OEDGE modeling of DIII-D density scan discharges leading to detachment*

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The OEDGE code is used to model the edge plasma for discharges from a density scan experiment on DIII-D with the objective of identifying the important physics controlling detachment. In this experiment the plasma density was increased over a series of L-mode discharges starting with a lower density discharge with both targets attached ($\bar{n}_e$=1.6x10^{19} m^{-3}) and ending with a higher density discharge with both targets detached ($\bar{n}_e$=4.5x10^{19} m^{-3}). These discharges used large X-point sweeps to maximize collection of divertor measurements. Scans with the recently installed swing probe at the inner wall provided n_e and T_e measurements in the inner scrape off layer (SOL) and at the entrance of the inner divertor. Target Langmuir probe, Thomson scattering and spectroscopic measurements in the divertor were also made. For the attached cases, OEDGE modeling replicates the relation between divertor measurements and measurements in the upstream SOL except for the flux tubes closest to the separatrix (the region between the peak of the target flux profile and the separatrix strike point). OEDGE already includes terms applied to near separatrix main SOL flux tubes to account for the losses to the private flux zone. Thus this discrepancy may indicate that significant physics is being missed in this near-separatrix region in the current OEDGE model. The OEDGE models are extended to resolve this issue and extend OEDGE modeling into detached plasma regimes. OEDGE analysis incorporating a number of additional terms dependent on the neutral hydrogen density, neutral hydrogen molecule density, neutral hydrogen mean free path, as well as drifts is presented.

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