§2. Statistical Analysis of Non-Diffusive Transport in Edge Plasmas of the LHD Device

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Recently, intermittent convective plasma transport, referred to as "blobs", has been observed in the scrape-off layer (SOL) of several fusion devices, which is thought to play a key role in cross-field plasma transport. It has strong influence on recycling processes and impurity generation from a first wall. Theory predicts that blobs move in the cross-field direction due to *E*x*B* drift, where the charge separation in the blobs is driven by gradient and curvature of magnetic field. On the other hand, in a detached plasma, which is thought to be one of the most effective methods to reduce plasma heat flux to plasma-facing components, the sheath resistivity and plasma resistivity along the blob filament are changed dramatically in comparison with those in the attached plasma. Thus, the blob transport should be modified in the detached plasma. In order to reveal the blob transport in the detached plasma condition, we will report the detailed comparison between fluctuation characteristics in attached- and detached plasmas.

We have investigated the ion saturation currents I_{sat} measured by Langmuir probe array embedding at a divertor plate as shown in Fig. 1(a). The distance between each probe tip is 6 mm. In the middle of a discharge, massive gas puffing leads to plasma detachment. The averaged I_{sat} peaks at the position of the probe tip corresponding to strike point. In the detached condition, the averaged I_{sat} of the probe tips near the strike point decrease and the profile expand toward the private region (Fig. 1(b)). Fluctuation of I_{sat} in this condition has a lot of positive spikes shown in Fig. 1(c). Moreover, in Fig. 1(d), strong cross-correlation between bursty fluctuations of the neighbored probe tips is clearly observed. The propagation velocity of positive bursts can be estimated by the time delay of the correlation peaks, which shows positive bursts propagate in the opposite direction of gradient B. The result is in a good agreement with the theoretical prediction.

Our experimental results indicate that blob transport becomes more active in the detached plasma to contribute to broadening of particle and heat loads to divertor plate.

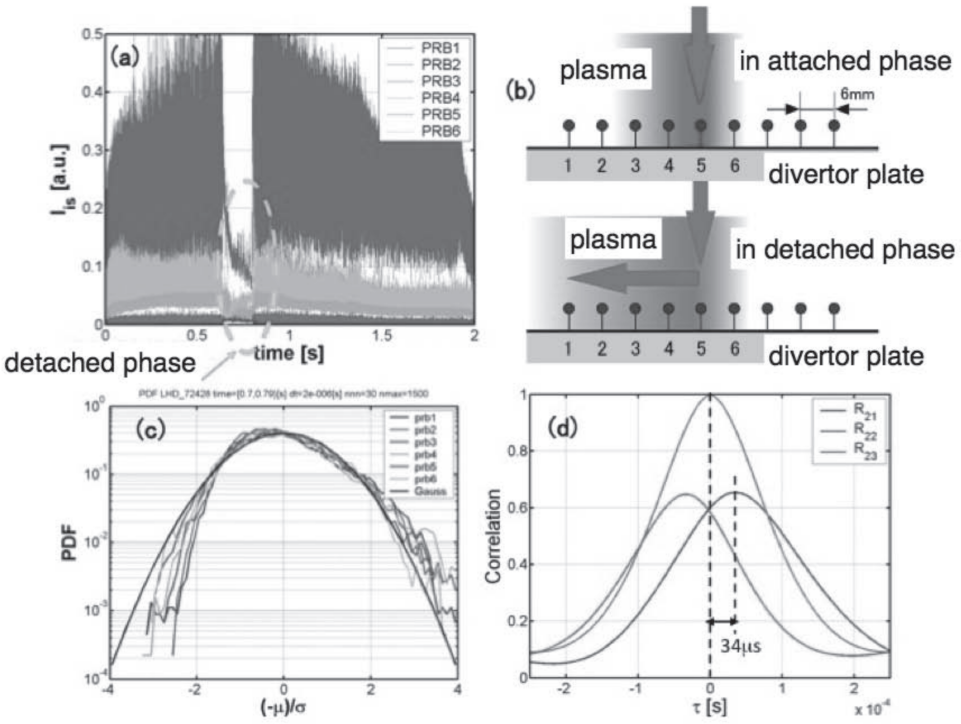

Fig. 1 (a): time evolution of ion saturation currents I_{sat} measured with a divertor probe array, (b): schematic view of plasma profiles in attached and detached phases, (c): probability distribution function of I_{sat} in the detached phase, (d): cross-correlation function of I_{sat}'s measured at probes #1, #2 and #3.