§19. Measurement of Edge Plasma Fluctuation by 2-D Thermal Li Beam

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From experiments on fusion devices, there are a lot of evidence that plasma turbulence is highly intermittent. Intermittent events play a crucial role in transport dynamics. Intermittent transport resulted from rare, large events is accompanied by coherent structures, leading to heat and particle losses more than ones predicted by classical diffusive scaling. The cross-field transport in the scrape-off layer (SOC), associated with the intermittent events, determines the heat and particle deposition width on a divertor target plate and a first wall. Recently, intermittent convective plasma transport, so-called “plasma blobs” has been observed in several tokamak devices, which is thought to play a key role for cross-field transport. In the LHD, bursty density fluctuation, associated with plasma blobs, was also observed with the divertor array. In order to clarify the propagation mechanism of plasma blobs, development of two-dimensional diagnostic method of density fluctuation in the SOL is quite important.

A two-dimensional thermal lithium beam source has been developed recently in NIFS and two-dimensional density distribution is becoming clear in the LHD edge plasmas.

In order to measure two-dimensional distribution of density fluctuation in SOL by using the two-dimensional thermal lithium beam source, it is necessary to develop high performance thermal lithium beam source and algorithm to avoid propagation of density fluctuation due to the beam propagation.

Figure 1 shows two-dimensional distribution of light emission (670.8nm) from the neutral lithium atom with a CCD camera with an interference filter in the linear divertor plasma simulator, NAGDIS-II. Two-dimensional distributions of electron density and temperature were obtained by analyzing the two-dimensional distribution of neutral lithium light emission. In addition, we have measured two-dimensional distribution of fluctuating lithium light emission with a high-speed camera with an image intensifier (ICCD), but could not reconstruct the two-dimensional distribution of density fluctuation because the light emission was weak.

Therefore, in order to obtain high intensity thermal lithium beam, we are developing new two-dimensional thermal lithium beam source having carbon heater with high heating efficiency and lithium oven made of BN as shown in Fig. 2.

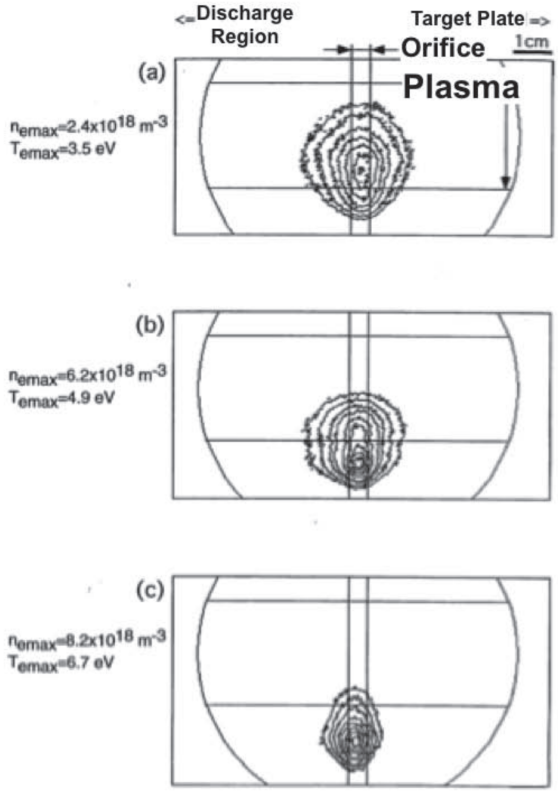

Fig. 1 two-dimensional distribution of light emission (670.8nm) from the neutral lithium atom with a CCD camera in the NAGDIS-II device at various plasma conditions.

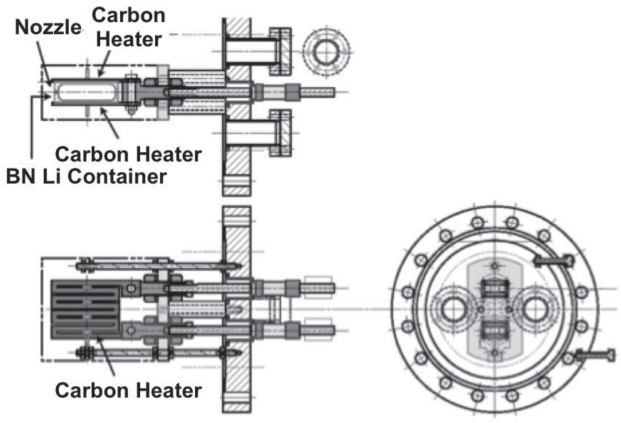

Fig. 2 Schematic drawing of two-dimensional thermal lithium beam source to generate high intensity beam.