Evolutions of limit cycle oscillation in L-I-H transitions on HL-2A

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\section*{ABSTRACT}

Poloidal symmetric low frequency oscillations at the plasma edge were observed during the low-intermediate-high transitions on the HL-2A tokamak. The limit cycle oscillation (LCO) frequency gradually reduces from 3.0 kHz to 1.5 kHz approaching the H mode. Meanwhile a transition of phase shift between the turbulence and the radial electric field was identified. In the initial phase, the turbulence grows first, followed by the localized electric field. In the later phase, the electric field leads turbulence, and the magnitude of the Reynolds stress gradient is out of phase with the LCO flow. The increasing magnitudes of the magnetic fluctuation may be correlated with the I-H transition. In addition, the divertor heat flux is also significantly modulated by the LCOs.