Turbulent-transport of energetic ions in tokamak plasmas with on-axis neutral beam injection

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Abstract.

Turbulent-transport of fast ions is predicted by theory and simulations to increase in high temperature plasmas, when the ratio of fast-ion energy to temperature, \( E/T \), is reduced. In DIII-D experiments featuring 2.5 MW of on-axis beam injection, the ratio \( E/T_e(0) \) is reduced by increasing central electron temperature a factor of two using an additional 3.3 MW centrally deposited electron cyclotron heating. Comparisons between measured fast ion density profiles and classically predicted profiles in both the low and high temperature plasmas show that there is evidence of fast ion transport by turbulence during on-axis beam injection, but there is no measured increase in turbulent-transport of fast ions at lower \( E/T_e(0) \). Changes in the nature of the long wavelength turbulence (\( k\rho_s < 0.5 \)), from predominantly ion temperature gradient mode driven turbulence to trapped electron mode driven turbulence, as \( T_e \) is increased may be related to the observed absence of the \( E/T_e \) scaling in these experiments.