

The poloidal plasma velocity oscillations in the FT-2 tokamak measured by Doppler backscattering in the UHR

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The Doppler frequency shift f_D of backscattered (BS) signal at oblique microwave plasma probing in the cutoff vicinity is often used for diagnosing of poloidal plasma velocity V_θ and corresponding radial electric field E_r in magnetic fusion devices [1, 2]. An analysis of f_D temporal dependence and corresponding frequency spectrum [3] allows investigation of the poloidal velocity oscillations associated, in particular, with geodesic acoustic mode (GAM). According to theoretical expectations this mode, localized in narrow radial zone, is a sort of poloidal zonal flow (with $m = 0$ and $n = 0$) which is induced by the nonlinear interaction of drift wave turbulent modes and in its turn could lead to the turbulence saturation and suppression of anomalous transport.

The Doppler upper hybrid resonance (UHR) BS technique utilizes X-mode microwave plasma probing out of equatorial plane of the tokamak from the low magnetic field side. It is benefiting from the effects of electric field and both poloidal and radial wave number growth in the UHR resulting in enhancement of scattering signal, millimetre spatial resolution and f_D substantial increase (in comparison with Doppler reflectometry). It was implemented recently for poloidal plasma velocity profiles measurements [4] demonstrating fine spatial and temporal resolution and reasonable accuracy.

In the present paper we report observations of f_D oscillations measured by Doppler UHR BS technique. The measurements were carried out at FT-2 tokamak ($R = 55$ cm; $a = 7.9$ cm; $B_t = 2.2$ T). Several narrow lines were clearly seen in the f_D spectrum at different radial position. In spite of the fact some of the lines coincide with those registered by Mirnov coils, nevertheless the clear line in f_D spectrum not correlated to the MHD signal and close to the theoretical GAM frequency was observed at mid radii. At the plasma edge f_D and MHD spectra were very similar, probably because of coincidence of the UHR and magnetic island.

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