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Non-equilibrium Relaxation of Driven Topological Defects[1]

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The non-equilibrium relaxation kinetics of topological defects in condensed matter systems provides a novel diagnostic tool to probe their fluctuation spectrum and dynamical correlations. We study the effects of rapid temperature, magnetic field, and driving current changes on the non-equilibrium relaxation dynamics of magnetic vortex lines in disordered type-II superconductors by employing a three-dimensional elastic line model and performing Langevin molecular dynamics simulations. We utilize the current-voltage characteristics, mean vortex radius of gyration and the fraction of pinned line elements as well as two-time flux line height autocorrelations and their mean-square displacement to study the non-linear stochastic relaxation kinetics in the physical aging regime. This allows us to distinguish the complex relaxation features that result from either point-like or columnar pinning centers and reflect the intricate competition between vortex pinning, line elasticity, and mutual repulsive interactions. With similar numerical tools, we investigate the dynamics of driven skyrmion topological defects in ferromagnetic thin films subject to the prominent Magnus force. References: [1] H. Assi, H. Chaturvedi, U. Dobramysl, M. Pleimling, and U.C. Täuber, Phys. Rev. E **92**, 052124 (2015) [`arXiv: 1505.06240`]; [2] H. Assi, H. Chaturvedi, U. Dobramysl, M. Pleimling, and U.C. Täuber, Mol. Simul. (in print, 2016) [`arXiv:1509.02227`]; [3] H. Chaturvedi, H. Assi, U. Dobramysl, M. Pleimling, and U.C. Täuber, J. Stat. Mech. (in print, 2016) [`arXiv:1606.06100`].

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