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Modelling of Alfvén modes properties in TJ-II plasmas

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Alfvén modes are a low-frequency electromagnetic class of instabilities, which degrade the fast ion confinement and result in poor performance. In burning plasma devices, i.e. ITER and beyond, it is expected that energetic alpha particles will heat the bulk plasma; therefore good confinement and the interaction of energetic particles with background plasmas are of the most important interest in fusion research. The study of Alfvén Eigenmodes (AE) in tokamak plasmas [1] and in 3D non-axisymmetric devices like TJ-II [2,3] demands detailed investigations and modelling of these structures for the optimization of fusion devices. The study of the properties of AE modes and their effect on fast ion confinement is deemed necessary for the enhanced performance of next step burning plasmas [4]. In this work, we take advantage of TJ-II flexibility and present modelling of the observed behavior of Alfvénic modes in a configuration scan of TJ-II, shown in Figure 1 from [5], and compare these results with the experimental ones for the different properties of Alfvén Eigenmodes in TJ-II plasmas. Simulations of selected instabilities [5] are performed by using STELLGAP [6] and AE3D [7] codes for the three-dimensional flexible Heliac TJ-II. Simulation results for the properties of observed AE modes i.e. frequency and radial location are consistent with the experimental observations. Additionally, in our simulations, the mode with same poloidal and toroidal mode numbers appears with the small variations in on-axis iota values. In next step, we will investigate the transition of AE modes between chirping and steady at different iota values.

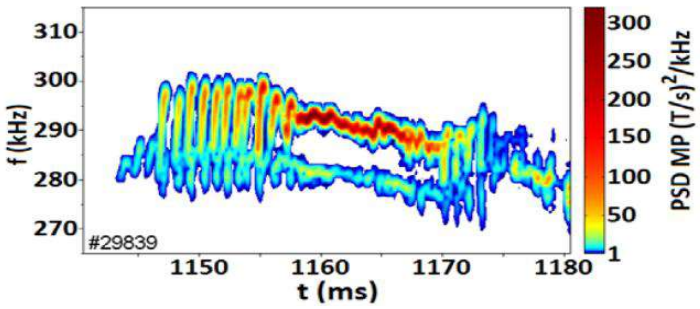

Figure 1: *Experimental observations of Alfvén Eigenmodes (AE) in TJ-II Stellarator.*

References

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