Topic D	Requested: ☒ Oral ☐ Poster	Panel suggestion: ☐ Oral ☐ Poster

Evolution of 2D Deuterium and Impurity Radiation Profiles During Transitions from Attached to Detached Divertor Operation in DIII–D*

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The detailed evolution of conditions along both the inner and outer divertor legs during the transition from attached ELMing H–mode to detached radiative divertor operation will be shown. This transition, induced by D_2 gas injection, will be characterized by the evolution of the 2D emission profiles from radiating constituents including impurities and deuterium (ionization and recombination emission). When the steady detached state is achieved, radiated power near the X–point is primarily due to carbon. Near the outer strike point (OSP), deuterium radiation is the main constituent. Analysis of the divertor power and particle balance in this state indicates that parallel deuterium ion flow into the divertor, produced by upstream ionization sources in the vicinity of the X–point, can play an important role in sustaining the radiation observed there. Neutralization of these flows by volume recombination further down the outer leg near the target plates is consistent with observed spectroscopic signatures of deuterium recombination and measurements of low heat and particle fluxes on the targets.

The physics of inner leg detachment appears to be important in producing the transition to radiative divertor operation. In ELMing H–mode prior to gas injection, both carbon and deuterium emission peak in the inner leg. Low ion flux measured by floor probes and low T_e from divertor Thomson scattering show that the inner leg is detached except at the inner strike point (ISP). After deuterium injection the profiles of CIII visible emission change first in the inner leg, followed by intermediate distributions in the outer leg before the final state with localized radiation near the X–point is reached. Deuterium emission during this transition decreases at the ISP and increases across the dome of the private flux region near the X–point before appearing in the outer leg. The evolution of the spatial profile of the recombination zones will be determined by forming images of the ratio of intensities from simultaneous images of D_α and D_γ emission in the divertor. Line integrated measurements of the L_α/L_β ratio using a new SPRED VUV spectrometer with coverage from 300 to 1650 verify changes in recombination during the transition. These observations will be compared with simulations using UEDGE plasma solutions combined with Monte-Carlo transport calculations of deuterium and carbon.

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