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## EX/P4-11: Study of the High-efficiency Fuelling Features of Supersonic Molecular Beam Injection on HL-2A Tokamak

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Features of high fuelling efficiency of supersonic molecular beam injection (SMBI) have been studied on HL-2A tokamak. Normalized by fuel inventory, the  $D_{\alpha}$  emission induced by SMBI is about 50% higher than that of gas puffing (GP), indicating that SMBI can send the fuel to the plasma edge more efficiently. And strong particle convection (inward pinch) is observed both by hydrogen cyanide (HCN) interferometer as the densities from core channels increasing whereas the edge channels decreasing during the post-fuelling phase and by the microwave reflectometry (MWR). By comparing the SMBI pulses with and without electron cyclotron resonance heating (ECRH), the pinch may be driven by the enhancement of normalized electron temperature gradient. It is observed that higher enhancement (up to twice) of normalized electron temperature gradient for SMBI than that for GP, and this may be another mechanism for higher fuelling efficiency of SMBI.

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