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Particle acceleration by fluctuating electric fields at a magnetic field null point

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Particle acceleration consequences from fluctuating electric fields superposed on an X-type magnetic field in collisionless solar plasma are studied and compared to particle acceleration from constant electric field superposed on an X-type magnetic field. Such a system is chosen to mimic generic features of dynamic reconnection, or the reconnective dissipation of a linear disturbance. We explore numerically the consequences for charged particle distributions of fluctuating electric fields superposed on an X-type magnetic field and of constant electric field superposed on an X-type magnetic field. Particle distributions are obtained by numerically integrating individual charged particle orbits when a time varying electric field or a constant electric is superimposed on a static X-type neutral point. The time varying electric field configuration represents the effects of the passage of a generic MHD disturbance through such a system. The constant electric field configuration represents the effects of steady state magnetic reconnection. A spectrum of frequencies of the electric field are used, representing a turbulent range of waves. The resulting particle distributions have properties that depend on the amplitude and frequency of the electric field. In many cases a bimodal form is found. Depending on the timescale for variation of the electric field, electrons and ions may be accelerated to different degrees and often have energy distributions of different forms. Protons are accelerated to gamma-ray producing energies and electrons to and above hard X-ray producing energies in timescales of 1 second. The acceleration mechanism is possibly important for solar flares and solar noise storms but is also applicable to all collisionless plasmas.