The Matter-Energy Intensity Distribution in a Quantum Gravitational System

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The study of matter-energy density distribution in a quantum gravitational system (QGS) is of interest in connection with the problem of the mechanism of nucleation of the expanding universe from the initial cosmological singularity point. The method of constraint system quantization can be taken as a basis of quantum theory of gravity suitable for the investigation of cosmological and other quantum gravitational systems. The canonical approach to quantization, successful in constructing the nonrelativistic quantum mechanics and quantum field theories in the flat spacetime, encounters well-known difficulties when applied to gravity.

It is shown that the state vector of the QGS satisfies the set of wave equations which describes the time evolution of a quantum system in the space of quantum fields. This state vector can be normalized to unity. For the arrow of time from past to future, the state vector describes the QGS contracting for the negative values of the scale factor and expanding for its positive values. The intensity distributions of matter are calculated for two exactly solvable models of spatially closed and flat QGSs formed by dust and radiation.

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1. Kuzmichev V. E. and Kuzmichev V. V. The matter-energy intensity distribution in a quantum gravitational system. Quantum Stud.: Math. Found., 2018, 5, 245-255.