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Quantum memory effects through interaction imbalance in ultracold bosonic and fermonic atoms CHEN-YEN LAI, CHIH-CHUN CHIEN, Univ of California - Merced — Memory effects result from history dependent behavior and have board applications. While ground states of noninteracting systems are not expected to exhibit memory effects in dynamic variables such as the mass current, interacting systems can support memory effects which may be measured in novel quantum simulators such as ultracold atoms. Here, we simulate real time dynamics of systems undergo an interaction change only on half of the system using the time-dependent density matrix renormalization group method. The quasi steady state current (QSSC) driven by the interaction imbalance exhibits a plateau lasting for a time period proportional to the system size. By comparing the value of the QSSC from different driving schemes, memory effects can be quantified. Here, two kinds of memory effects induced by interaction imbalance are discussed for both fermionic and boson systems. Starting from different initial states quenched to the same final configurations, memory of the initial quantum state can be observed. Secondly, driving the same initial configuration to the same final configuration linearly with different ramping times further leads to time-dependent memory effects. Those memory effects are from pure quantum origin and we will discuss possible experimental realizations.

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