Non-linear gyro-kinetic Ion Temperature Gradient and Trapped Electron Modes turbulence modelling in X-point geometry with Resonant Magnetic Perturbations.

M.Bécoulet[1], G.T.A.Huijsmans[1,2], X.Garbet[1], P. Donnel[1], Lian Wang[3], Guangzhou Hao[3], A. Marinoni[4], L.Kripner[5,6]

[1] *CEA, IRFM, 13108 Saint-Paul-Lez-Durance, France*
[2] *Eindhoven University of Technology, 5600MB Eindhoven, The Netherlands*
[3] *Southwestern Institute of Physics, P. O. Box 432, Chengdu 610041, China*
[4] *MIT-Plasma Science and Fusion Center, Cambridge,Massachusetts 02139,USA*
[5] *Institute of Plasma Physics of the CAS, Za Slovankou 3, 182 00 Prague 8, Czech Republic*
[6] *Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic*

marina.becoulet@cea.fr

The application of 3D magnetic fields such as Resonant Magnetic Perturbations (RMPs) demonstrated ELM suppression/mitigation in many tokamaks and will be used in ITER [1]. The understanding of ELMs and RMPs based on first principle modelling achieved significant progress during the last decade mainly using the Magneto Hydro Dynamics (MHD) fluid approach [2,3]. However a number of experimental studies [4,5] demonstrated that edge plasma turbulence also changed dramatically and hence should be taken into account in building the full physical picture of energy and particle transport during ELMs and RMPs.

In the present paper the non-linear electrostatic gyro-kinetic Ion Temperature Gradient (ITGs) and Trapped Electron Modes (TEMs) turbulence were studied in X-point geometry with the gyro-kinetic particle model coupled to the non-linear MHD fluid model within the JOREK code [2,3]. The increase of ITG/TEM turbulence was demonstrated in the presence of RMPs using realistic plasma and RMP parameters from COMPASS L-mode discharge [6] (Fig.1). The spectra of ITG/TEM turbulence in modelling with/without ELMs and RMPs are similar to the experimental measurements in H-mode discharges in HL2A tokamak [6]. In spite of the fact that edge profiles gradients decrease due to ELMs or RMPs leading to a smaller drive for turbulence, however at the same time the pedestal **ExB** sheared mean flow is also decreased. As a result this destabilization effect on turbulence become dominant.

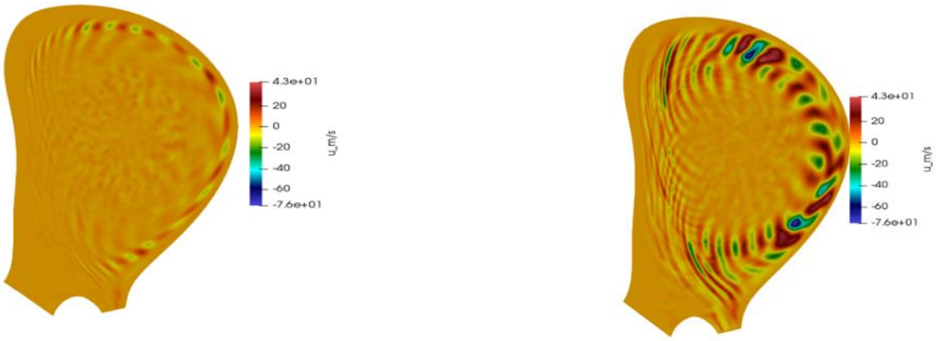

Fig.1.Electrostatic potential perturbations due to ITG modes in L-mode discharge (COMPASS#8078) without (left) and with(right) RMP N=2, 1.5kAt

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