Evaluation of an Improved Atomic Data Basis for Carbon in UEDGE Emission Modeling for L-mode Plasmas in DIII-D*

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New carbon and deuterium atomic physics data is utilized to evaluate comparisons between experimental measurements and fluid modeling of detached plasmas at DIII-D. A previous modeling study [1] with the code UEDGE found higher carbon emission than measured experimentally for detached outboard divertor plasmas in L-mode. The C II line emission for 514.7 nm was overestimated by a factor of 10 to 20 higher than observed experimentally for the inner leg, although the outer leg was within a factor of 2, while the predicted D_α emission from neutral deuterium at the outer strike point was predicted to be a factor of 4 lower than measured. The UEDGE atomic dataset for carbon is taken from ADAS, and relies on Plane Wave Born electron impact excitation data which is well known to overestimate significantly the electron-impact excitation cross-sections, thus affecting the predictions of carbon and deuterium line emission intensities and radiative cooling. A new atomic dataset for carbon is being constructed and consists on newly calculated electron impact excitation data from R-matrix that will yield better quality in the atomic dataset used. A new set of atomic data has already been calculated and it will be employed for the new emission calculation in order to study the discrepancies in the C II and D_α radiation. Divertor Thomson scattering measurements of electron densities and temperatures are utilized to compare measurements and modeling of C II and D_α emission. Finally, a comparison of overall power balance between the code and the experiment will examine radiative cooling due to carbon and deuterium, and parallel transport.

[1] M. Groth et al., Proceedings of the 19th Int. Conf. on Plasma Surface Interactions, San Diego, California, May 24–28, 2010.

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