Variation of the density profile of impurities in turbulent plasma with RF heating

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Objectives correspond to EU Fusion Programme and EFDA Work Programme

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Impact of central electron heating on both electron and ion temperatures, and on particle and impurity densities.

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Task agreement WP10-TRA-03-03

Motivation

- Experiments have shown that auxiliary heating can influence impurity accumulation and transport [1].
- In JET, various type of discharges at ITER relevant collisionality had shown that the density profile of Ni (A=28) impurity is flattening when ion cyclotron resonance heating (ICRH) is applied [2].
- There are still discrepancies between theory results (fluid and kinetic models) and experiments.

Ref:

[1] M.E. Puiatti et al, Phys. Plasmas **13** 042501 (2006)

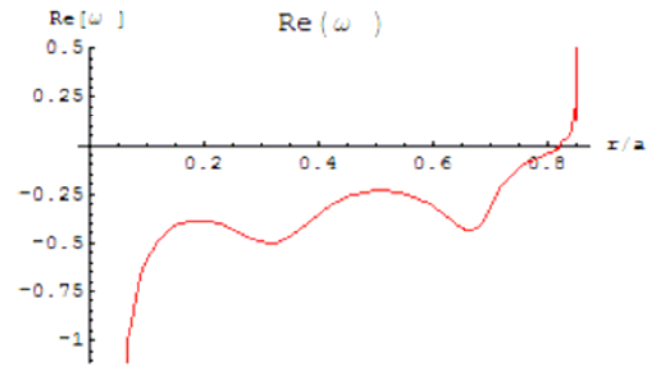
[2] L Carraro et al, 34th EPS Conference on Plasma Phys. Warsaw ECA Vol.31F O-4.028 (2007).

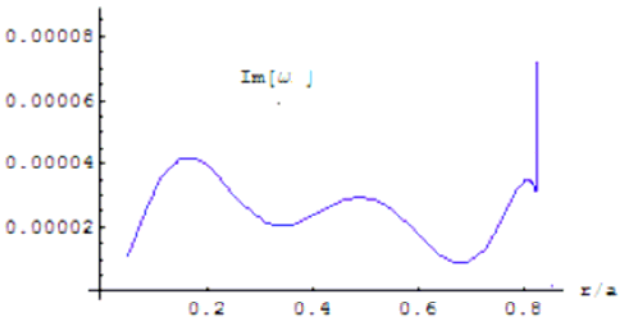
Features of the study:

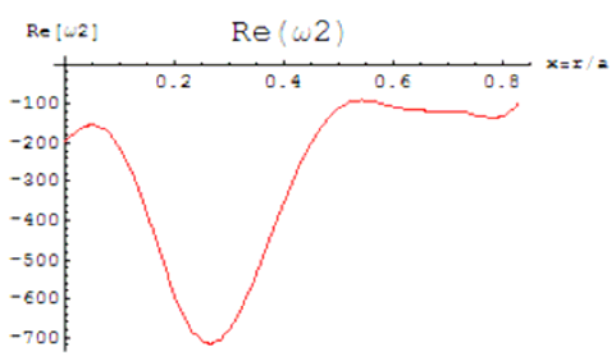
- Impurity density perturbation due to Ion Temperature Gradient (ITG) modes in plasmas with Ion Cyclotron Resonance Heating (ICRH) evaluated in multi-fluid model.
- Heating is applied to electrons in Hydrogen Minority Heating scheme.
- Temperature and density profiles for electrons and Ni-impurity are taken from experiments at JET:
  - The reference discharge #69808 without RF power
  - The discharge #68383 with the maximum ICRF power of 8.3 MW

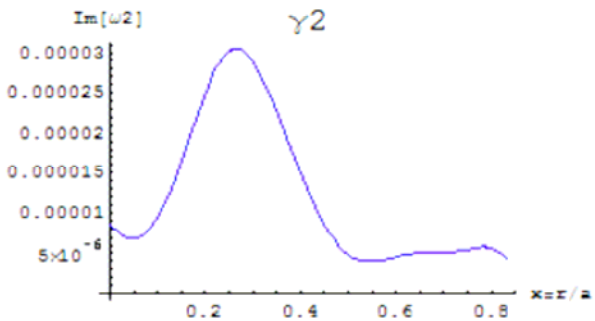
Results:

Radial variation of an instable ITG eigen-mod





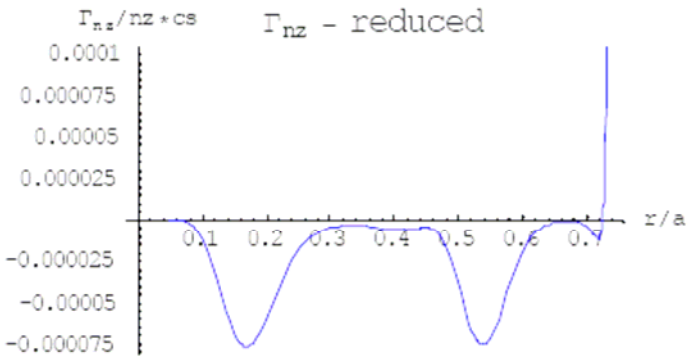


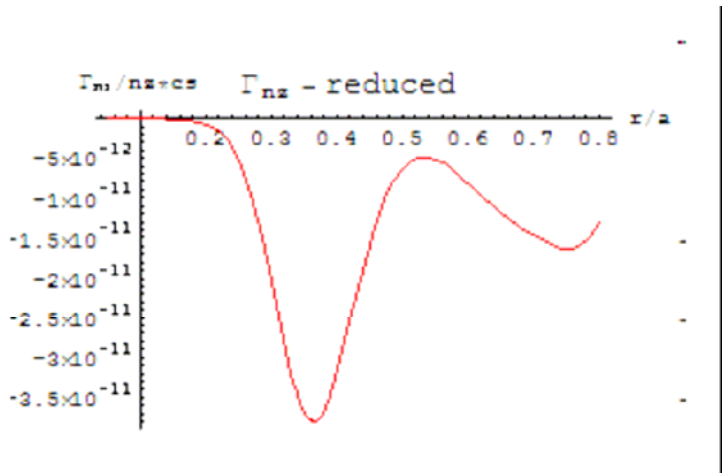


Shot 69808 (no ICRH)

Shot 68383 (with ICRH)

Results: Radial variation of the radial flux driven by ITG mod





Shot 69808 (no ICRH)

Shot 68383 (with ICRH)

Acumulation of Ni-impurities in the center is strongly reduced in the presence of electrons heating !

Problems to solve:

- Frequency of instable ITG/TE eigen-modes compatible with experiments in shots with and with-out RF heating.
- Density perturbation profile of Ni-impurities evaluated from Weiland multi-fluid model in shots with and with-out RF heating.
- Extract the features of heating effects on the transport due to the ITG/TE modes

Colaborations:

- Boris Weyssow – Université Libre de Bruxelles and CSU Garching
- Tünde Fülop – Chalmers University of Technology, Sweden