Contribution ID: **52** Type: **Invited talk**

Physical systems in a noncommutative space with preserved time-reversal and rotational symmetries

Tuesday, 10 June 2025 10:10 (40 minutes)

Physical systems in a noncommutative space with preserved time-reversal and rotational symmetries
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We consider a space with noncommutativity of coordinates and momenta with preserved time-reversal and rotation

We examine one- and many-particle systems in this space, including free particles, systems of harmonic oscillators, and exotic atoms. We derive corrections to the energy levels of these systems caused by space quantization [2]. Additionally, we discuss the problem of describing the motion of a macroscopic body in such a space. We propose conditions on the parameters of the noncommutative algebra that provide a resolution to the soccer-ball problem in noncommutative space.
Motion of a particle and a macroscopic body in gravitational field is examined in the noncommutative phase space. The problem of the violation of the weak equivalence principle is discussed [3,4]. On the basis of comparison of the results of theoretical studies with the experimental ones the upper bound on the minimal length and the minimal momentum are found [1].

[1] Kh. P. Gnatenko Minimal momentum estimation in noncommutative phase space of canonical type with preserved rotational and time reversal symmetries
Eur. Phys. J. Plus 135(8), 652 [12 p.] (2020)
[2] Kh. P. Gnatenko System of interacting harmonic oscillators in rotationally invariant noncommutative phase space Phys. Lett. A 382(46), 3317 (2018)
[3] Kh. P. Gnatenko, M. I. Samar, V. M. Tkachuk, Kepler problem in quantized space. Lviv: Lviv University Press, 2024. 136 pages.
[4] Kh. P. Gnatenko, V. M. Tkachuk Deformed Heisenberg algebras of different types with preserved weak equivalence principle J. Phys. Stud. 27(1), 1001 [19 p.] (2023)

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Session Classification: Quantum Technologies, Foundations and Optics

Track Classification: Quantum Technologies, Foundations and Optics