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Measurements of Reynolds stress and its contribution to momentum balance in the HSX stellarator[1] ROBERT WILCOX, DAVID ANDERSON, JOSEPH TALMADGE, SIMON ANDERSON, University of Wisconsin - Madison — It has been predicted that for a sufficiently optimized quasi-symmetric stellarator, the neoclassical non-ambipolar transport and viscosity can be small enough that other terms, such as the Reynolds stress resulting from plasma turbulence, can compete with it in the momentum balance to determine the rotation and radial electric field. In this case, the experimental flows may deviate from values calculated using the ambipolarity constraint by purely neoclassical codes such as DKES and PENTA which are commonly used for stellarators. Using multi-tipped Langmuir probes in the edge of the HSX stellarator, the radial electric field and parallel ion flows are found to deviate from the values calculated by PENTA in the edge of the optimized quasi-helically symmetric (QHS) configuration. A large Reynolds stress flow drive is measured via fluctuating floating potential signals in the same radial region as the measured deviation from neoclassical calculations. Probe measurements are made at two locations on the device near the maximum of variation of magnetic geometry on a flux surface. Experiments have been run in both the QHS configuration and configurations with the symmetry intentionally broken to explore the relationship between the neoclassical optimization and the measured deviation of the flows from the calculated neoclassical value.

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Robert Wilcox
University of Wisconsin - Madison

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