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Mitigation of Alfvén Eigenmodes in negative triangularity plasmas at TCV

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Recent experiments at TCV have shown a strong mitigation of Toroidal Alfvén Eigenmodes (TAEs) in negative triangularity (NT) plasma compared to its counterpart experiment in positive triangularity (PT). In order to better understand the underlying physics mechanisms, non-linear simulations with positive (δ = +0.4) and negative (δ =- 0.4) triangularities have been carried out with the hybrid kinetic-magnetohydrodynamic code MEGA [1]. Realistic and anisotropic initial fast-ion distributions have been used, showing a significant mitigation of the AE amplitude and growth rate.

Synthetic fast-ion losses show a significant reduction in heat loads (from fast-ions) in NT compared to the PT, using a 2D wall [2] for the TCV case. Significant differences are observed when comparing the power exchange between the confined FI population and the modes, showing a lower energy delivery from the fast-ion population to the wave in the negative triangularity case. Single-n toroidal mode and multi-n simulations are compared to determine the impact of the non-linear interaction between the different modes and their impact on the fast-ion transport and loss. Different pitch-angle and energy distributions are studied to assess whether the effects are dependent on the initial fast-ion distribution in phase-space.

[1] Y. Todo and T. Sato, Physics of Plasmas **5** 1321 (1998)
[2] P. Oyola *et al.*, Review of Scientific Instruments **92** 043558 (2021)

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