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O2.104 Steady and oscillatory applied sheared flows in global gyrokinetic simulations

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In order to get a better understanding of the linear and nonlinear plasma interaction of microinstabilities and associated turbulence with different specific modes, an antenna is implemented in the global gyrokinetic code ORB5. It consists in applying external chargeand current-density perturbations or, alternatively, external electrostatic and magnetic potentials, to the system. The contributions of the antenna are considered separately from the perturbed plasma fields and can thus be accounted for even in linear simulations where the perturbed field contributions to the particle orbits are neglected. In a first step, we use this antenna to excite zonal structures. As a proof of principle, we start by scanning the shearing rate of the applied ExB flow and measure its effect on the linear growth rate of electrostatic instabilities such as ion temperature gradient (ITG) instabilities and trapped electron modes (TEMs). Second, time-dependent antenna excitations are considered to address the effectiveness of the corresponding non-stationary ExB sheared flows in stabilizing such modes. Our results are consistent with previous analytical works [1]. Third, the nonlinear plasma response is included to study the effectiveness of the turbulence saturation by the oscillatory sheared flows. The antenna is also used to excite geodesic acoustic modes (GAMs) and study their coupling with microinstabilities. We then address the question of the origin of nonlinear zonal structures (avalanche-like features) observed to propagate at a frequency similar to the one of linear GAMs.

[1] T. S. Hahm et al., “Shearing rate of time-dependent E◇B flow”, Physics of Plasmas, 6(3), 922-926, 1999

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