Transport with Reversed Shear in the National Spherical Torus Experiment (NSTX)

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Over the last several years an improved understanding of ion thermal transport in tokamaks has emerged that is based on the suppression of microturbulence by $E \times B$ sheared flows. In the area of electron transport, however, little progress has been made in the understanding of the processes causing this transport and how to reduce it. It has been predicted that reversed magnetic shear can stabilize or reduce the growth rate of micro-instabilities. To this end, we have performed a set of experiments to understand the role of magnetic shear on electron transport. We have varied the magnetic shear, keeping all other plasma conditions the same, to isolate the effect of shear on transport. We observe an improvement in the electron and ion thermal diffusivities as the magnetic shear becomes more negative. The plasmas are well diagnosed with high spatial and temporal resolution measurements of the electron and ion temperature, density, and plasma toroidal rotation profiles. In addition, a new and novel motional Stark effect (MSE) diagnostic that measures the internal magnetic field pitch angle has been implemented. The MSE diagnostic utilizes a high resolution, high throughput filter to obtain good polarization from the Stark multiplet at low magnetic field (0.45 T). This research was supported by U.S. DOE contract DE-FG02-99ER54520.