Bulk Plasma Rotation in the TCV Tokamak in the Absence of External Momentum Input

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The question of plasma rotation in toroidal devices is receiving increasing attention due to its impact on the stability of resistive wall modes, neoclassical tearing modes and micro-instabilities causing anomalous transport. TCV provides unique insight into the mechanisms generating and regulating plasma rotation, and the related interplay between particle, energy and momentum transport, by exploring Ohmic and EC heated discharges with minimum external momentum injection. These investigations use the diagnostic neutral beam, which induces a small rotation (~1 km/s, compared to ~20 km/s in other machines), due to a combination of quasi-orthogonal injection angle, and a modest average deposited power (20 kW). Toroidal measurements of bulk plasma rotation in the TCV tokamak, in the absence of applied external torque, are described for limited and diverted plasma configurations. Core toroidal rotation is seen to scale inversely with plasma current (Scarabosio et al) and to exhibit a direction inversion with increasing plasma density in limited regimes (Bortolon et al).

These apparent changes in the internal torque balance of the plasma are seen to inverse for diverted configurations with rotation at the plasma edge now able to vary with the plasma parameters in contrast to near zero values for limited discharges. This complicated behaviour indicates the presence of several competing torques on the plasma. The paper will include results on the poloidal velocity profiles to complete the rotation measurements and will describe the limitations of the neoclassical model to predict rotation profiles and their dynamics, providing a clear benchmark for the understanding of momentum transport in Tokamak plasmas.

References

[1] Scarabosio et al, PPCF **48**, 663-683 (2006)

[2] Bortolon et al, PRL **97**, 235003 (2006)