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Quantum memory effects in noninteracting cold-atom systems: Hysteresis loop and lattice transformation CHIHCHUN CHIEN, MEKENA METCALF, CHENYEN LAI, University of California, Merced — Memory effects are observable in magnetization, rechargeable batteries, and many systems exhibiting history-dependent states. Quantum memory effects are observable, for instance, in atomic superfluids [1]. A counter-intuitive question is whether quantum memory effects can exist in noninteracting systems. Here we present two examples of cold-atom systems demonstrating memory effects in noninteracting systems. The first example is a ring-shaped potential loaded with noninteracting fermions. An artificial vector potential drives a current and with a tunable dissipative background, the current lags behind the driving and exhibits hysteresis loops. The dissipative energy can be controlled by the coupling between the fermions and the background. In the second example, cold atoms loaded in a tunable optical lattice transformed from the triangular to the kagome geometry. The kagome lattice supports a flat-band consisting of degenerate localized states. Quantum memory effects are observable after a lattice transformation as the steady-state density depends on the rate of the transformation [2]. The versatility of memory effects in cold-atom systems promises novel applications in atomtronics. [1] S. Eckel et al., Nature 506, 200 (2014). [2] C. Y. Lai and C. C. Chien, arXiv:1510.08978.

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