§18. Property of Intermittent Bursts in Edge Plasma of Large Herical Device

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Turbulence and intermittent phenomena in edge and scrape-off-layer (SOL) region of fusion oriented devices, have become an important issue. There has especially been a growing interest in blobs which cause large radial transport from the SOL to the vacuum region. We have developed a sheet-shaped thermal lithium beam probe(LiBP)[1-3] for 2 dimensional density measurements in the SOL region of Large Helical Device(LHD). The sheet-shaped beam injected into the poloidal cross section leads to a wide range of emission in one shot.

The thermal beam is injected from the lower port and a sheet-shaped beam is formed by spreading in the direction of the major radius. The mission light fluctuations, which are proportional to plasma density fluctuations, are observed by multi-channel photomultiplier tubes. Fig.1(b) also shows the configuration of view areas of multi-fiber array as circles. The diameter of each view area is about 5cm.

The fluctuating signals measured by PMT are obtained in a LHD hydrogen plasma produced by electron cyclotron wave heating. The line averaged electron density at the centre is n_e= 7.7∗10^{18}m^{-3}. Intermittent positive burst objects often appear in the time series of outer channel's. Positive spikes imply afflux of high density plasma into the view area. Some of these spikes appear to be correlated and propagate. For the purpose of understanding of the fluctuating signal including the intermittent bursts, p.d.f. analsis is a powerful tool[4]. Fig.1(b) is p.d.f. which is constructed from the fluctuation signal (a) obtained by ch1. That indicates that positive spikes are dominant in ch1's singal. On the other hand, the p.d.f. of inner channel has the similar shape to Gaussian and slightly positive skew. Fig.1(c) shows the distribution of skewness, which is quantified the p.d.f.'s 3rd moment normalized by 2nd moment. At all of the measurement channel, the skewness has positive value, that is to say the positive spike is dominant.

Furthermore, it is found that there is a tendency of increasing along the radial direction. From another standpoint, the skewness has dawnward trend on magnetic connection length L_c, as shown in Fig.1(d). In the area with long connection length, there are background plasma which is transported by diffusion mechanism, turbulent fluctuations also exist. Accordingly the shape of p.d.f. include the effect of turbulent. On the other hand, it is considered that blob phenomenon is dominant in the area with short connection length, since blob's transport mechanism is considered to be convection. In addition, at inner region, there are negative spikes as well as positive spikes. The negative spikes are assumed to be density hole which is track of low density at birth of blob[4]. That is, it is also considered that original source located in the elgodic area and the blobs with high density are transported to outer region.

It is found that there is a correlation between the skewness and the electron density, and that the skewness decreases by increasing density, while the skewness keep positive value. As a general trend, the collisinality increases when the density increases. Therefore, it is considered that generated blobs are uniformized and mixed with background plasma. And the decrease of skewness on ch3 and ch7 may indicate that the incidence rate of blob is related to the density.

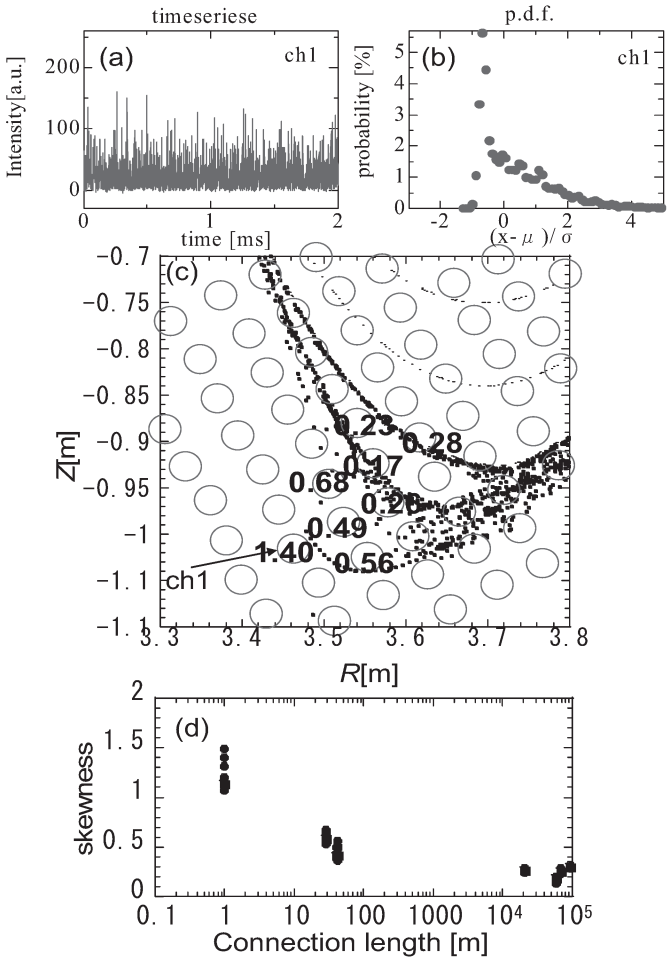

Fig. 1 (a)The time evlolution of LiI on ch1. (b) p.d.f. constructed from (a). (c)Distribution of skewness at n_e= 0.9∗10^{18}m^{-3}. (d) L_c dependence of the skewness.

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