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# Progress in DIII-D Towards Validating Divertor Power Exhaust Predictions

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Understanding of divertor heat load and its control in fusion reactors has been critically advanced in DIII-D radiative power exhaust experiments corroborated with state-of-the-art 2D fluid simulations. UEDGE simulations indicate that the non-linear interaction between the divertor electron temperatures and drifts can drive a bifurcation of the divertor solution between attached and detached branches. This mechanism provides an explanation for the experimentally observed step-like transition from strongly attached to well detached divertor conditions with increasing plasma density, as measured by Thomson scattering in plasmas with the grad-B-drift towards the X-point (fwd. BT). Analysis of the new extreme ultraviolet (EUV) spectroscopy shows that in detachment with D2-injection in fwd. B, the resonant CIV (154.9 nm) line dominates the radiated power and peaks next to the X-point. In contrast, operating with the grad-B-drift away from the X-point (rev. B), the radiated power peaks in front of the outer target and is dominated by the deuterium Ly-alpha (121.5 nm). Fluid simulations with UEDGE qualitatively reproduce the relative intensity of the emitting lines and regions in both field configurations. However, the simulations predict the radiation to be about a factor of 3 more localized than measured, indicating an under prediction of the transport mechanisms expanding the radiating volume.

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