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P4.1039 Global structure of stationary zonal flow in rotating tokamak plasmas

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Zonal flows (ZF) are low-frequency, predominantly electrostatic plasma oscillations (is the poloidal wave-number, is the toroidal wave-number) widely
observed in modern toroidal magnetic plasma confinement systems, such as tokamaks and stellarators [1]. It is believed that ZFs are able to regulate the level of anomalous transport in plasma through nonlinear interaction with small-scale drift-wave turbulence. Earlier, in the framework of ideal MHD, the local dispersion relation demonstrating coupling of ZF and geodesic acoustic mode (GAM) in rotating plasma was obtained [2,3]. Under the assumptions of the adiabatic equation of state and the equilibrium with constant on magnetic surfaces (is the plasma pressure, is the mass density, is an arbitrary function of the magnetic surface) the continuous spectrum of ZFs and GAMs in the presence of toroidal plasma rotation is described by Eq. (1) [2,3] reported at http://ocs.ciemat.es/EPS2019ABS/pdf/P4.1039.pdf.
The high-frequency branch of the oscillations described by Eq. (1) corresponds to GAM, and the low-frequency branch corresponds to the so-called stationary ZF. In this paper we consider the possibility of the existence of global mode of stationary ZF in tokamak with toroidal plasma rotation. The eigenfrequencies and the structure of corresponding eigenfunctions are calculated. It is shown that for typical profiles of tokamak plasma parameters global ZFs are localized at the periphery of plasma column. The stability of modes, their frequencies and increments are mainly determined by the type of plasma equilibrium, i.e. by the parameter .

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