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Investigating the role of plasmoid instability in the acceleration of charged particles in the solar coronal plasma

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Abstract
Plasmoid instability in the magnetized plasma of the solar corona, caused by the extended process of nonlinear magnetic reconnection, suddenly releases the plasma's stored magnetic energy in the form of plasma jets and accelerates non-thermal particles and relativistic charged particles. One of the most significant consequences of magnetic reconnection and the plasmoids formation in the solar Corona, as well as in the magnetopause and the Earth's magnetic tail, is the acceleration of charged particles towards the atmosphere. Based on a two-dimensional particle-in-cell simulation of plasmoid instability, the acceleration of charged particles within the solar coronal plasma is investigated through the charge particle distribution function. According to the distribution function of charged particles, electrons are capable of reaching upstream speeds upon plasmoid instability forming. During the early stages of the development of plasmoid instability, the Maxwell distribution function exhibits an additional hump due to an increase in the number of resonant electrons in the wave-particle interaction process. Eventually, this positive slope disappears and its energy is transferred to waves, but subsequent magnetic reconnection causes particles to travel at their most probable speed.

Keywords: Particles acceleration, Magnetic reconnection, Plasmoid instability, Solar corona, Particle-in-cell simulation

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