3D small-scale turbulent reconnection: energy transport and transfer.

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Energy dissipation in collisionless plasmas is a longstanding problem. Although it is well known that magnetic reconnection and turbulence are transport energy from system-size scales to subptroton scales, the details of the energy distribution and energy dissipation channels remain poorly understood. Moreover, the energy distribution associated with 3D small reconnection that occurs from a turbulent cascade is not entirely clear. To get some insight on this matter, we use an explicit fully kinetic particle-in-cell code to simulate 3D small scale magnetic reconnection events forming in anisotropic and Alfvénic decaying turbulence. We define a set of indicators to find reconnection sites in our simulation based on intensity thresholds. With these indicators, we identify the occurrence of reconnection events in the simulation domain and analyse one of these events in detail. The event involves two reconnecting flux ropes, and it is highly dynamic and asymmetric. We use a two-fluid approach to study the spatial energy distribution associated with the reconnection event and compare the power density terms in the two-fluid energy equations with standard energy-based dissipation surrogates. Our findings suggest that the distribution of the internal energy is controlled by the region between the reconnecting flux ropes whereas the fluid energy is associated with the inner part of the flux ropes.