A Comparison of Radiating Divertor Behavior in Single-Null and Double-Null Plasmas in DIII-D*

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We show that "puff and pump" radiating divertor scenarios, as can be applied to both upper single-null (SN) and double-null (DN) H-mode plasmas, can result in a 30%-50% increase in radiated power with a negligible decrease in τ_E. Argon was injected into the private flux region near the outer divertor target, and plasma flow into the divertors was enhanced by deuterium gas puffing upstream of the divertor targets combined with particle pumping at the targets. For a fixed deuterium injection rate, argon leaked out of the divertor of SN plasmas more rapidly and reached a higher steady-state concentration in the main plasma when the $B \times \nabla B$-ion drift was directed *toward* the divertor ($V_{\nabla B\uparrow}$) than when the $B \times \nabla B$-ion drift was directed *away from* the divertor ($V_{\nabla B\downarrow}$). The rate at which argon built up inside DN plasmas was not sensitive to the direction of the $B \times \nabla B$-ion drift, and was comparable to SNs with $V_{\nabla B\uparrow}$. In contrast, the argon buildup rate was 2-3 times *slower* for SNs with $V_{\nabla B\downarrow}$. The *exhaust enrichment* (η_{EXH}), defined as the ratio of impurity fraction in the pumping plenum to that in the plasma core, was relatively insensitive to increases in the argon injection rate Γ_{AR} for $V_{\nabla B\downarrow}$ but decreased rapidly for $V_{\nabla B\uparrow}$ as Γ_{AR} was raised. While radiated power in the divertor of SNs increased during argon puffing in both $B \times \nabla B$ cases, its distribution in the divertor was spatially more uniform for $V_{\nabla B\downarrow}$. The total radiated power fraction increased from ≈40%-45% to ≈60%-65%, while maintaining $\tau_E/\tau_{ITER89P\approx 2}$. Roughly half of the increase in the radiated power was in the main plasma. We also found that equal sharing of the radiated power between divertors of DNs was *not* obtainable during argon puff-and-pump, as significant increases in divertor radiated power were only observed in the divertor *opposite* $B \times \nabla B$. These results suggest that particle drifts in the SOL are important to understanding the behavior of SN and DN plasmas during puff-and-pump. Comparison of these data with simulations from the UEDGE, ONETWO, and MIST transport codes will be presented.

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