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Number squeezing and entanglement in a Bose Einstein condensate

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Abstract:

We report on our recent experimental results obtained with a new very stable double well setup combined with high spatial resolution imaging. The new setup allows the first direct demonstration of relative number squeezed states at finite temperature. With in situ imaging the statistics of the atom number difference between left and right is analyzed directly and reveals the expected deviation from the classical shot noise limit. The observation of the corresponding fluctuation of the relative phase allows the experimental demonstrate that a number squeezed state is produced which improves the performance of a standard Ramsey type interferometer beating the standard quantum limit by a factor of two [1]. Furthermore, with the observed squeezing a sufficient criterion for pairwise entanglement can be constructed confirming that for our experimental parameters pairwise entanglement between the atoms exist even at finite temperature [2][3][4]. We will also report on the status of the experiment dealing with squeezing of the internal degree of freedom.

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