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Gyrofluid Studies on Avalanche-like Transport and Formation of Transport Barrier

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Recent experiments in KSTAR have exhibited the evidence of the non-diffusive avalanche-like electron heat transport events from the L-mode and the weak internal transport barrier (ITB) plasmas without magneto-hydrodynamic instabilities[1]. During the events, corrugated profiles of electron temperature are observed, which suggest the existence of $E \times B$ staircase. Based on Self-Organized Criticality(SOC) dynamics, $E \times B$ staircase is known to strongly correlate with corrugated mean profile and regulate the avalanche events by the formation of micro-barriers[2]. Moreover, a model based on Hasegawa-Mima equation showed that those mesoscale structures can merge and become a global structure in the self-organized process, achieving an enhanced confinement state[3]. Inspired by previous works, we analyze the evolution of structures using gyrofluid code developed by Yagi[4], which adopts the 3-field equations with neoclassical poloidal flow damping. With the condition similar to the ITB plasma in KSTAR[5], the weak transport barrier formation is observed. Before the formation of transport barrier, corrugated structures rise and evolve in the way described in Ref. 3, resulting in the creation of global structure in the self-organized process.

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