Contribution ID: **21** Type: **Poster**

Study of Alfvénic modes driven by energetic particles using the code HYMAGYC for the NLED AUG testcase and DTT equilibria

Thursday, 5 September 2019 14:00 (15 minutes)

The code HYMAGYC [1] is a hybrid code suited to study the interaction between energetic particles (EPs) and Alfvénic modes. The thermal plasma is described as a single fluid by fully, resistive, linear MHD equations written in general curvilinear coordinates, while the EPs are described by nonlinear gyrokinetic Vlasov equations [2]. The code capabilities will be fully exploited: realistic shaped plasma cross section, finite magnetic compression, and Finite Larmor Radius (FLR) effects will be considered [3]. The so-called NLED-AUG testcase will first be assumed, both with monotonic and nonmonotonic energetic particle density profile, considering a Maxwellian EP distribution function. The experimental equilibrium has been reconstructed using CHEASE [4] in order to compute the specific equilibrium quantities required by HYMAGYC; moreover, the Alfvén continuous spectra have been evaluated by the linear stability eigenvalue code MARS [5]. Linear dynamics results for modes driven by EPs and characterized by different toroidal mode numbers will be considered, as well as the dependence of the growth-rate and frequency on parameters characterizing the EP distribution function. First results showing nonlinear saturation will also be presented. Moreover, preliminary results of Alfvénic modes in presence of EPs generated by Neutral Beams and/or ICRH in the recently proposed DTT experiment will also be presented.

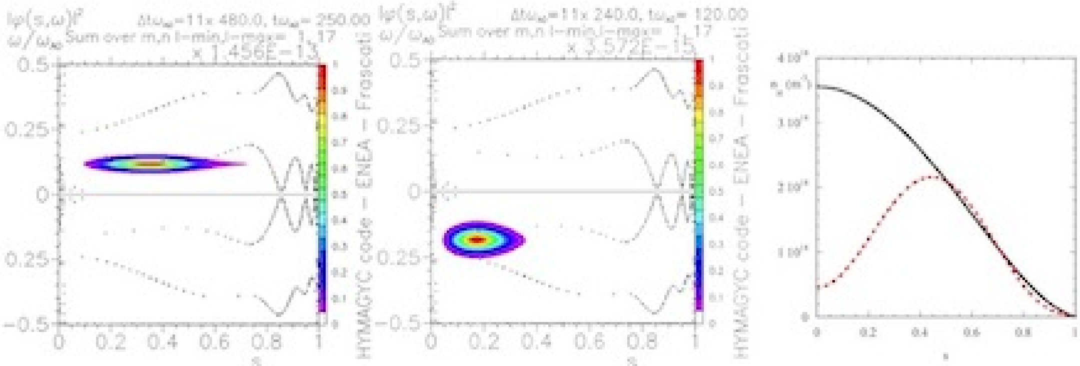

Figure 1: NLED-AUG case, n=1: (left) frequency spectrum for the electrostatic potential and monotonic EP density profile (black solid curve, see the right frame), and (centre) frequency spectrum for nonmonotonic EP density profile (red dashed curve, see the right frame); Maxwellian EP distribution function with temperature TH=0.093 MeV.

References:

[1] Fogaccia G., Vlad G., Briguglio S., Nucl. Fusion 56 (2016) 112004
[2] Brizard A.J. and Hahm T.S. 2007 Rev. Mod. Phys. 79 421–68
[3] Fogaccia G., Vlad G., Briguglio S., Fusco V., submitted to the 46th European Physical Society Conference on Plasma Physics (EPS 2019)
[4] Lütjens H., Bondeson A. and Sauter O. 1996 Comput. Phys. Commun. 97 219–60
[5] Bondeson A., Vlad G., and Lütjens H., Physics of Fluids, B4:1889–1900, 1992

*This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2014-2018 and 2019-2020 under grant agreement No 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission. The computing resources and the related technical support used for this work have been provided by EUROfusion and the EUROfusion High Performance Computer (Marconi-Fusion), and by CRESCO/ENEAGRID High Performance Computing infrastructure and its staff [6].

[6] Ponti G et al 2014 Proc. 2014 Int. Conf. on High Performance Computing and Simulation, HPCS 2014 pp

1030–3 art. no. 6903807

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Session Classification: Poster

Track Classification: Collective Phenomena