

P5.1087 Impact of 3D magnetic perturbations on turbulent transport in tokamak limited plasmas

Friday, 12 July 2019 14:00 (2 hours)

See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/P5.1087.pdf>

A tokamak has theoretically a toroidally symmetric magnetic field. However, the magnetic field is never perfectly homogeneous in the toroidal direction. The 2 most common reasons for non axisymmetric fields are engineering limitations and voluntary perturbations applied by additional coils for control purposes. The latter are planned to be used in ITER to mitigate and/or suppress Edge Localized Modes (ELMs) via Resonant Magnetic Perturbations (RMPs). Experiments on current machines have shown the capability of RMPs to achieve their purpose but have also demonstrated an impact on the edge plasma equilibrium as well as on turbulence. One of the concerns for futur devices is the consequences on the heat load distribution at the targets. If the impact of RMPs has been studied through MHD and 2D transport simulations, self-consistent modelling of their impact on turbulent transport remains to be done.

In this presentation, we use the 3D fluid turbulence edge plasma code TOKAM3X to investigate the response of the plasma to simple 3D RMP-like perturbations. Although TOKAM3X has the capability to solve full fluid-drift equations in complex geometries, we restrict ourselves as a first step to an isothermal model in an idealized circular limited geometry. The response of the equilibrium to the perturbation is neglected assuming the common vacuum approximation.

In a limiter tokamak geometry, with a single mode perturbation, we have performed a scan in perturbation amplitude, comparing resulting simulations with a reference case without perturbation. Pertrubed simulations exhibit of drop of the particle content reminiscent of the pump-out observed in experiments. The amplitude of the pump-out is of the order of 5 to 10 % for perturbations of the order of 10^{-4} . Experimental trends are also recovered in the response of the radial electric field which is not impacted in open field lines but decreases by a factor of 2 in the closed field lines region. On the other hand, key features of turbulence are only moderately impacted, even though one can observe a change in the poloidal distribution of the turbulent flux which becomes less ballooned. The physical mechanisms explaining these observations are then discussed. Finally, first simulations with more realistic and complex perturbation patterns are presented.

pppo

Presenter: LUCE, B. (EPS 2019)

Session Classification: Poster P5