Turbulence simulations of high toroidal Mach number Neutral Beam-driven MAST discharges

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Neutral Beam Injection (NBI) can be used in tokamaks not only for heating purposes, but also to inject momentum in the plasma. This momentum injection has been shown to affect transport in various devices including MAST in Culham, with significant improvement of confinement when toroidal flows were driven against the plasma current (counter-injection). To understand the mechanisms involved, we perform a numerical simulation of a MAST discharge, using the two-fluid code CUTIE [2], where the interaction between the toroidal flow and the other components of the velocity field via the Reynolds stresses, as well as the interaction of the flow with the magnetic field via Maxwell stresses, are taken into account. The toroidal velocity reaches values around 300 km/s, implying a Mach number $M = V_\Phi/(T_i/m_i)^{1/2}$ greater than unity in agreement with recent observations [1]. At the same time, a radial electric field and associated zonal flows are driven indirectly. An analysis of these results and a comparison with a co-injected discharge will be presented.

References

[1] Akers R *et al.*,"Comparison of plasma performance and transport between tangential co- and counter-NBI heated MAST discharges", in *Proc. of the 20th Fusion Energy Conference, Vilamoura*, EX/4-4(2005)

[2] de Baar MR *et al.*, "Global plasma turbulence simulations of q=3 sawtooth-like events in the RTP tokamak", Phys. Rev. Lett. **94** (2005) 035002.

This work was funded jointly by the United Kingdom Engineering and Physical Sciences Research Council and EURATOM.