

Main-ion charge exchange spectroscopy for ion temperature and rotation at DIII-D

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Charge exchange (CX) spectroscopy using impurities is the standard diagnostic technique for ion temperature, impurity density and velocity. However, neoclassical theory predicts the rotation of the main ions (deuterons) and impurities are not necessarily the same. Accurate measurement of the bulk ion rotation is required for comparison with theory to assess the rotation stabilization of MHD modes, and to develop predictions for future devices where differential impurity and main-ion rotation can be significant. A prototype main-ion diagnostic is operational on DIII-D that measures the D_α emission from direct CX with the beams and halo emission, and has two unique sightlines viewing co- and counter- I_p neutral beams. The atomic processes that contribute to D_α emission are simulated with a Monte-Carlo based beam injection and halo diffusion code. Comparison between main-ion and carbon temperature and velocity measurements will be presented. Work supported by the US DOE under DE-AC02-09CH11466, DE-FC02-04ER54698, DE-FG02-07ER54917.