Brownian fluctuations of kinetic energy under Lorentz force

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In stochastic thermodynamics, significant attention has been given to studying the statistical behavior of thermodynamic quantities such as heat and work. However, fluctuations in other quantities, such as kinetic energy and internal energy, can also exhibit intriguing statistical properties. In this study, we investigate the fluctuations of kinetic energy within an initially equilibrated underdamped Brownian particle subsequently exposed to a Lorentz force, comprising both electric and magnetic fields. Providing insights through the examination of the characteristic function, central moments, and kinetic energy distribution.