Multi-scale turbulence in collisionless magnetic reconnection

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The collisionless solar wind plasma is prone to develop multi-scale turbulence from fluid to kinetic (particle) scales. Embedded in the solar wind are current sheets which also are formed at multiple scales. The current sheets are sites of collisionless magnetic reconnection, of instabilities and turbulence generation which self-consistently might enhance the annihilation rate of the magnetic energy towards electromagnetic (plasma-) wave-, thermal and kinetic energy. The current progress in the numerical simulation of kinetic plasma properties has now finally reached a stage at which a spatio-temporal resolution can be reached as it is necessary to obtain the statistical properties of the turbulence at collisionless reconnection sites. We simulated Harris-type-, shear flow driven and force free current sheets using PIC and EMHD codes. We found the turbulence spectra typical for the collisionless plasma (-particle-) scales of reconnection regions and its anisotropic properties. We calibrated our numerical simulation results on the spectra obtained by laboratory reconnection experiments. We derived the consequences of turbulence for the rate of magnetic reconnection finding its strong enhancement in small scale turbulence. Predictions are made which could be verified by the high resolution spacecraft observations.