Characterization of Neutral-Beam Induced $D_\alpha$ Emission on DIII-D

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Abstract. $D_\alpha$ emission from neutral beam heated tokamak discharges in DIII-D [J. L. Luxon, Nucl. Fusion 42, 614 (2002)] is characterized for evaluation of physically relevant main ion plasma parameters, such as deuterium temperature and toroidal rotation velocity. The spectral analysis takes into account passive $D_\alpha$ emission from the plasma edge and active emission from neutral beam injection. The interpretation of the spectral analysis is assisted by a complete physics model of the plasma environment. The result of the analysis is that $D_\alpha$ light emitted from charge-exchange between bulk ions and beam neutrals and halo neutrals can be quantitatively interpreted to extract accurate measurements of the thermal deuterium ion temperature and toroidal rotation velocity in a wide range of plasma conditions.

PACS numbers: 52.25.Fi, 52.55.Fa, 52.70.Kz