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The current driven by the electromagnetic Ion Temperature Gradient turbulence

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The turbulence-driven current has attracted significant attention due to its impact on current profile modification and plasma confinement [1]. Our previous studies have demonstrated the multi-scale structures of the turbulence-driven current and their influence on current profile modification [2,3]. Recently, gyrokinetic simulations, considering the electromagnetic effects in the collisionless limit, elucidate the physical mechanisms and amplitude of the current driven by ion temperature gradient turbulence. The result indicates that although the current remains relatively insensitive to electromagnetic effects since the current is primarily driven by the electrostatic term in Reynolds stress, the electromagnetic effects can significantly influence the electromagnetic components in both Reynolds stress and turbulence acceleration terms. Phase-space analysis reveals that electromagnetic effects influence the role of barely passing particles in the turbulence-driven current across different directions. A significant difference in the phase-space distribution of δf_e between the linear and nonlinear stages is also observed. Multiple mode simulations show that at a specific radial position, the amplitude of the turbulence-driven current becomes comparable to the equilibrium current [4].

References

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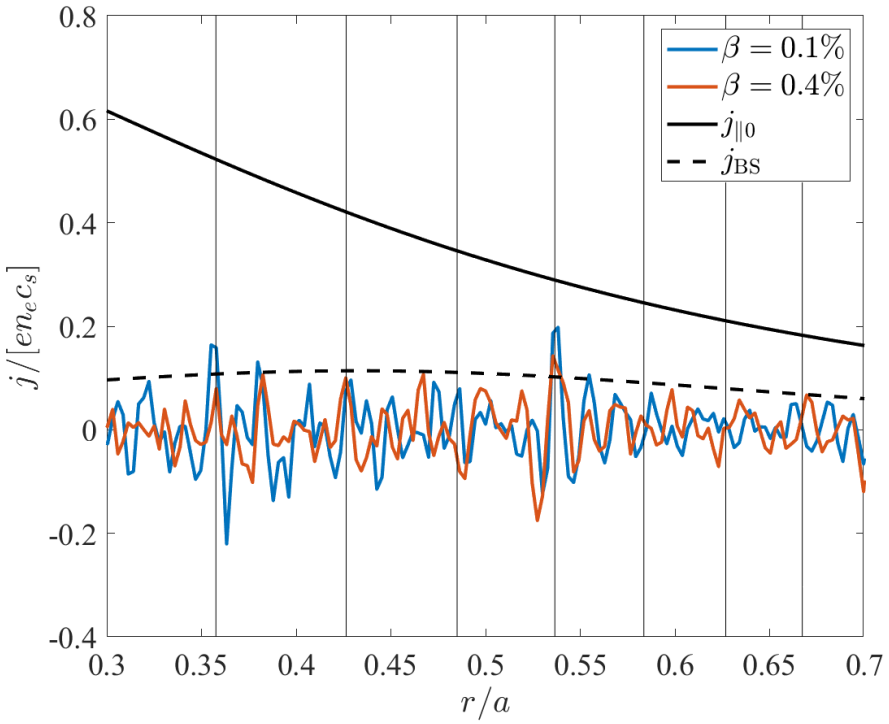

Figure. 1. Turbulence-driven current distribution of different β cases during the nonlinear stage with equilibrium current plotted in black solid line and bootstrap current in black dashed line