Abstract Submitted
for the DPP97 Meeting of
The American Physical Society

Sorting Category: 5.1.1.2 (experimental)

Divertor Detachment in Helium Plasmas[1] D.N. HILL, Lawrence Livermore National Laboratory, AND THE DIII–D DIVERTOR PHYSICS TEAM, General Atomics — Detached divertor operation with helium as the working gas was recently obtained in the DIII–D tokamak. Changing the gas from deuterium to helium changes the atomic physics of ionization, recombination, charge-exchange, and impurity generation by chemical sputtering. In deuterium plasmas, D_2 gas injection produces strong heat flux reduction due to increased carbon radiation. When the divertor temperature falls below a few eV, we obtain a Partially Detached Divertor (PDD) and energy transport by convection becomes important. In helium L–mode plasmas, we observe a strongly radiating X–point marfe with He gas puffing, but the particle flux at the plate does not exhibit the usual characteristics of the PDD state (*i.e.*, much flatter spatial distribution). The target plate peak heat flux is reduced by a factor of 3–5, with a profile similar to D_2 PDD. Thomson scattering and Langmuir probe measurements show that X–point temperatures of 2–3 eV are obtained in these conditions, and spectroscopic data show that carbon radiation is strongly reduced. Further comparisons with D_2 operation will be presented.

[1]Work supported by U.S. DOE Contracts DE-AC03-89ER51114, and W-7405-ENG-48.

[X] Prefer Oral Session
[ ] Prefer Poster Session

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Date submitted: July 7, 1997 Electronic form version 1.2