Creating a massive minimal uncertainty wavepacket using Gross-Pitaevskii breathers

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We assess the difficulties in creating a provably coherent quantum state of a relative motion of two bosonic solitons using Gross-Pitaevskii breathers. The scheme for creating such state-a four-fold quench of the interactions applied to a bosonic soliton-is not new. However, an experimental proof of a macroscopic coherence is difficult. Our proposal is to suggest a protocol where variances of the relative distance and the relative momentum are experimentally accessible: then whenever the product of the two gets close to the Heisenberg uncertainty limit, such state can be declared to be coherent. We present an extensive numerical study on the subject.
The projects are run in a tight collaboration with Randall Hulet's experimental group at Rice University.