Gravity and super-curvature the phase space

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Modern general theory of relativity considers gravity as the curvature of space-time. The theory is based on the principle of equivalence. All bodies fall with the same acceleration in the gravitational field, which is equivalent to locally accelerated reference systems. In this article, we will affirm the concept of gravity as the curvature of the relative wave function of the Universe. That is, a change in the phase of the universal wave function of the Universe near a massive body leads to a change in all other wave functions of bodies. The main task is to find the form of the relative wave function of the Universe, as well as a new equation of gravity for connecting the curvature of the wave function and the density of matter.

Many approaches treat quantization of gravity differently, string theory using extra dimensions, causal triangulation using fundamental events, and other hypotheses. However, long-standing experience in the creation of fundamental theories does not consider too radical approaches, on the contrary, they use old concepts, but in the context of their synthesis and generalization. The most economical solution in the field of quantum gravity is the concept of the wave function of the Universe.

$$\Psi = \int e^{\,i\,I}\,\{dg\}$$

$$I = \frac{1}{h}\int L\,dV dt$$

The problem with this approach is that the total energy of the Universe is zero, and time outside does not exist at all. However, this task can be solved if we consider not the absolute, but the relative wave function of the Universe, then relative to the observer himself inside the Universe. The main thing is to find the form of this wave function. Consider the wave function through the definition of the variation of the metric with respect to some point in space.

We get through the variation of the gravitational potential.

$$d\varphi = \frac{G\,\rho dV}{r} = \frac{G\,L\,dV}{c^2 r}$$

$$I = \frac{1}{h}\int L\,dV dt = \frac{c^2}{Gh}\int r\,d\varphi\,dt$$

In the metric form, the final variation of the wave function leads

$$d\varphi = d\sqrt{-g}\,c^2$$

$$I = \frac{c^4}{Gh}\int r\,d\sqrt{-g}\,\,dt$$

$$\Psi = \int e^{\,i\frac{c^4}{Gh}\int \sqrt{-g}\,\,r\,dt}\{dg\}$$

$$-g = 1$$

In the average flat space-time, the relative wave function of the Universe is only a function of coordinates and time, and the phase is the product of time and the radius of coordinates.

$$\Psi = A\, e^{\,i\frac{c^4}{Gh}\int r\, dt}$$

Thus, space-time is the phase space of the relative wave function of the Universe. Roughly speaking, the relative wave function of the Universe is a fabric of space-time. In addition, the space-time interval is the distance in the phase space of the relative wave function of the Universe.

$$s^2 = -c^2 t^2 + r^2$$

The minus sign before the square of time is determined by the complexity of the wave function.

$$s^2 = (i\, c\, t)^2 + r^2$$

From all this, an attractive hypothesis arises: gravity is the phase curvature of the relative wave function of the Universe.

1. The curvature of the phase space of the wave function of the universe and gravity.

Consider the relative wave function of the Universe in a flat space-time.

$$\Psi = A\, e^{\,i\frac{c^4}{Gh}\int r\, dt}$$

Now we define the wave function relative to the particle with mass M. Since the phase, that is, the effect of the relative wave function of the Universe decreases by an amount equal to the action of a massive particle.

$$\Psi = A\, e^{\,i\frac{c^4}{Gh}\int r\, dt - \frac{i}{h}\int Mc^2 dt}$$

This leads to the effect of gravitational time dilation, where the phase of the relative wave function of the Universe itself changes in empty space.

$$\frac{c^4}{G}\int r\, dt - \int Mc^2 dt = \frac{c^4}{G}\int r\, d\tau$$

$$d\tau = dt\left(1 - \frac{GM}{c^2 r}\right)$$

$$\Psi = A\, e^{\,i\frac{c^4}{Gh}\int r\, d\tau}$$

It is remarkable that the change in the phase of the universal wave function of the Universe as the main conductor leads to a change in the phases of the wave functions of all other particles in the Universe. Which leads to the equivalence principle and the concept of emerging gravity.

Wave functions must exist in a Hilbert space state. Different metrics are offered as geometry. Consider a common approach, the Fubini-Study metric. Where the metric is defined through the generalized

coordinate form. The coordinates in the phase space will be the synthesis of four-dimensional coordinates space-time and energy-moment.

$$ds^2 = l_p^2 \frac{\delta \Psi}{\Psi} \frac{\delta \Psi^*}{\Psi^*} = f_{ik} dz^i dz^k$$

$$dz^i = dx^i + l_p^2 dk^i$$

$$l_p^2 = \frac{Gh}{c^3}$$

$$\Gamma_{\alpha\beta}^k = \frac{1}{2} \left(\frac{\partial f_{\alpha\beta}}{\partial z_k} + \frac{\partial f_{\beta k}}{\partial z_\alpha} - \frac{\partial f_{k\alpha}}{\partial z_\beta} \right)$$

Curvature geometry the Fubini-Study

$$R_{\alpha i \beta}^k = \frac{\partial \Gamma_{\alpha\beta}^k}{\partial z^i} - \frac{\partial \Gamma_{i\beta}^k}{\partial z^\alpha} + \Gamma_{\alpha\mu}^k \Gamma_{i\beta}^\mu - \Gamma_{\alpha\beta}^\mu \Gamma_{\mu i}^k$$

Cotton tensor

$$C_{\alpha i \beta} = \frac{\partial R_{\alpha i \beta}^k}{\partial z^k}$$

As a first approximation, based on dimensional analysis, we obtain the connection between the super-curvature of the Fubini-Study metric and the energy-momentum density tensor.

$$K_{ik}^{(6)} = \partial^\alpha \partial^\beta \partial_\alpha C_{\beta ik} + \partial^\alpha \partial_\beta \Gamma_{\alpha i}^\sigma \partial^\mu \partial_\sigma \Gamma_{\mu k}^\beta + \ldots$$

$$\left[K_{ik}^{(6)} \right] = m^{-6}$$

$$\partial^\alpha \partial^\beta \partial_\alpha C_{\beta ik} + \partial^\alpha \partial_\beta \Gamma_{\alpha i}^\sigma \partial^\mu \partial_\sigma \Gamma_{\mu k}^\beta \approx \frac{c^2}{Gh^2} T_{ik}$$

$$T_{ik} = \frac{Gh^2}{c^2} K_{ik}^{(6)}$$

However, it is clear that the equation requires strong modification. For example, you can introduce additional members. For example, you can enter in addition to the Fubini metric, and the information metric in the following form. As a result, it can lead to a nonlinear modification of the original equation. Thus, the main task remains to find the exact law of super-curvature of the phase space the wave function (Hilbert space) and including the behavior for all other wave functions. And also to show on the basis of the principle of compliance with the convergence of this law to the classical limit.

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