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A space-time quantum hypothesis and the speed of the action of the "fifth" force

Miklós Banai
Retired Theoretical Physicist, Budapest, Hungary

Abstract: *This letter suggests that 1) Hawking radiations of black holes should display a „space time quantum" if Nature really applies it, and 2) the speed of the action of the "fifth" force might be greater than the speed of the light.*

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We discuss in this letter two aspects of the observed universe. One is its sub-microscopic nature attainable through measurements. The other one is its observed big scale nature disclosed in the last decades.
1) The view is widely accepted that the mathematical difficulties of local quantum field theories arise from their paradoxical and semantically inconsistent nature. Namely, they are quantum theories over a classical space-time (for references see the list e.g. in [1]). To remedy this problem, among other possibilities, we suggested a space-time quantum hypothesis in [1]. The point of this is that we are not able to distinguish two events by measurements inside an $\check{h}$ size region of the Minkowski space M^4 . If Nature really has such a constant, a „space-time quantum", then its measurement procedure is the question, i. e. how one can measure the value of this constant?
We suggest here that the analysis of the Hawking radiations of black holes must reveal the existence of this type of a natural constant if Nature really applies it. According to reference [1] the classical limit of the quantum space-time model applying the space-time quantum hypothesis is provided by the set of events for which the dispersions of the time observable **t** and of the observable **r** (describing the position of the point like test particle in its rest frame) are minimal, i. e., for which

$$\Delta t \Delta r = \tfrac{1}{2}\, \check{h} \qquad (1)$$

In that case

$$\Delta t = \check{h}/2\Delta r \qquad (2)$$

This relation tells us that the smallest the dispersion of **r** (the smallest the spread of the test particle in its rest frame) the longest the dispersion of its proper time, its life time. Then it implies that the life time of an elementary particle as a test particle must become longer approaching the event horizon of a black hole where the spread of its position shrinks to the centre of its rest frame. Therefore, in principle the Hawking radiations of black holes should display the relation (2).

2) The greatest news of this year in physics is the announcement of a measurement indicating the possibility of the fifth force [2, 3]. Then one should ask the question: what is the speed of the action of this new force? By special relativity it should be not greater than the speed of the light. However one must check this statement by experiment. Nevertheless we discuss this question here by considering a simple thought experiment. For this reason let us imagine a stream of uniform quanta each of the same velocity v and mass m. Let we insert in this stream a particle of mass M being in rest relative to the quanta of the stream. Let the interaction between this particle and the quanta of the stream be the inelastic collision. Then theconservation law of momentum yields, after a simple algebra, the velocity v(N) of the inserted particle after the Nth collision

$$v(N) = [Nm/(Nm + M)]v \qquad (3)$$

We see from this relation that if N goes to infinity the velocity of the particle does go to the velocity v of the quanta of the stream, while the mass of the particle does go also to the infinity. If the accelerating stream is provided by the electromagnetic force then v is the velocity c of the light. However if the accelerating stream is provided by the fifth force then v is the velocity of the quanta of this force and the relation (3) is also true when v is not equal to c. Thus this simple thought experiment might suggest that the speed of the action of the fifth force might be different, even greater than the speed of the light. The observed volume of the Universe does not contradict to this theoretical possibility.

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