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Plasma Rotation Studies Carried out in the TCABR Tokamak and its Comparison with Neoclassic Theory

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Plasma rotation in thermonuclear fusion plasma plays an important role for particle and energy confinement and it can stabilize magnetohydrodynamic instabilities if some rotation level is achieved. In early studies, the relation between plasma confinement and radial electric field E_r was studied via measurements of the electric potential distribution and also via spectroscopic measurements of plasma rotation. Since no significant effect of E_r on plasma confinement was observed, little attention was given to it. However, after the discovery of H-mode, the need for accurate measurements of E_r, and consequently, plasma rotation, became necessary. Nowadays, interest in the electric field, whether by its origin or by influence in plasma confinement, is one of the most current topics in nuclear fusion research.
In TCABR, plasma rotation has been measured using Doppler shift of both the C^{+5} spectral line emission (529.05 nm) [1-2]. In Figure 1, (b) poloidal and (c) toroidal rotation measurements of C^{+5}. In panels (a-b), C^{+5} poloidal rotation measurements are compared with the rotation profile expected from neoclassical theory. As can be seen, the observed C^{+5} poloidal rotation in TCABR is well described by neoclassical theory. Plasma rotation in the presence of anomalous processes and toroidal momentum damping are introduced phenomenologically into neoclassic equations in [3]. So, the next phase of this work will focus on the estimation of radial electric field and the comparison of the toroidal velocity with the model proposed in [3-4].

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