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Secondary Energization in Compressing Plasmoids during Magnetic Reconnection HAYK HAKOBYAN, MARIA PETROPOULOU, ANATOLY SPITKOVSKY, Princeton University, LORENZO SIRONI, Columbia University — Plasmoids – quasi-circular structures formed in reconnecting current sheets – were previously considered to be the graveyards of energetic particles. We demonstrate the important role of plasmoids in shaping the particle energy spectrum in relativistic reconnection. Using 2D PIC simulations in pair plasmas, we study a secondary particle energization process that takes place inside compressing plasmoids. We demonstrate that plasmoids grow in time, while their interiors compress, amplifying the internal magnetic field. The magnetic field felt by particles injected in an isolated plasmoid increases linearly with time, which leads to particle energization as a result of magnetic moment conservation. For particles injected with a power-law distribution function, this energization process acts in such a way that the shape of the injected power law is conserved, while producing an additional non-thermal tail E^{-3} at higher energies followed by an exponential cutoff. The cutoff energy, which increases with time as $E_{\rm cut} \propto \sqrt{t}$, can greatly exceed $\sigma m_e c^2$. We analytically predict the secondary acceleration timescale and the shape of the emerging particle energy spectrum, which can be of major importance in certain astrophysical systems, such as blazar jets.

Hayk Hakobyan
Princeton University

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