Modeling plasma toroidal flow profile control via NTV torque with n = 23D fields in MAST-U

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Nucl. Fusion **60** (2020) 096026; https://doi.org/10.1088/1741-4326/aba334

Abstract:

Toroidal modeling utilizing the MARS-Q code (Liuet al2013Phys. Plasmas20042503) shows that large (compared to electromagnetic torque) neoclassical toroidal viscous (NTV) torque can be achieved in the plasma core region in reference MAST(-U) L-mode plasmas, by applying then=2 (n is the toroidal mode number) 3D fields generated by the magnetic coils used for controlling the edge localized mode and/or by the error field correction coils. Large NTV torque, occurring at relatively slow plasma flow, in combination with strong variation of the torque amplitude versus the coil phasing of the 3D coils, offers a tool to control the plasma toroidal rotation profile in spherical tokamaks. To effectively employ the toroidal NTV torque, the potentially fast initial flow needs to first be damped by 3D fields. MARS-Q quasi-linear initial value simulations demonstrate that this is achievable in MAST-U, within the designed 3Dcoil current capability for the device.