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Coherent Structures and Reconnection in Collisionless Turbulence VADIM ROYTERSHTEYN, Space Science Institute and SciebrQuest, Inc, HOMA KARIMABADI, SciebrQuest, Inc — The sub-proton range of collisionless turbulence has attracted considerable attention in the last decades due to its role in the dissipation of cascading energy and increased availability of high-quality measurements capable of constraining the relevant models. Coherent structures, such as current sheets, have long been considered important sites for the dissipation of energy. However, a self-consistent treatment of their formation and of the relevant collisionless dissipation mechanisms has only become possible recently. Here we discuss several examples from recent kinetic simulations of turbulence focusing on the role of current sheets and magnetic reconnection. In the 3D fully kinetic simulations with initial conditions relevant to solar wind turbulence, current sheets form over a large range of scales and are shown to be sites of increased energy transfer between fluctuating fields and particles. Moreover, depending on the initial conditions and the type of driving, other types of coherent structures are possible, such as magnetic holes. 2D and 3D global hybrid simulations of the interaction between solar wind and planetary magnetospheres demonstrate inherent connection between collisionless shocks, turbulence, and magnetic reconnection. Specifically, the interaction of foreshock turbulence driven by reflected ions with the shock itself leads to a variety of fascinating phenomena in the magnetosheath, seeding both small-scale turbulence and large-scale global perturbations.

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