New deformed Heisenberg algebra from the μ-deformation based model of dark matter

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Recently, the μ-Bose condensate (extending Bose-Einstein condensate (BEC) phase), occuring in certain μ-deformed Bose gas model, was used as a model of dark matter [1]. It shows some virtues relative to the BEC DM model [2]: (i) prediction of the total mass of galactic DM halo is in a somewhat better agreement with observations than in the BEC DM model; (ii) the critical temperature of condensation $T_c(\mu)$ is higher for $\mu > 0$, making the μ-condensate phase more stable against possible heating sources.

For the study of galaxy rotation curves, a μ-deformed Lane-Emden (LE) equation is used, and different versions of μ-LE arise [3]. We study three versions of deformation, compare with observation, and find certain improvement. Two versions are mutually equivalent (admit same solution built from μ-sine function). From the equivalence, we infer new μ-deformed Heisenberg algebra for the radial position operator $r\cdot$ and the radial μ-derivative $D_r^{(\mu)}$ as generators. There are two distinct forms of μ-Heisenberg algebra: one involves usual commutator in the l.h.s. and nontrivial terms in the r.h.s.; the other has usual r.h.s. $i\hbar$, but operates with unusual μ-deformation of the commutator in the l.h.s. of relation.

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3. Khelashvili M. V., Gavrilik A. M., Kachurik I. I. Galaxy rotation curves in the μ-deformation based approach. XI Bolyai-Gauss-Lobachevsky (BGL-2019) Conference: Non-Euclidean, Non-Commutative Geometry and Quantum Physics, May 19 - 24, 2019, Kiev, Ukraine. Book of Abstracts, p.19.