Contribution ID: **417** Type: **Oral**

Mu-deformed extension of the Bose-Einstein condensate dark matter model.

Exploration of the nature of dark matter (DM) still remains an important unsolved problem for astrophysicists as well as theoretical physicists. Among all existing models of DM, we consider the ones which describe DM as a Bose-Einstein condensate (BEC). Those models look as appropriate cold dark matter (CDM) candidate due to the fact that, in the absence of heating mechanisms, its temperature is supposed to be low, so that the condensate state looks quite realistic. BEC DM models were applied to solve core-cusp problem, and give realistic prediction on other DM halo parameters. However, at the same time these models have their own difficulties like a problem of gravitational collapse and overestimated DM halo mass.

In our work, we extend condensate DM models by introducing for that role an analog of Bose gas whose particles obey deformed statistics. This can be achieved by applying some algorithm involving certain generalization of differential calculus. In the present work, so-called mu-calculus is used to realize this idea. Our choice of mu-deformation for this purpose is partially based on its earlier successful usage for effective description of non-Bose like properties of two-pion correlation function intercept observed in the STAR/RHIC experiments at BNL.

The possibility of Bose-like condensation is studied in the framework of thermodynamic geometry: we calculate metric components, Christoffel symbols, Riemann tensor and scalar curvature. The singular behavior of the latter provides the evidence of presence of phase transition in the system. We find which values of parameters (critical temperature and fugacity) are correspon¬ding to the condensation.

For the presented model, we also find basic features of galactic DM halo, such as radius and total mass of halo depending on the parameter μ, as well as the limits on DM particle mass, temperature, scattering length, which provide good agreement of predicted halo parameters with the astrophysical observations.
The main advantages of the present model, as compared with classical BEC dark matter, are wider range of temperatures relevant for the condensate state, i.e. higher critical temperature, and better agreement of predicted halo mass with observational data, in contrast with a bit overestimated one of classical model.

Keywords: boson condensate, deformed Bose gas model, nonstandard statistics, critical temperature, thermodynamic geometry, dark matter halo.

Author: Ms KHELASHVILI, Mariia (Bogolyubov Institute for Theoretical Physics, Kiev, Ukraine)

Co-authors: Prof. GAVRILIK, Alexandre (Bogolyubov Institute for Theoretical Physics); Dr NAZARENKO, Andriy (Bogolyubov Institute for Theoretical Physics); Prof. KACHURIK, Ivan (Bogolyubov Institute for Theoretical Physics)

Presenter: Ms KHELASHVILI, Mariia (Bogolyubov Institute for Theoretical Physics, Kiev, Ukraine)

Track Classification: Theoretical Physics