

# Nonequilibrium dynamics of strongly interacting mixtures in 1D box traps

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One-dimensional gases offer a convenient and flexible platform for investigating open problems in modern physics, such as the full understanding of strongly interacting, out-of-equilibrium quantum systems. In particular, this work focuses on strongly repulsive one-dimensional gases consisting of two equally balanced spin components under a box confinement. To induce nonequilibrium dynamics, we prepare our initial state by spatially separating the two spin components and allow this system to evolve in the presence of strong interactions. We model the many-body wave function near the infinite repulsion limit using a well-known ansatz that is based on the symmetries of the system [1, 2]. As discussed in Ref.[3], we can identify a regime in which the dynamics of the spatial and spin parts of the wave function decouple and, at relative short timescales, only the spin degrees of freedom change over time. We then calculate several observables, such as the magnetisation and its fluctuations in space and time, and the momentum distribution at fixed times. Finally, we extrapolate the high-momenta tail of the momentum distribution, which is usually related to two-body short-range correlations, and, due to the presence of a box trapping potential, we observe the appearance of oscillations related to non-local spin coherence, as recently shown in Ref.[4].

- [1] A. G. Volosniev, D. V. Fedorov, A. S. Jensen, M. Valiente, and N. T. Zinner. *Nat. Commun.*, **5**, 5300 (2014).
- [2] F. Deuretzbacher, K. Fredenhagen, D. Becker, K. Bongs, K. Sengstock, and D. Pfannkuche. *Phys. Rev. Lett.*, **100**:160405 (2008).
- [3] G. Pecci, P. Vignolo, and A. Minguzzi. *Phys. Rev. A*, **105**, L051303 (2022).
- [4] G. Aupetit-Diallo, S. Musolino, M. Albert, and P. Vignolo. *Phys. Rev. A*, **107**, L061301 (2023).

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