Planck's constant is not constant in different quantum phenomena

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Висунута ідея про те, що стала Планка h в мезодинаміці істотно відрізняється від сталої Планка в електродинаміці. Запропоновані рівняння руху для електрона, протона і нейтрона, в яких стала Планка має різні значення.

At present, it is a generally accepted axiom that the Planck's constant

$$h = 6.626 \cdot 10^{-34} J \cdot s \tag{1}$$

has the same meaning and value in electrodynamics, mesodynamics, quantum theory, theory of quarks, gravidynamics, etc. Planck's fundamental quantum hypothesis, put forward for the explanation of the energy spectrum of black body radiation, is ad hoc employed in all quantum physics.

In [1] we have suggested the following hypothesis: the fundamental value of Planck's constant h in mesodynamics is considerably different from (1). This assumption, for example, can be explained by the fact that in mesodynamics, not a photon but a meson is emitted, which mass does not equal zero. There are no fundamental grounds to assume that h in mesodynamics has to have the value of (1) [1–4].

In this short note we focus on the equation of motion for the fundamental particles (e — electron, p — proton, n — neutron) based on the aforementioned hypothesis. Schrödinger equations for electron, proton and neutron have the following form in our approach:

$$i\hbar_e \frac{\partial \Psi_e}{\partial t} = -\frac{\hbar_e^2}{2m_e}\Delta\Psi_e + V_c(x)\Psi_e, \tag{2}$$

$$i\hbar_p \frac{\partial \Psi_p}{\partial t} = -\frac{\hbar_p^2}{2m_p}\Delta\Psi_p + V_p\Psi_p, \tag{3}$$

$$i\hbar_n \frac{\partial \Psi_n}{\partial t} = -\frac{\hbar_n^2}{2m_n}\Delta\Psi_n + V_n\Psi_n, \tag{4}$$

$$\Delta \equiv \frac{\partial^2}{\partial x_1^2} + \frac{\partial^2}{\partial x_2^2} + \frac{\partial^2}{\partial x_3^2},$$

where

$$\hbar_e = \hbar, \quad \hbar_p \neq \hbar, \quad \hbar_n \neq \hbar,$$

$\hbar_e$ — Planck's constant for electron (electrodynamics); $\hbar_p$ — Planck's constant for proton (mesodynamics); $\hbar_n$ — Planck's constant for neutron (mesodynamics).

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The V_e, V_p, V_n potentials are assumed to be depended on h_e, h_p and h_n, the wave functions Ψ_e, Ψ_p and Ψ_n as well as the coordinates of particles.

In addition, let us consider Poincaré invariant equations of motion for meson and for e, p, n. As is known, the energy of an elementary particle is defined by formulae:

$$E^2 = c^2 p_a^2 + m^2 c^4, \quad p_a^2 = p_1^2 + p_2^2 + p_3^2, \tag{5}$$

where m is the mass of a particle; c is the velocity of light in vacuum; p_a is momentum. Formulae (5) give us the following Poincaré-invariant equations for particles

$$-\hbar_\mu^2 \frac{\partial^2 u}{\partial t^2} = \left(-\hbar_\mu^2 c^2 \Delta + m_\mu^2 c^4 \right) + V_\mu u, \tag{6}$$

$$i\hbar_e \frac{\partial \Psi_e}{\partial t} = \left\{ -i\hbar_e \gamma_0 \gamma_k \frac{\partial}{\partial x_k} + m_e c^2 \gamma_0 \right\} \Psi_e + V_e \Psi_e, \tag{7}$$

$$i\hbar_p \frac{\partial \Psi_p}{\partial t} = \left\{ -i\hbar_p \gamma_0 \gamma_k \frac{\partial}{\partial x_k} + m_p c^2 \gamma_0 \right\} \Psi_p + V_p \Psi_p, \tag{8}$$

$$i\hbar_n \frac{\partial \Psi_n}{\partial t} = \left\{ -i\hbar_n \gamma_0 \gamma_k \frac{\partial}{\partial x_k} + m_n c^2 \gamma_0 \right\} \Psi_n + V_n \Psi_n, \tag{9}$$

where Ψ_e, Ψ_p, Ψ_n are four-component wave functions; u is a scalar wave function for meson with mass m_μ; γ_μ are 4×4 Dirac's matrices. Equations (7), (8) and (9) are Dirac's equations with different Planck's constants, $V_e = V_e(\Psi_e, \Psi_p, \Psi_n, x, t)$, $V_p = V_p(\Psi_e, \Psi_p, \Psi_n, x, t)$, $V_n = V_n(\Psi_e, \Psi_p, \Psi_n, x, t)$.

Consequently, to describe interactions between electron and proton, electron and neutron, etc., it is necessary to use different values for $\hbar_e$, $\hbar_p$ and $\hbar_n$ in equations (6)–(9).

A phenomenological approach, proposed in [2–4] for determining fundamental constants and based on a few known constants, gives us the following values [2, 3]:

$$h_e = 6.626 \cdot 10^{-34} J \cdot s, \quad h_p = 2.612 \cdot 10^{-30} J \cdot s, \quad h_n = 2.668 \cdot 10^{-30} J \cdot s.$$

Obviously, because h_e, h_p and h_n enter most of quantum relationships, we must review the standard theoretical schemes and possibly explore new physical experiments. This fundamental challenge will take time. Our main objective is to show a new possibility for description of interactions of particles which is related to a new value of h.

According to [5, 6], formulae (5) can be used for nonlinear generalization of equations of motion for elementary particles. Assume that in formulae (5) c is not constant but a function of field (or a functional with respect to fields)

$$c = c\left(\bar{\Psi}\Psi, \frac{\partial \bar{\Psi}\Psi}{\partial x^\mu} \frac{\partial \bar{\Psi}\Psi}{\partial x_\mu} \right). \tag{10}$$

Therefore, we can obtain from (10) a nonlinear equation of the type (6)–(8). This assumption means that velocity of a signal is a function of field [5, 6) and not a constant, as is presently accepted for the velocity of light in vacuum. The latter statement is a cornerstone of modern quantum physics. We should like to emphasize that here we have discussed a new glance on this fundamental point.

A more detailed development of these ideas will be published elsewhere.

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