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Inter-species Energy Transfer and Turbulent Heating in CTEM
L. ZHAO, P.H. DIAMOND, CMTFO and CASS; UCSD — We reconsider the classic problem of calculating "turbulent heating" and the inter-species transfer of energy in drift wave turbulence. The total heating is composed of the parallel quasilinear and nonlinear terms, as well as ion polarization and diamagnetic terms. The parallel quasilinear terms effect a collisionless transfer of energy from electrons to ions with ion Landau damping mediating the resulting heating. The nonlinear contribution describes the ion heating associated with beat wave Landau damping. Ion polarization and diamagnetic terms account for the net Reynolds work of the turbulence on the zonal flow. At steady state, these must balance collisional zonal flow damping, thus driving ion heating through zonal flow friction. This process of energy transfer via zonal flows has not previously been accounted for in analyses of energy transfer. Note that these are at least two "channels" for turbulent electron-ion energy transfer, namely one via Landau resonance heating and one via zonal flow frictional heating. Ongoing work is concerned with the ratios of these two heating channels in CTEM, including trapped electron beat heating.

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