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Flare particle acceleration resulting from the interaction of twisted coronal flux ropes

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Solar flares are highly explosive events which release significant quantities of energy (upto 1032 ergs) from specific magnetic configurations in the solar atmosphere. As part of this process, flares produce unique signatures across the entire electromagnetic spectrum, from radio to ultra-violet (UV) and X-ray wavelengths, over extremely short length and timescales. Many of the observed signals are indicative of strong particle acceleration, where highly energised electron and proton populations rapidly achieve MeV/GeV energies and therefore form a significant fraction of the energy budget of each event. It is almost universally accepted that magnetic reconnection plays a fundamental role (on some level) in the acceleration of particles to such incredible energies.

I will briefly summarise a recent investigation of non-thermal particle behaviour in a three-dimensional (3D) magnetohydrodynamical (MHD) model of unstable multi-threaded flaring coronal loops. Using the test-particle approach, I will describe how particle orbits respond to the reconnection and fragmentation in MHD simulations wherein the onset of the kink instability in a single loop thread can lead to the destabilisation and fragmentation of other loop threads. I will also compare the test particle energy distributions and final positions with other theoretical particle acceleration models in the context of observed energetic particle populations during solar flares.