# FLOWS IN MAGNETIZED FUSION PLASMAS

Flows are playing a key role in tokamak plasmas performances. In particular, the confinement time of the energy is limited in such device by the presence of small-scale turbulence, which induces heat transport from the hot core toward the colder edge. This transport is sensitive to the flows taking place in the plasma in such way that a strong velocity shear tends to reduce the spatial scale of turbulent structures and then the associated energy transport.

In the context of a close collaboration between the Research Institute on Magnetic Fusion (IRFM) from the CEA-Cadarache and the Laboratory of Plasma Physics (LPP, Ecole Polytechnique), the WEST tokamak is equipped by a Doppler backscattering system (DBS) accessing the intensity and the velocity of density fluctuations at a selected spatial scale. This microwave system is commonly used in the community to measure the radial profile of the perpendicular plasma velocity and in particular the formation of a strong velocity shear when a transport barrier is forming at the extreme edge.

The interpretation of the measurements and the identification of the dominant mechanisms in the formation of the flows relies on the combination of experimental, numerical and theoretical studies. The comparison of experimental measurements in the WEST tokamak with the results from gyrokinetic simulations, modelling turbulence and collisional processes, is addressed at different levels. One approach consists in using a wave propagation code able to model backscattering phenomenon. This kind of numerical code, called “full-wave code” models a microwave beam similar to the experimental system by solving the Maxwell equations in a turbulent plasma (i.e including density fluctuations). In this case, the modelled plasma may be generated artificially using analytical expressions leading to “synthetic turbulence map” or from first principle turbulent codes, such as gyrokinetic code.

The PhD project, which will take place at the CEA-Cadarache, includes the characterisation of the flow measured by DBS in the WEST tokamak as well as numerical studies using a “full-wave” code, already operational, applied to synthetic turbulent map as well as results from the gyrokinetic code GYSELA. The main objective of this work is to identify the dominant mechanisms in the flows formation and the interaction of these latter with the turbulence .

laure.vermare@lpp.polytechnique.fr

phone : 04 42 25 49 92