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New Developments in the Theory of Intrinsic Torque: Turbulent Acceleration and Non-Locality Phenomena PATRICK DIAMOND, University of California, San Diego; W.C.I. Center for Fusion Theory, NFRI, ROK, LU WANG, CEEE, HUST, China, ZHIBIN GUO, W.C.I. Center for Fusion Theory, NFRI, ROK — This paper discusses two related new developments in the theory of intrinsic torque, namely turbulent acceleration and description of nonlocality phenomena. The key common element here is that both originate from extensions of the conventional model of intrinsic torque, in which the intrinsic torque density results only from the divergence of the local turbulent residual stress. Previous studies have noted the equivalence between conventional and wave momentum description of intrinsic torque. The latter is especially useful to elucidate alleged nonlocality phenomena, since the calculation of the wave momentum flux near criticality (for large correlation time τ_c) has a structure analogous to that for radiation hydrodynamics in the long mean free path limit. In this spirit, we can express the wave momentum flux (which defines the intrinsic torque) near critcality, and recover a non-local explicit form, with a kernel of width $\mathrm{v}_{gr}\tau_c$. Results indicate that electric field shear and fluctuation pondermotive stress (intensity gradient) can drive a non-Fickian response at radii displaced from the excitation by $\ell_{mfp} \sim \mathrm{v}_{gr}\tau_c$. Note that τ_c and ℓ_{mfp} both diverge approaching criticality.

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