Studies of the plasma poloidal rotation in the T-10 tokamak using HIBP

1,2Khabanov P.O., 1Melnikov A.V., 1Eliseev L.G., 1,2Drabinskii M.A., 3Kharchev N.K., 1Lysenko S.E., 1Zenin V.N.

1NRC “Kurchatov Institute”, Moscow, Russia   
2Moscow Institute of Physics and Technology, Dolgoprudny, Russia  
3Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia

Plasma E × B drift poloidal rotation may suppress plasma instabilities and can also be connected with the transition to a better confinement regime (L-H transition) [1]. Radial electric field Er studies is an important task on the way to understanding the role of Er × Bt shear rotation in plasma turbulence suppressing.

In Т-10 tokamak (R = 1.5 м, а = 0.3 м) it has been shown that the velocity of Er × Bt rotation is equal to the velocity of plasma broadband turbulence rotation [2, 3]. Radial electric field Er in the core plasmas (7 cm < r < 21 cm) was measured with heavy ion beam probe (HIBP). Broadband turbulence rotation was measured with correlation reflectometry. Later, the velocity of plasma poloidal rotation was measured using charge-exchange recombination spectroscopy by the Doppler shift of spectral line of hydrogen-like ion of carbon С5+ [4]. Now with the five-slit energy analyzer of HIBP, which allows to conduct simultaneous measurements in five sample volumes, neighboring in plasma, there is an opportunity to measure plasma poloidal velocity as a phase shift between density fluctuations at two poloidally shifted sample volumes v = Δx∙2πf/θi,j , i, j = 1–5, i ≠ j [5, 6].

Is this work the velocity of broadband turbulence poloidal rotation will be calculated using HIBP and then it will be compared to Er × Bt drift velocity.

References

1. Burrell K. H. Effects of E×B velocity shear and magnetic shear on turbulence and transport in magnetic confinement devices // Physics of Plasmas, 4, 1499 (1997).
2. A.V. Melnikov et al. Measurements of Plasma Potential, Radial Electric Field and Turbulence Rotation Velocity in the T-10 Tokamak // 37th EPS Conference on Plasma Physics, Dublin, 2010, O5.128.
3. A.V. Melnikov et al. Plasma potential and turbulence dynamics in toroidal devices (survey of T-10 and TJ-II experiments) // Nucl. Fusion, 51, 083043 (2011).
4. Klyuchnikov L.A. et al. Measurements of poloidal and toroidal plasma rotation using active spectroscopy on the T-10 tokamak // XLV International conference on plasma physics and controlled fusion, Zvenigorod, Russia, April, 2018.
5. Eliseev L.G. et al. Two Point Correlation Technique for the Measurements of Poloidal Plasma Rotation by Heavy Ion Beam Probe // Plasma and Fusion Research: Regular Articles, Vol. 7, 2402064 (2012).
6. Eliseev L.G. et al. Evaluation of Turbulent Particle Flux by Heavy Ion Beam Probe in the T-10 Tokamak // Plasma and Fusion Research: Regular Articles, Vol. 13, 3402106 (2018).