Impact of avalanche type of transport on the profile formation in tokamaks

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As we already know, the formation of plasma profiles is a central topic of magnetic confinement plasmas. In tokamaks, particularly in the region between the core and the edge, a stiffness region has been observed where the temperature gradient scale length is maintained constant. In the stiffness region, the flux-driven global gyrokinetic simulation reveals the spatio-temporal heat flux that exhibits avalanching transport [1]. As the heating power increases, the avalanching transport is enhanced, which is consistent to the formation of the resilient temperature profiles [1]. To confirm these simulation results, we analysed the data from heating power scan experiments conducted in JT-60U. We observed avalanche-like transport events in the ECE signal, characterized by a *1/f*-scaling of the frequency spectrum and the long-radial propagation. We estimated the electron heat flux driven by large-scale avalanches using a conditional averaging technique. Specifically, in the case of higher heating, the increase in avalanche-driven heat flux corresponds to the increase in heating power, indicating the sustainment of the stiffness profiles [2]. In addition, increased auxiliary heating led to the formation of the internal transport barrier (ITB), indicating a loss of stiffness. We found that the avalanches disturb the ITB formation by expelling the heat stored at the transition phase [3]. As a result, the $E \times B$ flow shear does not develop to form the ITB. The inhibitive feature of avalanches on the transport barrier is consistent to the numerical simulation [4].

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