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Three-dimensional reconnection in the outer heliosphere: interactions between parallel current sheets, and the effects of interstellar pick-up ions

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We examine the evolution of a three-dimensional system comprising a series of closely packed, parallel current sheets. Each individual current sheet may be subject to a tearing instability, and hence generate magnetic islands and hot populations of ions associated with magnetic reconnection. However, previous studies have shown that a drift-kink instability can significantly affect the three-dimensional evolution of each current sheet, leading to an effective widening that can reduce reconnection rates and limit magnetic island formation compared to the two-dimensional case. This system also introduces the possibility of interaction between adjacent current sheets, leading to a complex magnetic topology, perpendicular particle transport, and a turbulent end-state. The evolution of this system has important consequences for the structure of the outer heliosphere, where pile-up of parallel current sheets is expected to produce a sectored heliosheath. In order to better model this region, we also introduce a population of interstellar H+ pick-up ions, which may dominate the pressure in the region and significantly alter the spectra of the otherwise largely monochromatic drift-kink instability. We will discuss the evolution of this system with particular focus on particle heating and transport, and the turbulent spectrum of the fluctuations generated by current sheet interactions.