Abstract Submitted
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A Derivation of Critical Balance from Two-Point Evolution in Gyrokinetic Turbulence[1] P.W. TERRY, University of Wisconsin-Madison — The critical balance of parallel and perpendicular correlation times has been postulated for anisotropic turbulence ranging from weak-guide-field MHD to strong-guide-field gyrokinetics. While observed in simulations, an analytical derivation establishing the mechanisms responsible for critical balance has not been given. From a calculation of the temporal evolution of two-point phase-space correlation for turbulence in a reduced gyrokinetic model with a Lenard-Bernstein collision operator critical balance is demonstrated. Using a phase-space conserving closure, differential equations for the temporal evolution of relative separation are derived and solved. When the collision rate is smaller than the turbulent decorrelation rate, critical balance holds as observed in simulation[2]. When the collision rate becomes comparable to the turbulent decorrelation rate, the perpendicular decorrelation rate lags for large eddies. Critical balance is maintained in a collisional regime where collisions set the decorrelation rate, but the relationship between perpendicular and parallel scales is modified by the collision rate through the eddy-damping propagator of the turbulent diffusivity. [2]D.R. Hatch et al., Phys. Rev. Lett. **111**, 175001 (2013).

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