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Title : Physics of Edge Localised Modes (ELM) control by Resonant Magnetic Perturbations (RMPs) in tokamaks.

Summary : H-mode (H for« high confinement ») is one of the regimes of functioning envisaged for tokamak ITER. This regime is characterised by quasi-periodical losses of confinement at the plasma edge caused by phenomena MHD: Edge Localized Modes (ELMs) that represent the edge transport mechanism through very narrow (few cm) external transport barrier (ETB) and define in many aspects the global plasma confinement. Notice also that depending on the ELM size, energy and particle losses could be dangerous for the divertor target plates and limit the divertor life-time in the tokamak and in particular in ITER. One of the promising method of ELMs control is based on the specially designed coils producing small (compared to the equilibrium field) Resonant Magnetic Perturbations (RMP), which are supposed to produce ergodic zone at the plasma edge . This method of ELMs control was tested on existing tokamaks DIII-D (US), JET(UK) , MAST (UK), NSTX(US) and is proposed for ITER. Recent experiments clearly demonstrated that the physics of ELM suppression depend strongly on plasma response to RMPs, which is in many features not understood at present.

In this thesis we propose to work on RMP physics with the aims: 1) Improve the understanding of mechanisms of interaction RMP with plasma and ELMs based on non-linear MHD theory and modelling of plasma response to RMPs in order to give more reliable predictions for ITER. In this part the existing non-linear codes (JOREK, RMHD) can be used, however, some new developments in theory and modelling are needed to include essential features related to the plasma response to RMPs (plasma rotation, diamagnetic effects, neoclassical physics etc). 2) In the frame of this thesis the experimental work on the existing RMP experiments is envisaged on (DIII-D(US), JET(UK), MAST(UK), COMPASS Prague) with the aim to compare theory predictions with experimental observations of density and heat transport, plasma braking or acceleration, the physics of ELMs suppression (or not) by RMPs.

Skills: some basic knowledge in MHD, plasma physics, numerical methods, excellent English.