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Magnetic reconnection as a trigger for sub-proton-scale cascade in magnetized plasma turbulence LUCA FRANCI, University of Florence, SILVIO SERGIO CERRI, University of Pisa Princeton University, FRANCESCO CALIFANO, University of Pisa, SIMONE LANDI, EMANUELE PAPINI, ANDREA VERDINI, University of Florence, LORENZO MATTEINI, Imperial College London, FRANK JENKO, UCLA, PETR HELLINGER, Astronomical Institute Prague
— We provide the first numerical evidences that the development of power-law energy spectra below the so-called ion break can be related to the occurrence of magnetic reconnection, regardless of the actual state of the turbulent cascade at MHD scales. This mechanism is investigated via high-resolution two-dimensional hybrid-kinetic simulations employing complementary approaches (Lagrangian vs Eulerian) and with completely different mechanisms to feed the turbulent dynamics (freely-decaying Alfvénic fluctuations vs continuously-driven compressible fluctuations). In both cases, the reconnection-mediated kinetic spectrum of parallel magnetic fluctuations develops a spectral slope of -2.8 whether or not an MHD cascade has already developed, without changes even after a successive formation of a power law at larger scales. Once a quasi-steady turbulent state is reached, the total magnetic spectrum exhibits a slope of $-5/3$ in the MHD range and of -3 below the ion scales. Based on this and on the analysis of the turbulent and reconnection characteristic time scales, we therefore suggest a scenario where magnetic reconnection may represent a relevant non-local transfer mechanism simultaneously at play in addition to the classical local turbulent energy transfer.

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