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Nonlinear structures in one and two-mode BECs[1] DOUGLAS FAUST, WILLIAM P. REINHARDT, University of Washington, Seattle, WA 98195-1560 — In recent years, precise control of optical potentials has allowed coherent BECs to be split into multiple entities. The most famous example is the superfluid to Mott insulator transition, where phase coherence is completely lost between wells. Alternatively, a specific phase relationship characterizes other structures - such as solitons and Josephson junctions - in quantum gasses. We present results from a novel computational method which is able to break the spatial symmetry of a mean-field state which evolves into multiple entities and gives a full accounting of both non-linear effects and tunneling to access the superfluid and Mott insulator regimes as well as give, previously unknown, details of the transition between them. Our results include characterizing BEC atom interferometry experiments and an investigation of two-mode analogues of one-mode structures such as solitons and phase-driven oscillations.

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Douglas Faust
University of Washington, Seattle, WA 98195-1560

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