Turbulent transport via wave-particle decorrelation in collisionless plasmas

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Large scale, gyrokinetic particle kinetic simulations show that wave-particle decorrelation is the dominant mechanism responsible for the electron heat transport driven by electron temperature gradient (ETG) turbulence. ETG turbulence is dominated by radial streamers and is a subject of current interest because of its possible role in driving electron transport in fusion plasmas. We find that the transport process is characterized by the radial diffusion with a time scale close to the wave-particle decorrelation time associated with the parallel spectral width of the fluctuations. These kinetic time scales relevant to the transport process are much shorter than turbulence auto-correlation time or fluid eddy turnover time. Our results show that ETG transport is not induced by the streamer trapping of charged particles and that extrapolation based on the mixing length argument to larger devices, e.g., ITER, could be over-pessimistic.