Solitons in a One-Dimensional BEC with Curvature

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The study of perturbations in superfluids, including Bose-Einstein condensate (BEC), is an interesting and active research area in modern nonlinear dynamics [1]. One of these manifestations of perturbation is solitons [2-4], which consists of a pulse with finite and localized energy states, maintaining a constant shape and velocity for a long travel distance. The observation of such nonlinear objects was first documented by the scottish engineer John Scott Russel in 1834, under the term "solitary wave", depicting a water pulse in the canal between Edinburgh and Glasgow [5]. Since then, solitons have been observed and studied in various platforms, such as optical fibers [6], waveguides [7,8], electric transmission lines [5], among others including bosonic atomic gases [9,10]. In the case of bosonic gases, there remains an open window of investigation regarding gases in curved geometries, as their existence and stability in such contexts are not yet clear [11], making the research of solitons in curved settings a promising and challenging area both theoretically and experimentally. In this presentation, I will discuss the fundamental concepts and the state of the art of solitons in superfluids, exploring the specific case of solitons in a one-dimensional BEC with curvature.

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