QUANTUM REFLECTION OF MATTER-WAVE SOLITONS FROM POTENTIAL WELLS

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Matter wave solitons are non-spreading wave packets of Bose-Einstein condensates held together by attractive interactions. In many respects, solitons resemble classical particles. Non-classical effects like quantum reflection may occur when potential structures change on length scales smaller than the soliton length. In this case the nonlinear interaction can lead to an enhancement of quantum reflection with respect to linear matter waves. A simple variational model is used to explain the effect seen in numerical simulation in terms of interference between the moving soliton and a localised bound state[1].

Extended numerical studies of matter-wave solitons scattering on narrow potential wells show a rich structure of reflection, absorption, and transmission resonances. Compared to the transmission function of linear waves, very abrupt transitions are observed. A detailed analysis of the linear and nonlinear bound state spectrum reveals an intimate relationship to observed reflection and transmission windows. The observed effects may become useful for the manipulation of matter-wave solitons.

1. C. Lee and J. Brand. Enhanced quantum reflection of matter-wave solitons, *Europhys. Lett.* **73**, 321 (2006)