X-point radiator and better confinement after detachment in HL-2A L mode plasma

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In HL-2A the L-mode plasma has achieved better confinement after partial detachment and pronounced detachment by injecting a mixture of nitrogen and deuterium. X-point radiation forms, detected by three sets of AXUV arrays, and the strongest radiation point locates under the X point. The closed divertor configuration has a good screening effect on impurities, so only a small amount of impurities enter the main plasma and results in an increase of approximately 10% in the total radiation power of the main plasma. The impurity presents a hollow distribution in the main chamber, as can be seen in figure 1. The impurities in the main plasma enhanced the Ti profile in the core plasma, as is shown in figure 2. The impurity radiation cools the boundary, and the decrease in Ti gradient leads to a significant decrease in ITG turbulence. The increased density and temperature profiles, as well as the decreased boundary turbulence transport, are the main factors accounting for the increased total stored energy after detachment. These results show that the closed divertor has unique advantages in detachment and heat load control.

Keyword: closed divertor, confinement, X-point radiation,

Reference:
[1] Wu T. et al. 2023 Plasma sci. Tech. **25** 015102
[2] Xue G Q et al, 2021 Nucl. Fusion **61** 116048

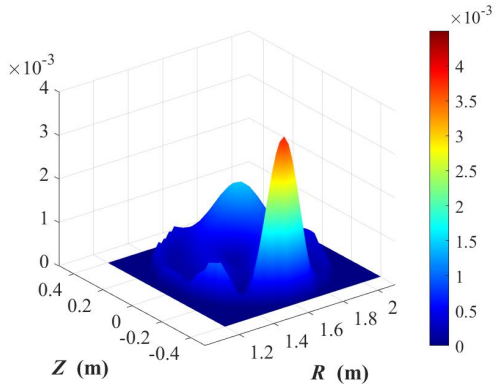

Figure 1 The NII radiation in the main chamber measured by the the visible spectroscopy and inverted by a Bayesian based non-stationary Gaussian Process method.

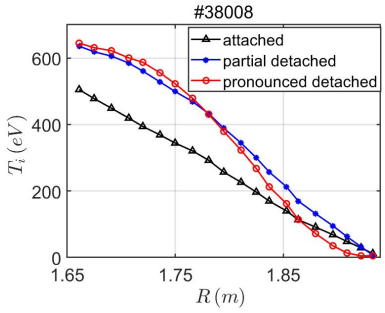

Figure 2 The ion temperature profiles when plasma is in the attached, partial detached and pronounced detached states, measured by CXRS.