-cell code ORB5 [1]. This enables to investigate the relative importance and the evolution of the resonances responsible for the ion and electron Landau damping, and of the EP drive. An ASDEX Upgrade discharge is chosen as a reference case for this investigation due to its rich EP nonlinear dynamics [2,3]. In particular, the saturation mechanisms [4] are identified, by separating the wave-particle and wave-wave nonlinear dynamics, and the comparison with the experimental measurements is discussed.

References

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