Are Planck-particles the primordial particles of matter in the universe?

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1 The values of the constant of gravitation and of other physical constants

If one looks at the stars, it seems astonishing that their velocities as well as those of galaxies are negligible compared to light velocity after almost 14 billion years of gravitation and expansion of the universe. In fact, it seems that there is a very fine tuning between these two cosmic phenomena. It is therefore assumed, that "potential energy" caused by gravitation and "kinetic energy" caused by expansion of the universe are equal to each other (using the relations $R = ct$ and $E = Mc^2$):

$$\frac{GM^2}{R} = Mc^2 \rightarrow G = \frac{c^5 t}{E} \text{ or } G = \frac{R^5}{t^4 E} \tag{1}$$

$$E = \frac{c^5 t}{G} \approx 1.3 \cdot 10^{70} J \text{ (for } t = 1.4 \cdot 10^{10} a) \tag{2}$$

R: radius of the universe
c: velocity of light
t: age of the universe
G: constant of gravitation
M: mass of the universe
E: energy of the universe

Equation 1 has independently been proposed by Riofrio recently [1].
Similarly, one can obtain values for several other physical constants, using the equation above for G and the relations introduced by Planck over hundred years ago [2]. For example, the value of the Planck constant h can be obtained by the following equation:

$$\Delta E \cdot \Delta t = N_p^2 \cdot \hbar \tag{3}$$

In this case, N_p is the number of "Planck-masses", expressed through division of the total energy of the universe by the Planck-energy:

$$N_p = \frac{E}{m_p c^2} \approx 10^{61} \tag{4}$$

By introducing equation 2 for ΔE one obtains:

$$\hbar = \frac{c^5 t^2}{N_p^2 \cdot G} \tag{5}$$

Therefore, it seems that many if not all physical constants may be related to the structure (size, age and energy) of the universe.

2 The energy of the universe and mass production

Although very speculative, the following assumptions lead to conclusions, which are extremely surprising: The value of E in equation 2 is very close to recently published estimations for the whole energy of the universe [3]. It follows that either c [1] or G vary with the age of the universe (E = const.) or that E is a function of the age of the universe and increases linearly with the age (G and c remaining constant). If E was constant, then probably all other physical constants would have to vary, too, since they all seem to be related to each other [2]. Otherwise the "fine tuning" of them would be valid only for status quo, which seems to be most unlikely. Therefore, it seems to make more sense, to assume G to be a constant and E to vary with time, although this seems to contradict the principle of energy conservation. Introducing some kind of "negative energy" in the way

$$E + E_n = 0 \tag{6}$$

on the other hand, might be a solution for that problem (similar to Λ introduced by Einstein in his general theory of relativity). In this case, the principle of energy conservation applies to the sum of both "normal" and "negative" energy (however, any positive value of E, created in the big bang contradicts this principle, too!). It is interesting that in this case the total energy of the "system universe" would constantly stay null over time, thus needing no explanation for its existence.
Furthermore, the increase of positive (mass) and negative energy probably is not continuous, but happens in discrete

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steps. The smallest possible step for such an event may be the Planck-time:

$$\Delta t_p = \sqrt{\frac{\hbar G}{c^5}} \tag{7}$$

Using equation 2 in the form

$$\Delta E = \frac{c^5 \Delta t_p}{G} \tag{8}$$

and introducing equation 7 leads to

$$\Delta E = \sqrt{\frac{\hbar c^5}{G}} \, . \tag{9}$$

This is exactly the value of the Planck-energy, meaning that the increase in energy (or mass) of the universe in steps of the Planck-time is exactly one Planck-mass per time interval. Most curiously, this production rate gives exactly the observed mass of the universe after a total of about 14 billion years!

3 Cosmic rays

The production rate of Planck-particles (one Planck-mass per Planck-time) deduced above can also be expressed as about 10^{44} particles/second. Using the present volume of the universe (about 10^{79} m^3), this would give a value of about 10^{-35} particles per m^3 and second (or about 1 particle per 10 million years within the volume of the earth).
Particles of the cosmological radiation of very high energy interfere with the background of photons, thus losing parts of their energy. Therefore, particles coming from outside a distance of about 163 million light years should not exceed an energy of about $6 \cdot 10^{19}$ eV (GZK-cutoff [4,5]). Nevertheless, several particles with higher energies have already been detected, meaning that they must have been produced within this radius.
One Planck-particle has enough energy to produce about 10^9 secondary particles with energies of about $6 \cdot 10^{19}$ eV. Using the above deduced value of about 10^{-35} Planck-particles per m^3 and second, this would lead to a density of approximately 10^{-26} particles per m^3 and second, which seems to be in accordance with the observed values [6].

4 Conclusion

It has been demonstrated that probably all physical constants can be expressed in terms of cosmic parameters. Therefore it follows, that either all physical constants vary with time, which is contradicted by observation, or that the energy of the universe must increase with time. Since a production rate of one Planck-particle per Planck-time would exactly lead to the presently observed amount of matter in the universe, the question is posed, whether Planck-particles are still produced in our universe and whether they are the primordial particles of matter. Particles in cosmic rays exceeding an energy of $6 \cdot 10^{19}$ eV may lead to an answer of this question.

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