Abstract Submitted
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Ideal Classical Solitons as a Limit to a Quantum Many-Body System[1] SIMON GARDINER, Durham University, TOM BILLAM, University of Otago, JOHN HELM, DAVID HOLDAWAY, CHRISTOPH WEISS, Durham University — Classical solitons arise as solutions to the one-dimensional nonlinear Schrodinger equation

$$i\frac{\partial}{\partial t}\psi(x,t) = -\frac{1}{2}\frac{\partial^2}{\partial x^2}\psi(x,t) - |\psi(x,t)|^2\psi(x,t),$$

which can be seen as a one-dimensional limiting case of the Gross-Pitaevskii equation, that has been so successful in describing the collective properties and dynamics of atomic Bose-Einstein condensates, for attractively interacting atoms. Solitons are robust to collisions, which makes them of significant interest for matter wave interferometry. We will examine how closely one can approach the one-dimensional, unconfined, classical field description assumed by exact classical soliton solutions, when the physical system exists in three spatial dimensions, and is an interacting quantum many-body system.

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