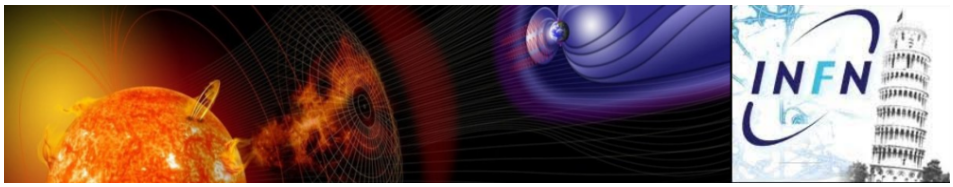

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Electron Acceleration and the Development of Power-Law Energy Spectra in Magnetic Reconnection with A Force-free Current Sheet

Thursday, 8 July 2021 17:44 (4 minutes)

Extensive observations have discovered that a huge number of energetic electrons with energy up to MeV (~0.9c and Lorentz factor ~2) are produced during solar flares. These very mild relativistic energetic electrons demonstrate two-stage power-law spectral evolutions. What mechanism efficiently accelerates non-relativistic particles to a power-law has been a long-standing "injection problem"in particle acceleration theory since Fermi first proposed his famous Fermi-acceleration model in 1949. In this talk, I will discuss why particle acceleration in solar flares is an "injection problem"and what problems are with the previous and current widely invoked models. I will present a new acceleration mechanism in magnetic reconnection. I will show how the velocity shear stored naturally in force-free currents drives an electron Kevin-helmholtz instability (EKHI) during magnetic reconnection and efficiently acceleration electrons to a power-law energy spectrum via a two-stage soft-hard-hard evolution. Finally, I will discuss the potentially broad application of this mechanism in solar physics and how the complexity of solar flares may impact the further development of this model.

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