

Preparation, dynamics and extraction of entanglement in one-dimensional BECs

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The key ingredient for studying the dynamics of quantum many-body systems is the ability to prepare and manipulate quantum states and eventually perform an efficient readout of the available information. In this talk, I present our experimental studies using one-dimensional Bose-Einstein condensates on an atomchip combined with spatially resolved measurements.

We prepare quantum-correlated states of two tunnel-coupled superfluids and track the dynamical evolution of the relative atom number squeezing [1]. The observed dynamics are governed by the interplay of on-site interactions and tunneling. Utilizing the control over the dynamics, we prepare optimized spin-squeezed states prolonging the phase coherence of the system.

We present our first experimental results concerning the implementation of weak probes for the simultaneous readout of number imbalance and phase to study mean-field dynamics and quantum correlations in this system with previously inaccessible observables.

References

[1] Zhang, T. et al., arXiv:2304.02790

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