Lagrange bracket approach to quantum fluctuations in macroscopic parameters of NLS breathers

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In the focusing nonlinear Schrodinger equation, multisoliton "breathers" may be created from a single mother soliton by quenching the strength of the nonlinear interaction. In ultracold-gas realizations, atop the mother soliton there are quantum fluctuations coming from its underlying quantum many-body nature, computable from the Bogoliubov theory. Post-quench, these fluctuations become the fluctuations in the macroscopic parameters of the daughters, which exist in a coherent macroscopic quantum state. We present a mean-field formalism that uses Lagrange brackets to compute, from given pre-quench fluctuations, the fluctuations of the macroscopic parameters of the daughter solitons, with results for both the 2-soliton and 3-soliton breathers.

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