

## §51. MARFE-Like Radiative Collapse in LHD

Peterson, B.J., Xu, Y., Kostrioukov, A.Yu., Liu, Y. (SWIP, China), Ashikawa, N., Tokuzawa, T., Tanaka, K., Sudo, S.

In LHD discharges NBI heated plasmas are terminated at the density limit by asymmetric radiative collapse [1,2]. This phenomenon is similar to MARFE in a tokamak [3] in several respects. (1) The asymmetry manifests itself as a peaking of the radiation on the inboard side (Figs. 1-3) which corresponds spatially and temporally with a degradation of the interferometer signal most likely due to beam deflection due to high density gradients (Fig. 1) [1]. (2) There is a spatial and temporal coincidence of the asymmetries in the radiation, electron density and temperature which is characteristic of the thermal radiative instability preceding the asymmetric radiation [2]. (3) Radiation measurements at 3 different toroidal angles,  $\phi = 93, 140, 250$ , in addition to the electron temperature ( $\phi = 234$ ) and density ( $\phi = 72$ ) measurements indicate that this phenomenon is axisymmetric even though

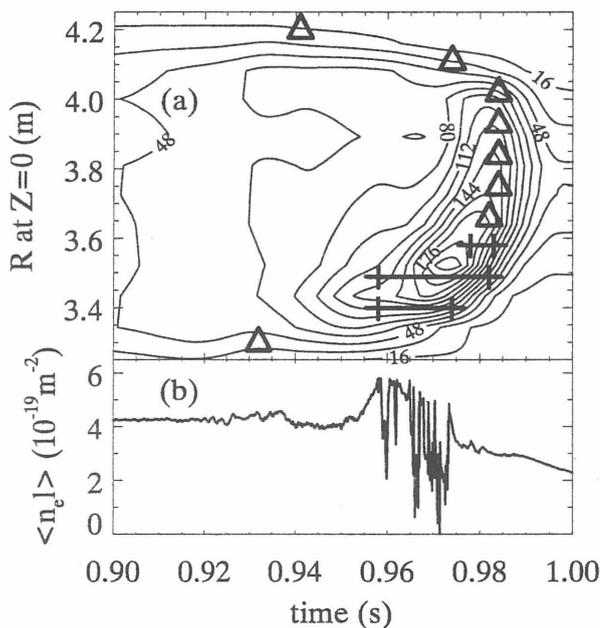


Fig. 1. (a) Comparison of Bolometer brightness ( $\text{W/m}^2$ ) profile evolution (contours,  $\phi = 140$ ) and FIR interferometer data (peaks - triangles, degradation - ++,  $\phi = 72$ ) during radiative collapse. (b) Line density evolution for the FIR interferometer chord at  $R = 3.4$  m.

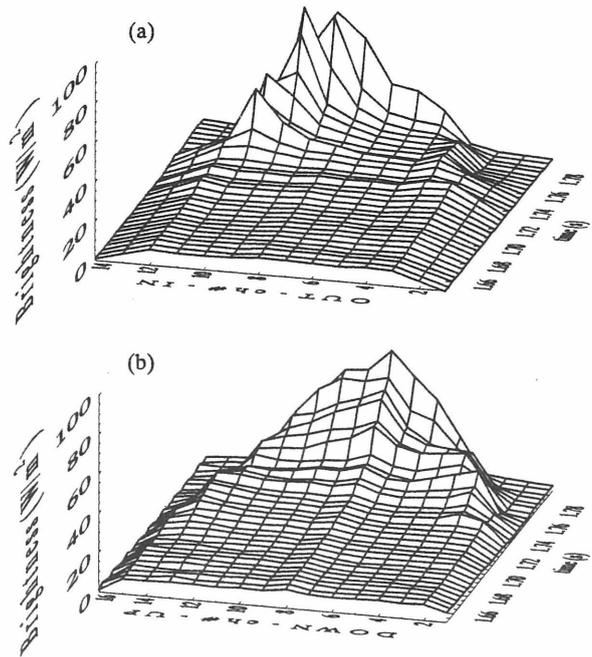


Fig. 2 Bolometer brightness profiles at the (a) vertically ( $\phi = 140$ ) and (b) horizontally ( $\phi = 93$ ) elongated cross-sections.

LHD has a non-axisymmetric magnetic field and vacuum vessel. But unlike MARFE, the asymmetric radiation in LHD is rather transient since it appears right before the end of the discharge.

### References

- [1] B. J. Peterson et al., Phys. Plasmas **8** (2001) 3861.
- [2] Y. Xu et al., Nucl. Fusion **42** (2002) 601.
- [3] B. Lipschultz et al., Nucl. Fusion **24** (1984) 977.

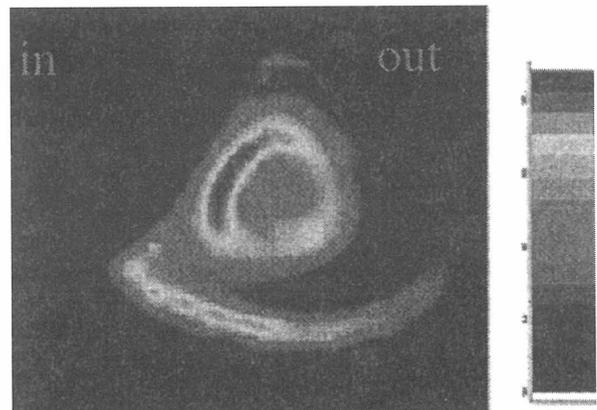


Fig. 3. Tomographic reconstruction of a two-dimensional radiation profile during radiative collapse using two twenty channel AXUV diode arrays in a semi-tangential cross-section ( $\phi \sim 250$ ).