

# Bright matter-wave solitons: formation, dynamics and quantum reflection.

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## Abstract

What happens to a Bose-Einstein condensate when the atomic interactions are switched from repulsive to attractive? The experimental observations of the collapse of  $^{85}\text{Rb}$  condensates reveal the formation of a robust configuration of bright matter-wave solitons or solitary waves that oscillate along the (weaker) axial direction of the trap, colliding repeatedly in the trap centre [1]. We show that, within the framework of the Gross-Pitaevskii equation (GPE), such collisions exhibit a rich behaviour [2] that indicates the need for a  $\pi$  relative phase between neighbouring solitons to explain the stability observed experimentally [3]. However the question remains whether the GPE model accurately captures the essential physics in this case? We describe new experiments planned to address this issue and discuss the application of bright solitons to the study of quantum reflection and the measurement of atom-surface interactions [4].

**Keywords:** BEC, matter-wave, solitons, GPE,  $^{85}\text{Rb}$

## References

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