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P1.1006 Local measurements of the radial plasma velocity fluctuations in the FT-2 tokamak core plasmas by equatorial enhanced scattering

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Considerable interest in radial fluctuations of plasma velocity is associated with their significant role in the formation of turbulent radial flows. In this paper we implement the new microwave technique - the equatorial enhanced scattering (EES) [1], possessing the submillimetre spatial radial resolution and demonstrate its feasibility for diagnosing the radial plasma velocity fluctuations temporal and spatial characteristics. The developed diagnostics utilizes the equatorial microwave X-mode probing by a narrow beam from the high field side and measurements of backscattering off small-scale density fluctuations in the upper hybrid resonance (UHR) vicinity. The radial propagation of the density fluctuations at a radial velocity associated with the plasma motion leads to the Doppler frequency shift in the EES spectrum. The random nature of the plasma radial motion leads to the broadening of the frequency spectrum at long-term measurements of the backscattered signal. An analysis of alternative mechanisms of the EES signal spectral broadening associated with poloidal plasma rotation (including GAM) or with a small-angle scattering of the probing/scattering wave in the UHR [2, 3] allowed to find the limits of applicability of the method. The dual-frequency probing provides the possibility to measure the radial correlation length of the velocity fluctuations in the equatorial plane. The local correlations between fluctuations of the EES Doppler frequency shift and oscillations of the scattered power of the X-mode reflectometer with the low field side equatorial probing were revealed. This effect, indicating the presence of correlation between the radial velocity fluctuations and the level of density fluctuations, possesses a potential for experimental investigation of the radial turbulent particle flux in the plasma. The experimental measurements data were compared to results of numerical gyrokinetic simulation by the global full-f nonlinear code ELMFIRE in the FT-2 tokamak regimes where the detailed validation was performed for the multi-scale turbulence [4].

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