Confirmation of Momentum Injection by Compact Torus Injection into the STOR-M Tokamak*


Plasma Physics Laboratory, University of Saskatchewan, Saskatoon, Canada

Toroidal flow plays important roles in tokamak physics to mitigate the effects of error field, resistive wall mode, and to avoid major disruptions. In the STOR-M tokamak \((R = 46\ \text{cm}, a = 12\ \text{cm}, B_t \leq 1\text{T}, I_p \leq 30\ \text{kA})\), previous experiments have shown that the toroidal flow velocities measured with Ion Doppler Spectroscopy (IDS) can be similarly modified by several techniques, including resonant magnetic perturbation (RMP) [1] and tangential compact torus (CT) injection [2]. In particular, the toroidal flow velocity changes toward the co-current direction (coincidentally, also the CT injection direction, i.e., counter-clockwise (CCW) direction (top view)). The two techniques are fundamentally different. RMP interacts directly with the tearing MHD modes and resulted in significant suppression of the MHD fluctuations. A compact torus carries both magnetic field and the momentum, which is estimated approximately 10 times the measured tokamak plasma rotational momentum in the toroidal direction, and also suppresses the MHD activities. A fundamental question is: is the flow velocity change, in the CT injection case, caused by momentum injection or suppression of MHD activities. In order to answer this question, the tokamak discharge current direction was reversed to the CW direction, keeping the CT injection direction intact. The intrinsic toroidal flow velocity has been found to be also reversed as expected, changing from the CCW to CW direction for the edge plasma and from the CW to CCW direction for the core plasma. It has been observed that the plasma flow still changes in the CT injection direction independent of the intrinsic flow direction. This observation clearly confirms the momentum injection by CT injection. More quantitative studies will be carried out to study the dependence of the amount of the velocity change on the CT injection velocities and also the influence of MHD activities on the flow change.

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