Abstract Submitted
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**Reentrant stability of BEC standing wave patterns** RYAN M. KALAS, DMITRY SOLENOV, EDDY TIMMERMANS, Los Alamos National Lab — We describe standing wave patterns induced by an attractive finite-ranged external potential that is placed inside a large Bose-Einstein condensate (BEC) [1]. As the potential depth increases, the time independent Gross-Pitaevskii equation develops solutions that have nodes in their wavefunction. We elucidate the nature of these standing wave BEC states and study their dynamical stability. One type of standing wave BEC solution is closely related to bound state solutions of the attractive potential; it can be dynamically stable in intervals of the potential well depth, implying that the standing wave BEC can evolve from a dynamically unstable to stable, and back to unstable status as the potential well is adiabatically deepened, a phenomenon that we refer to as "reentrant dynamical stability." We numerically study the problem in a 2D BEC subject to a cylindrically symmetric square well, but our analysis reveals important general trends for 2D and 3D, independent of the symmetry of the potential. We also comment on long-range phase fluctuations that can be observed at the stability/instability transition points.

[1] R.M. Kalas, D. Solenov, and E. Timmermans, arXiv:0910.2711.

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