Kinetic Electromagnetic Instabilities in an ITB Plasma with Weak Magnetic Shear

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Internal transport barriers (ITBs) had been observed on almost fusion devices including HL-2A. ITBs are favored by weak or reversed magnetic shear. As predicted by MHD theory, the high-n ballooning modes seem to be stabilized in ITB region, but low-n MHD instabilities remain a problem. In this talk, we will report experimental results in HL-2A NBI ITB plasmas with weak magnetic shears ($s \sim 0$)and low pressure gradients ($\alpha < 0.3$). The low-n Alfvenic ITG (AITG) instabilities with $f_{BAE} < f < f_{TAE}$ and $n = 2-8$ are found to be unstable in the NBI plasmas with weak shears and low pressure gradients. The measured results are also consistent with the extended generalized fishbone-like dispersion relation (GFLDR-E) and KBM equation, and the modes are more unstable |s| is smaller in low pressure gradient regions. These modes have possibly opposite effects on the ITB formation. The interaction between AITG/KBM activities and EPs should also be investigated with greater attention in fusion plasmas, such as ITER, since weak magnetic shear amplifies the role of and possible excitation by EP of these fluctuations. It is worth emphasizing that the study of AITG/KBM should be paid more attention because they link to the ITB and H-mode pedestal physics for weak magnetic shears. These results also pave the road to more in depth analysis of similar phenomena in fusion plasmas with non-perturbative EP populations, with suggestive possibility of controlling plasma performance by a careful choice of plasma profiles in the weak shear core region typical of burning fusion plasmas.