Nonlinear gyrokinetic investigation of energetic particle driven geodesic acoustic modes

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Geodesic acoustic modes [1] (GAM) are zonal, i.e. axisymmetric oscillations of the radial electric field, typically observed in tokamaks in the presence of turbulence. GAMs can be driven unstable by the presence of energetic particles (EP), i.e. fast ions which can be present as the product of fusion reactions or external heating mechanisms. A possible role of these EP-driven GAMs (EGAM) [2] in the nonlinear saturation of turbulence, has been recently emphasized by means of gyrokinetic (GK) semi-lagrangian simulations [3]. In this work, the nonlinear dynamics of EGAMs is investigated with the GK particle-in-cell code ORB5 [4, 5]. The EGAM saturation due to wave-particle nonlinearity [6] and wave-wave nonlinearity is compared. The radial structure of EGAMs is also investigated. Finally, the nonlinear interaction of EGAMs and turbulence is studied. Comparisons with reduced models and with the GK codes GENE and GYSELA, are presented.

References

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