Non-linear evolution phase space quantum gravity

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Wave function the general state

$$\Psi = \exp(\phi)$$

Local phase the gauge symmetry

$$\phi = \phi(x_\beta, t)$$

Space-time operators

$$\delta_\beta = d/dx_\beta$$

$$\delta_t = d/dt$$

Metric the local phase

$$g_{\alpha\beta} = \delta_\alpha\phi\, \delta_\beta\phi + \delta_\alpha\delta_\beta\phi$$

Gauge geometry

$$\Gamma_{\alpha\beta\lambda} = \tfrac{1}{2}(\delta_\alpha g_{\beta\lambda} + \delta_\beta g_{\lambda\alpha} - \delta_\lambda g_{\beta\alpha})$$

$$\Gamma^{\lambda}_{\alpha\beta} = g^{\mu\lambda}\Gamma_{\alpha\beta\mu}$$

$$R_{\lambda\sigma} = \delta_\mu \Gamma^{\mu}_{\lambda\sigma}$$

Simbol Levi - Civita

$$e^{\eta\mu\lambda} = +1, -1$$

Cotton scalar

$$C = e^{\alpha\beta\lambda}\, \delta_\alpha R_{\lambda\beta}$$

In an earlier paper [1], we first considered a possible modification of unitarity based on non-linear time to describe the general dinamics in quantum gravity

$$(\delta_t\phi)^3 + \delta_t\phi\, \delta_t^2\phi \sim k\, e^{\alpha\beta\lambda}(\delta_\alpha\phi)^3\, \delta_\beta\delta_\lambda\phi$$

Planck constant (h) and gravitational constant (G)

$$k = Gh$$

In addition, the equation describes topology of gauge geometry as a space-time foam.

Analogy topological model for time

$$dS = L_t\, dt^3$$

$$L_t = (\delta_t\phi)^3 + \delta_t\phi\, \delta_t^2\phi$$

The theory is clearly non-linear in time.

We will use for gauge geometry of the topological model space-time.

The we obtain a modification of the dinamical equation on non-linear time and a given gauge geometry in the form of the Cotton curvature the phase space.

The scalar form

$$\Delta = \delta^\mu \delta_\mu$$

$$\Delta L_t = k\, C$$

The equation defines the non-linear dinamics the gauge metric of the space-time foam, gauge curvature the time and gauge curvature the space.

In general, a non-linear modular equation makes it possible to make an asymmetrical time modification of quantum field theory.

$$\delta C \sim F^4$$

$$F_{\lambda\beta} = \delta_\lambda\delta_\beta\phi$$

This allows us to formulate a general action for the topological string model in the form of the field line

$$T^3 \sim k\, F^4$$

$$dS_0 = -T\, dx\, dt$$

$$dS = k\, F^4\, dx^3 dt^3$$

General model the quantum field theory for non-linear evolution

$$dS = k\, (F^2 + \Psi^*\delta\Psi)^2\, dx^3 dt^3$$

We believe that the asymmetrical part of the energy correction is non-linear in time with the unitarity wave function the condensate fermion vacuum.

$$\delta_t^3\Psi = - k\,|\Psi|^2\Delta\Psi + k\,\Delta|\Psi|^2\,\Psi$$

Wave function the condensate vacuum (density the fermion particle).

$$|\Psi|^2 = dN/dV$$

Potential

$$b = \Delta|\Psi|^2$$

Information

$$I = \ln P$$

This model condiser the relationship of the problem cosmological constant and the non-linear time in gravity.

[1] Non-linear time quantum gravity, 2022, Kuyukov Vitaly, openreview.