Decoherence in a bosonic Josephson junction

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Abstract

If N interacting bosons are distributed among two modes, they can evolve to highly entangled states, which are useful for interferometry. A prominent examples of such states are squeezed states [1, 2, 3]. During longer time evolution, the system goes through superpositions of a few coherent states, then it reaches a Schrödinger cat state, to return to its initial state after the revival time. Here we discuss how the dynamics changes when the system is subject to particle losses. We analyze separately the contributions to the Fisher information from subspaces with different number of atoms. Surprisingly, in the subspace with number of atoms smaller than the initial one, the quantum correlations will increase when the losses are getting faster. Furthermore, the cat state is more robust when the rate of losses differs between the modes.

References

[1] A. Sørensen, L. M. Duan, J. I. Cirac and P. Zoller, Nature **409**, 63 (2001)

[2] J. Esteve, C. Gross, A. Weller, S. Giovanazzi and M. K. Oberthaler, Nature **455**, 1216 (2008)

[3] F. Riedel, P. Böhi, Li Yun, T. W. Hänsch, A. Sinatra and P. Treutlein, Nature **464**, 1170 (2010)