Implementation of a new atomic basis for the He I equilibrium line ratio technique for electron temperature and density diagnostic in the SOL for H-mode plasmas in DIII-D

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Abstract

Evaluating the ratio of selected helium lines allows for measurement of electron densities and temperatures. This technique is applied for L-mode plasmas at TEXTOR [O. Schmitz, et al., Plasma Phys. Control. Fusion 50, 115004 (2008)]. We report our first efforts to extend it to H-mode plasma diagnostics in DIII-D.

This technique depends on the accuracy of the atomic data used in the Collisional Radiative Model (CRM). We present predictions for the electron temperatures and densities by using recently calculated R-Matrix With Pseudostates (RMPS) and Convergent Close-Coupling (CCC) electron-impact excitation and ionization data. We include contributions from higher Rydberg states by means of the projection matrix. These effects become significant for high electron density conditions, which are typical in H-mode. We apply a non-equilibrium model for the time propagation of the ionization balance to predict line emission profiles from experimental H-mode data from DIII-D.

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