Fundamental constants and equations of motion

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CODATA [2] suggests considering the constants c, h, G, e, k as fundamental constants.

The constant k connects the energy of micro-objects with the energy of macro-objects and we will not consider it here.

The physical dimension $[c] = \mathrm{LT}^{-1}$ and $[h] = \mathrm{ML}^{+2}\mathrm{T}^{-1}$ does not depend on the dimension of the configuration space D.

The physical dimension $[G] = \mathrm{M}^{+1}\mathrm{L}^{+\mathrm{D}}\mathrm{T}^{-2}$ and $[e^2] = \mathrm{M}^{-1}\mathrm{L}^{+\mathrm{D}}\mathrm{T}^{-2}$ depends on the dimension of the configuration space D.

However, it is possible to construct an expression: $e^2/G = M_{St}^2$. Here M_{St} is the Stoney mass [4]. $M_{St} = \sqrt{e^2/G}$ does not depend on the configuration space dimension D.

Note that M_{Pl} is the Planck mass, just as L_{Pl} is the Planck length, which depends on the configuration space dimension D.
For example: $L_{Pl}^{D-1} = G\ h/c^3$.

Recognition of c as a fundamental constant leads to the equality of the d'Alembert operators $\boxdot$ for two wave equations in different inertial reference frames K and K'.
From the equality $\boxdot_K = \boxdot_{K'}$ follow the Lorentz transformations, and then the special theory of relativity [3].

Recognition of h as a fundamental constant allows us to extend wave properties from fields to matter. It allows us to construct a "massive" wave equation. That is, instead of the d'Alembert operator for the wave equation, we can construct the Klein-Gordon-Fock (KGF) equation operator: $\boxdot \to \boxdot - (mc/h)^2$.

This is also true for configuration spaces of arbitrary dimension D.

The presence of the Stoney mass allows us to construct dimensionless constructions m/M_{St} and $L^2_{K(M_{St})}$ ⊡. Here $L^2_{K(M_{St})} = \frac{h^2 G}{e^2 c^2}$ is the square of the Compton length of the Stoney mass.

Let us define a function $f(x)$ such that $f(0) = 1$.

This function can have the form $f(m/M_{St})$ or $f(L^2_{K(M_{St})}$ ⊡$)$.

Let us consider the case: $f(m/M_{St}) = 1/(1 + (m/M_{St})^2)$.

For the KGF equation we get: $\boxdot - (mc/h)^2 * 1/(1 + (m/M_{St})^2)$. Here m is a parameter: $m \in [0, +\infty]$. Then, if $m/M_{St} \ll 1$, we return to the usual KGF equation. If $m/M_{St} \gg 1$, we get $\boxdot - (M_{St}c/h)^2$.
Thus, the KGF equation for $M > M_{St}$ does not exist. Objects with $M > M_{St}$ do not have wave properties and are described by the usual Hamilton-Jacobi equation. While objects with $M < M_{St}$ can also be described by it, but approximately. An exact description requires using the modified KGF equation.

Using this approach, the problem with "Schrödinger's cat" is solved.
The problem of the existence of a classical device, not as a limiting case of a quantum-mechanical design, but as an independent entity, including a number of other problems requiring restrictions on M.

Note that a quantum-statistical object: a Bose-Einstein condensate (BEC), can have $M_{BEC} \gg M_{St}$. However, the wave nature of the BEC is determined not by its total mass M_{BEC}, but by the mass m of the individual objects of which it consists. Otherwise, the de Broglie wavelength for the BEC would become much smaller than its characteristic dimensions, which would lead to its decay. This is also evident from interference experiments with the BEC [1] and the construction of the Gross-Pitaevskii equation.

(P.S.) The Einstein-Hilbert (EH) equation with the Λ term can be subjected to a similar modification. Moreover, in the weak field approximation it is written similarly to the KGF with $\boxdot$.

We obtain: $R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = \kappa\, F_{\mu\nu} - g_{\mu\nu}\, \Lambda * 1/(1 + L^2_{K(M_{St})}\, \Lambda)$

Here $\Lambda \in [0, +\infty]$. Then for $L^2_{K(M_{St})}\, \Lambda \ll 1$ we return to the unmodified EH equation. And for $L^2_{K(M_{St})}\, \Lambda \gg 1$ we obtain the EH equation with $g_{\mu\nu}\, \Lambda$ replaced by $g_{\mu\nu}\, 1/L^2_{K(M_{St})}$.

Such an equation corresponds to the inflation stage.

REFERENCES

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