

UDC 530.122.2

Gravity quantization approaches revisited

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Abstract. The levels of quantization in gravity theory have been classified. The objects and processes in gravitationally bound systems and their general properties are analyzed to create a consistent theory of gravity quantization by constructing quantum models of compact astrophysical objects and the early Universe.

Keywords: gravity quantization, compact astrophysical objects, early Universe, quantum mechanics, quantum field theory, quantum geometrodynamics, graviatom, Universe birth

Introduction. The gravitationally bound systems in quantizing particle motion, extraneous fields and geometry as a whole are considered. To these quantization levels correspond such quantum objects and processes as graviatoms, Lemaitre's atom, the Universe's birth and particle creation [1–4]. The general properties of the gravitationally bound systems are due to several levels of quantization being simultaneously present at the same quantum object or process. This research is aimed to create a consistent theory of gravity quantization by constructing quantum models of compact astrophysical objects and the early Universe.

Methods and materials; results. Gravity quantization is considered in the framework of general relativity and quantum theory. The latter — in terms of quantum mechanics and quantum field theory in curved space-time. The quantum objects involved are graviatoms, comprising miniholes, which capture microparticles, and Lemaitre's atom simulating the early Universe. The quantum processes are — Universe's birth, interpreted as a tunnel effect, and particle creation in Hawking's effect [5] and in the early Universe due to a decay of leptiquarks [6]. The result obtained is that the product of the masses of miniholes and particles captured by them in the graviatom and that of the masses of miniholes and leptiquarks being born in the early Universe are of the order of the Planckian mass squared.

Conclusion. The graviatom and Lemaitre's atom are described by Schrödinger's type equation. The similarity between the relationships for graviatoms and the formation of miniholes and leptiquarks in the early Universe is due to the presence of miniholes and quantum field effects in both cases. The product of the masses of miniholes and particles captured by them and that for the masses of miniholes and leptiquarks being born in the early Universe are of the order of the Planckian mass squared. The consideration of gravitationally bound quantum systems may play a

part in the creation of a consistent theory of gravity quantization allowing loop and string cosmology to be combined.

References

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