
Propagation and interferometry of bright matter wave solitons

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Abstract

The creation and propagation of bright matter wave solitons in ^{85}Rb will be discussed. Recent results on atom interferometry using these states will be presented, showing a dramatic improvement in fringe visibility around the soliton point. Results will be presented on an intriguing new observation of matter wave breathers - stable excited state solitons. Evidence, both from theory and experiment, will be presented suggesting that significant three-body scattering is present in this system. For example, in a non-interacting gas (zero s-wave scattering, $a_s=0$), the ratio of the centre of mass mode to the breathing mode is measured to be ~ 1.7 , instead of the expected ratio of 2, an observation that is precisely modelled by a non-zero three body scattering rate. At $a_s < 0$, stable breather solitons are observed, and here too, soliton existence and oscillation ratios are found to be consistent with the presence of three-body scattering. A discussion of implications for past and future experiments will be given.

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