Linkages between Turbulence and Magnetic Reconnection in Kinetic Plasmas

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We discuss recent progress made by the INCITE project “Linkages between Turbulence and Magnetic Reconnection in Kinetic Plasmas“. The overall goal of this work is to explore the relationship between turbulence and magnetic reconnection in high-temperature plasmas. These two basic plasma physics processes play a crucial role in a wide range of applications, including laboratory experiments, the solar wind, and the Earth’s magnetosphere. Magnetic reconnection, which is a process of rapid changes in magnetic field topology, is behind such important and diverse phenomena as magnetospheric substorms, solar eruptions, and instabilities that adversely affect plasma confinement in laboratory experiments on magnetized fusion. Similarly, plasma turbulence is an important mode of energy, momentum, and mass transfer in many systems across the universe. Specifically , the project aims to understand the formation and break-up of current sheets using fully kinetic simulations, which rigorously describe the plasma physics at small scales. The primary focus areas are 1) simulations of decaying turbulence to examine the statistics of current sheet formation and their relative contribution to the dissipation 2) the development of reconnection in ion-scale current sheets in close collaboration with three experimental groups at UCLA, Madison and Princeton.