Energetic spectra of relativistic reconnection at large scales using implicit PIC methods.

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The energetic particle spectra obtained from magnetic reconnection in the relativistic magnetically dominated regime, where the magnetization $\sigma \gg 1$, is studied using 2D particle-in-cell (PIC) simulations at large scales. In explicit simulations, small scales must be well resolved and, in addition, one must deal with numerical heating, which can add up for large simulations even when otherwise negligible. Using semi-implicit methods, one can take advantage of both better stability and, in our case, near energy conservation to increase the system size without the strict restrictions on resolution in explicit codes. We explore the potential of these methods and compare them with explicit PIC simulations, considering both computational advantages and the role of electron-scale physics and how well it must be resolved. While a large body of research has investigated the energetic particle spectra generated due to reconnection in such relativistic systems, the mechanism remains under debate. Understanding the differences in the energetic particle spectra at large scales may help shed light on this debate, and provide more accurate spectra to compare with astronomical observations.