Momentum Transport Studies in NSTX

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The momentum diffusivity in the low aspect ratio NSTX, as calculated from a steadystate momentum balance, is often found to be much lower than the ion thermal diffusivity, especially in H-mode plasmas where the ion thermal diffusivity is near neoclassical levels. Further, the momentum and ion thermal diffusivities do not track each other, as is generally the case at higher aspect ratio. Calculations from GTC-NEO indicate that despite the ion thermal diffusivity being near neoclassical, the momentum diffusivity is much greater than the neoclassical momentum diffusivity, which can be near zero or even negative due to ion temperature gradient effects. The momentum confinement time is approximately 150 ms, which is a factor of three to four greater than the energy confinement time. Perturbative experiments using n=3 braking fields near the edge of the plasma have allowed a separation of the momentum diffusivity and momentum pinch velocity. A significant inward pinch of up to 40 m/s is calculated, and the associated momentum diffusivity is about a factor of two to three greater than the corresponding value as computed from steady-state momentum balance. The momentum pinch velocities agree well with values based on low-k turbulence theory.

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