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Modification of toroidal flow velocity through momentum injection by compact torus injection into the STOR-M tokamak discharge

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Plasma flow and its shear in tokamak discharges have many beneficial effects including suppression of turbulence, confinement improvement, control of the resistive wall modes, as well as enhanced tolerance to the error fields which may cause mode locking and even major disruptions. CT injection has also been considered not only as a candidate to directly fuel the core of a tokamak reactor, but also as a means to inject momentum leading to modification of plasma flow velocities. This paper reports on the first-ever evidence of modification of toroidal flow velocity by momentum injection by tangentially injecting a compact torus (CT) into the STOR-M tokamak discharge. In the previous experiments, the CT was injected into the tokamak discharge along the tokamak discharge current direction. It has been observed that CT injection suppressed magnetic fluctuations and also induced modification of the toroidal flow velocity towards the CT injection direction or co-current direction, similar to the flow velocity modification by resonant magnetic perturbations which also suppresses magnetic fluctuations. In order to clarify whether the flow modification after CT injection is due to suppression of magnetic fluctuations or due to momentum injection, the tokamak discharge direction was reversed and the CT was then injected in the counter-current direction. Experimental observations reveal that modification is still in the CT injection or counter-current direction although the intrinsic flow direction was reversed along with the discharge current. This observation strongly suggests that CT injection indeed injects momentum into the tokamak discharge and modifies the plasma flow. The experimental results demonstrate the additional benefit of CT fueling for future tokamak reactors.

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