Particle Transport in HSX

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The density profile in the Quasi-Helically Symmetric (QHS) configuration is centrally peaked for both on- and off-axis heating. In a magnetic configuration with the symmetry broken (Mirror), the density profile is flat or slightly hollow with on-axis heating, where the temperature profile is centrally peaked. When the ECH resonance is moved off-axis, the temperature profile becomes flat inside the heating radius, and the density profile becomes peaked. This suggests that a thermodiffusive particle flux is the cause of the hollow profile in the centrally heated case. In order to study the particle transport in more detail, experimental data from a set of absolutely calibrated H_α detectors has been coupled to simulations using the DEGAS[1] neutral gas code. These calculations yield the particle source rate, which can be integrated using the continuity equation to give the steady state radial particle flux. It is found that in QHS plasmas, the experimental particle flux is much larger than the neoclassical flux across the entire minor radius. In Mirror plasmas, however, the neoclassical flux is comparable to experiment in the core ($r/a < 0.4$). In this region, the thermodiffusive flux is the dominant term in the total neoclassical particle flux, suggesting that neoclassical thermodiffusion is the cause of the hollow density profile. The peaked density profiles observed in QHS plasmas indicate that, at present parameters, thermodiffusion is not a significant part of the total particle balance. This work is supported by DOE Grant DE-FG02-93ER54222.

1. Heifetz, D.B. *et al*, J. Comp. Phys. **46,** (1982) 309