

The Gross-Pitaevskii equation: symmetries and coherent states.

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The Schrödinger equation with cubic nonlinearity, also known as Gross-Pitaevskii equation, is one of the most relevant equations in Mathematical Physics, due to its wide variety of applications, mostly in Nonlinear Optics and Quantum Physics. In particular, it is a widely accepted model for the description of the evolution of a Bose-Einstein condensate. While the existence of this new state of matter was theoretically conjectured by Satyendra Nath Bose and Albert Einstein in 1924, a genuine experimental synthesis of a BEC was not achieved until 1995 and can be regarded as a milestone of the contemporary Physics. In this context, a coherent state is a solution that self-propagates in time without significant changes of its spatial structure, in analogy to the well-known travelling waves of the wave equation. Some important examples are the solitons (bright and dark) and the nonlinear Bloch waves. The identification of this type of solutions is a difficult problem in general, specially when the coefficients are variable in time or/and space (inhomogeneity). The main objective of the talk is to describe different strategies leading to existence results of different types of coherent states.