Self-Gravitating Condensate of Deformed Bosons, Described by the Modified Gross–Pitaevskii Equation

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Often the spatial distribution of condensed bosons, which possess both repulsion due to scattering and attraction caused by Newton's gravity, is found from the Gross–Pitaevskii equation derived from the variational principle [1]. At the same time, the geometry of the distribution is strictly determined by the relation of repulsion and attraction (the case of resonance). It is shown that this solution is also obtained from the path integral. Within this approach, one can additionally observe the effect of thermal fluctuations and "non-resonant" geometric configurations.

Assuming that the condensate is formed from non-ordinary bosons with deformed commutation relations for the wave function in the coordinate representation, we naturally modify the measure of integration in the path integral. This leads immediately to the appearance of additional terms in the Gross–Pitaevskii equation. Applying the model of the deformed boson condensate to the dark matter description in which we are interested, this deformation can be chosen to better reproduce the observed data. Moreover, using the path integral, we can take into account more of the effects mentioned above.

1. Harko T., Bose-Einstein condensation of dark matter solves the core/cusp problem, JCAP, 2011, **05**, 022.