General Relativity and Quantum Cosmology

An inhomogeneous toy-model of the quantum gravity with explicitly evolvable observables

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An inhomogeneous (1+1)-dimensional model of the quantum gravity is considered. It is found, that this model corresponds to a string propagating against some curved background space. The quantization scheme including the Wheeler-DeWitt equation and the "particle on a sphere" type of the gauge condition is suggested. In the quantization scheme considered, the "problem of time" is solved by building of the quasi-Heisenberg operators acting in a space of solutions of the Wheeler-DeWitt equation and the normalization of the wave function corresponds to the Klein-Gordon type. To analyze the physical consequences of the scheme, a (1+1)-dimensional background space is considered for which a classical solution is found and quantized. The obtained estimations show the way to solution of the cosmological constant problem, which consists in compensation of the zero-point oscillations of the matter fields by the quantum oscillations of the scale factor. Along with such a compensation, a slow global evolution of a background corresponding to an universe expansion exists.

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