Turbulence at electron scales: phase mixing and entropy cascade

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I will review our (or, at any rate, mine) current understanding of low-frequency magnetized plasma turbulence at scales below the electron Larmor radius. The salient feature is the process of nonlinear perpendicular phase mixing: as electrons execute their finite-sized Larmor orbits, they average over electromagnetic (predominantly electrostatic) fluctuations whose coherence scale is smaller than the Larmor radius; as particles that have different velocities perpendicular to the magnetic field have different Larmor radii, this induces decorrelation of the particle distribution function in the velocity space. From this, one can derive energy spectra for all relevant measurable fields: electric field $k^{-4/3}$, density $k^{-10/3}$, magnetic field $k^{-16/3}$ [see Schekochihin et al., ApJS 182, 310 (2009), sec 7.12]. I will also discuss, time permitting, some news ideas on the way in which nonlinear advection (turbulence) coexists and competes with linear (parallel) phase mixing and so what happens to Landau damping in a turbulent system.