U054-P003 **Room: Poster Session Hall** **Time: May 14**

Interaction of Alfven Eigen modes with energetic ions on LHD

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The interaction of Alfen Eigen (AE) modes on energetic particle transport is one of the most important issues in fusion reactor research since fusion produced alphas could be super Alfveninc particles and the interaction might cause serious problem. On the Large Helical Device(LHD), energetic hydrogen neutral beam, up to 180 keV, are tangentially injected to plasmas and the operational magnetic fields are ranging from 0.4-3.0[T]. These conditions enable us to study the interaction with super Alfvenic particles on LHD.

During the high-beta experimental campaign on LHD, where the magnetic field strength is set around at 0.5[T], the fast change of energetic neutral particles being associated with Toroidicity induced AE(TAE)-burst signals were observed on the tangential Charge Exchange(CX) Neutral Particle Analyzer(NPA). The signals of neutral particles at high energy(typically ˜130-keV) were increased simultaneously with these bursts, while the signal increase of lower energy particles occurred after the increase of the high energy particles. From the analysis, it turned out that the signal increase at high energy region is the result of a formation of a ’clump’ with the enhanced transport of energetic particle by the TAE-bursts and that the increase at low energy is simply the result of the energy slowing-down of the ’clump’. Recently, the creation of a ’hole’ and its slowing-down are also observed on LHD. Using the NPA data, the slowing-down time of both the clump and the hole are evaluated. With this slowing-down information being combined with the orbit analysis on the NPA sight line, the location of the clump and hole formations are identified and the enhanced transport of energetic particles with TAE-bursts are clearly observed by the experiments.

Enhanced temperature rises which are associated with the TAE-bursts are also observed at the plasma facing walls close to the diverter region of LHD-plasmas. It is predicted by the classical orbit calculations that the energetic particles are lost around the diverter regions and the distance from these loss regions to the diverter traces becomes longer as the magnetic field strength of LHD due to the finite Larmour radius effect. Since these regions, where the enhanced temperaute rises are observed, coincide with the energetic particle loss regions of LHD at its operational magnetic field of 0.5[T], it is considered these temperature rises are due to the loss of energetic particles being induced by TAE-bursts.

The analysis for these phenomena will be shown in the presentation.