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**2D Bose–Einstein Condensate Expansion Variational Model**[1] HADAYAT SEDDIQI, MARK EDWARDS, MICHAEL KRYGIER, BRANDON BENTON, Georgia Southern University, CHARLES CLARK, JQI and NIST — We developed a set of coupled equations to approximate the dynamics of an expanding Bose-Einstein condensate (BEC) properly described by the 3D Gross–Pitaevskii equation (GPE). These equation apply to the case where the condensate is initially confined strongly in one dimension and only weakly in the plane transverse to this direction. The equations were derived using a hybrid Lagrangian Variational Method (LVM) where the trial wave consisted of a completely unspecified function of the coordinates in the plane of weak confinement multiplied by a gaussian function of the transverse coordinate whose width and quadratic phase are variational parameters. The resulting equations consist of a 2D GPE whose nonlinear term is inversely proportional to the time-dependent transverse gaussian width coupled to an equation of motion for the width. The equation of motion for the gaussian width contains a term in which the integral of the fourth power of the 2D GPE solution appears. This factor represents the interaction energy of the confined 2D BEC. This method is applied to model recent experiment with BECs confined in ring–shaped potentials and the solutions are compared to solutions of the full 3D GPE as well as to the results of these experiments.

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