# L-H transition and small amplitude oscillations triggered by sawtooth crashes at marginal heating power

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The poloidal flow shear increasing ∼25% up to the threshold value at the very plasma edge is observed just before the L-H transition by means of a fast reciprocating probe array in EAST. The sudden rise of the poloidal flow shear is motivated by an edge heat flux peak originally released by a sawtooth crash at the core. The increased poloidal flow shear is sustained by zonal-flows driven by turbulence excited by another heat pulse for a few hundred microseconds till the plasma entering the H-mode. The ultrafast transport of the sawtooth heat pulses from the plasma core to the edge within a few 0.1 ms is probably caused by (poloidal,toroidal)=(1,1) mode coupling to (2,1) and (3,1) modes.

Before the L-H transition small amplitude oscillations (SAOs), different from the widely known intermediate phase (I-phase [1]), at frequency of a few kilohertz can be triggered by sawtooth crashes in EAST [2]. Negative edge radial electric field ($E_\mathrm{r}$) and pressure gradient inside the separatrix are observed to deepen after bursts of SAOs. In SAOs the turbulence level preceding the negative floating potential perturbation about $90^\circ$ in phase consistent with the model of zonal-flows and turbulence interaction [3] is measured at the bottom of edge $E_\mathrm{r}$ well. A physical mechanisms diagram of SAOs is developed: at a critical gradient in pressure and $E_\mathrm{r}$, turbulence increases at the inboard edge of the $E_\mathrm{r}$ well. The increased turbulence level enhances the radial particle, energy and momentum transport at the plasma edge and increases the amplitude of the zonal flow at the bottom of the $E_\mathrm{r}$ well due to the increased Reynolds force. The increase in the zonal flow amplitude acts to mitigate the turbulence on the inboard edge of the $E_\mathrm{r}$ well, driving a limit-cycle oscillation. The poloidal magnetic perturbations of the oscillations are in-out/up-down asymmetric and toroidal symmetric in the SAOs.

## References

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