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Study of Filament Features of Edge Plasma Fluctuations in Heliotron J

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To investigate plasma fluctuations and particle transport around LCFS region, a Langmuir probe array has been installed at #14.5 section in Heliotron J. In a condition-fixed ECH discharge series, supersonic molecular-beam (SMB) was injected at 222ms from #11.5 port. The Langmuir probe array was scanned along the radial direction shot by shot to get the radial profiles of ion saturation current (Is) and floating potential (Vf).

The conditional average (CA) method is applied to $\widetilde{Is}$ ($\widetilde{A}$ means 2kHz high pass filtered signal of A) data to extract the blob. The trigger condition of CA is set to 2.5σ in this case, where σ is the standard deviation of $\widetilde{Is}$ during a time window of 5ms . The CA results of $\widetilde{Is}$, $\widetilde{Ep}$ and a blob-induced particle flux Γ_{blob} at two radial positions (r-a = -4 mm and +10 mm) are shown in Figs. 1(a) and (b). Here, The Γ_{blob} is calculated by $\widetilde{Is}\cdot\widetilde{Ep}$, where Ep is the poloidal electric field evaluated from two floating potential signals of two electrodes arranged in the poloidal direction. The positive Γ_{blob} means the outward flux. The shapes of $\widetilde{Is}$, $\widetilde{Ep}$ and Γ_{blob} just after SMBI (225-230 ms, red lines in Fig.1) do not change very much between r-a = -4 mm and +10 mm, here the blob count number per millisecond is about 3-4 for each position. On the other hand, long after SMBI (245-250 ms, blue lines), $\widetilde{Ep}$-structure is different between two positions, r-a = -4mm and 10mm. A characteristic structure, which is usually observed for the blob, is not observed at r-a = -4 mm, but, at r-a = +10 mm, the characteristic structure is observed. This and the data in-between the two position suggest the blobs are born probably near r-a = +10 mm in this timing (long after SMBI). The averaged particle flux carried by a single blob reduced to a small value compared to that at 225-230 ms, due to smaller values of $\widetilde{Is}$ and $\widetilde{Ep}$. The count number per millisecond, however, increased from 1 to 6 at this timing.

Figure 2 shows the radial profiles of time averaged Is, Er (radial electric field) and total Γ_{blob} during the time window (calculated from the CA results). In Fig. 2(a), the gradient of Is at 245-250ms (long after SMBI) is much steeper than that at 225-230ms (just after SMBI). As in Fig. 2(c), however, the blob-induced particle flux at 245-250 ms is much reduced from that at 225-230 ms. The much steeper Er profile in the region of -4 mm < r-a < +6 mm long after SMBI may be a candidate to explain the reduced blob-induced particle flux and increased count number. It can be expected that the sheared flow might tear up the coherent blob structures and reduced the blob-induced transport.

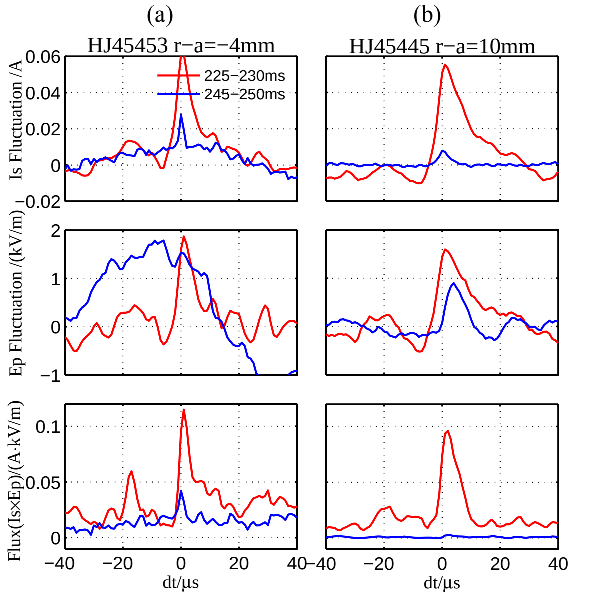

Figure 1. Auto CA of $\widetilde{Is}$, cross CA of $\widetilde{Ep}$ and blob induced particle flux; red: 225-230ms, blue: 245-250ms. Location: (a) r-a=-4mm; (b) r-a=10mm.

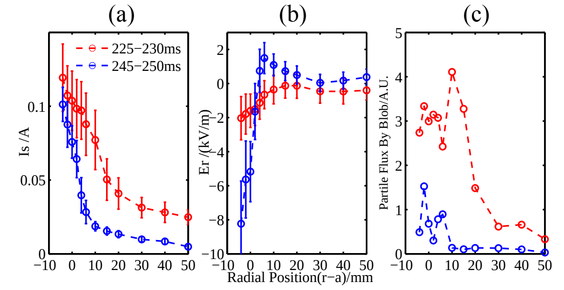

Figure 2. Radial profiles of (a) Is; (b) Er; (c) particle flux induced by blob. Red: 225-230ms, just after SMBI. Blue: 245-250ms.