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Theoretical Quantum Mass

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Abstract

In the present theoretical work, attempts have been made to find the least mass, which quantifies the discrete mass, in terms of the reduced Planck constant and cosmological constant in the Heisenberg position-momentum uncertainty relation as well as by employing the time period of oscillating universes in mass-time inequality. It has been estimated and reported that the least mass exists in the range $5.98\times10^{-74} \le m \le 2\times10^{-68}$ kg, which quantifies discrete masses in the universe of size ≤8.64 G ly.

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Introduction

Everything is inherently discrete microscopically and is an integral multiple of a smallest value. Photon energy, electronic charge, reduced Planck constant, Bohr's Magneton, neuron, nephron, and Plank time, etc., quantify energy, charge, angular momentum, magnetic moment, nerves, kidney, time, etc., respectively. Although the Planck length is the quantum length, three Planck volumes quantize the discrete volume.[1-3] Energy less than Planck's value is not quantifiable.[4] Thus, the least quantifiable energy is E=h, which corresponds to a system of frequency 1Hz with time 1s. The mass energy equivalent relation $E=mc^2$ yields the least quantifiable mass $m=h/c^2 \approx 7.37\times10^{-51}$ kg for Planck's energy value. However, many systems have a time period of more than one second and possess quantifiable energy with different values of least mass. A claim has been found that mass $m_q \cong 2\times10^{-68} kg$,, estimated using the modified Heisenberg uncertainty relation $m=(h\sqrt{\Lambda})/c$ in terms of the cosmological constant $\Lambda=1.1\times10^{-52}$ m^{-2}, light speed c in vacuum and the Planck constant h instead of the reduced Planck constant ħ , quantizes discrete masses.[5]

According to our scientific estimation, the universe is approximately 13.8 G years old with prefix G for Giga.[5] The creation and annihilation of the material universe occurs 36000 times at intervals of 8.64 G years inside a giant universe of life 311.04 T years with prefix T for tera or trillion.[6-9] The inner universe contains both energy and matter in half its time

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period; otherwise, it contains energy only. With these two time periods and an ultimate light speed a ly/year, the outer giant universe is ~311.04 T ly while the size of the inner universe is ~8.64 G ly. All estimated universe sizes after 1965 AD and until now are in the range 8.64 G ly ~311.04 T ly.[10]

However, from a survey of the literature, it is found that no work is available on the least mass obtained in terms of the reduced Planck constant and mass-time inequality using the cosmological constant and time period of universes, respectively. Thus, it becomes quite imperative to estimate the minimum mass in terms of the reduced Planck constant and cosmological constant in the Heisenberg position-momentum uncertainty relation as well as to employ the time period of oscillating universes in mass-time inequality ab initio to re-examine the claimed quantum mass. In the present theoretical approach, for the first time attempts have been made to find the least mass in terms of the reduced Planck constant using the cosmological constant and mass-time inequality by employing the time period of universes. In the course of calculating the least mass using the modified Heisenberg uncertainty relation in terms of the reduced Planck constant and cosmological constant as well as the mass-time inequality employing the time period of universes, five values of least mass have been estimated and reported excluding the claimed mass. The claimed mass is in the mass range 5.98×10^{-74} kg-7.37×10^{-51} kg.

Theory and Calculations

According to the Heisenberg uncertainty inequality limit, the product of the standard deviation in position x and the linear momentum p=mc of a particle of mass m moving at speed c will never be less than half the reduced Planck constant[3,11] as follows:

$$xp = xmc \geq \hbar/2 \qquad ...(1)$$

The estimated universe size R is the reciprocal of the square root of the cosmological constant Λ i.e. $R=1/\sqrt{\Lambda}$.[4] When, x=R, equation (1) results in the mass formula:

$$m \geq \frac{\hbar}{2cx} = \frac{\hbar}{2c}\sqrt{\Lambda} = 1.59 \times 10^{-69} kg \qquad ...(2)$$

For the case, in which x is on the order of wavelength λ, equation (1) becomes:

$$\lambda mc \geq \hbar/2 \qquad ...(3)$$

However, for λ=cT in terms of time period T and light speed c, equation (3) reduces to the mass-time inequality[3] as follows:

$$mT \geq \frac{\hbar}{2c^2} = 5.87 \times 10^{-52} kgs \qquad ...(4)$$

The time period and frequency v are reciprocal to each other thus, the time period $0 \leq T \leq 1$ is crucial because its corresponding frequency changes suddenly in the range $\infty \leq v \leq 1$ for an unknown cause. Equation (4) gives the mass value 1.34×10^{-69} kg for the time 13.8 Billion years of age of the observable universe. With the time periods of the inner and outer universes, the mass-time inequality relation (4) results in masses $\sim2.15\times10^{-69}$ kg and $\sim5.98\times10^{-74}$ kg, respectively. The least masses obtained via the different methods with different constants/variables are summarized in decreasing order in Table. 1

Table Comparison of least mass obtained in different methods with different variables.

Formula	Constant/variable	Mass (kg)
$m=h/c^2$	Energy of a Planck constant h.	7.37×10^{-51}
$m=h/2c\ \sqrt{\Lambda}$	Planck constant h and cosmological constant Λ	2×10^{-68}
$m=\hbar/(2c^2\ T)$	Reduced Planck constant ħ and time period 8.64 Billion years	2.15×10^{-69}
$m=\hbar/2c\ \sqrt{\Lambda}$	Reduced Planck constant ħ and cosmological constant Λ	1.59×10^{-69}
$m=\hbar/(2c^2\ T)$	Reduced Planck constant ħ and age 13.8 Billion years	1.34×10^{-69}
$m=\hbar/(2c^2\ T)$	Reduced Planck constant ħ and time period 311.04 T years	5.98×10^{-74}

It is clear from the Table that the least mass $\sim5.98\times10^{-74}$ kg may be the quantum mass. Approximately 36000 times the least mass created due to energy transformation during creation in the outer universe quantifies the masses in the inner universe.

Conclusions

Although there may be a minimum mass that quantizes every mass, no value of mass obtained in the present calculations is equal to the quantum mass claimed in reference (4) due to differences in the approaches used. In comparison, the earlier claimed masses are approximately 33439 and 9.3 times the masses obtained using the time periods of outer and inner universes, respectively while they are nearly 12.56 times the masses obtained in terms of the reduced Planck constant and cosmological constant values. The claimed mass is approximately 1.35 times the mass obtained at 13.8 billion years. However, the three masses are of the same order of magnitude with fewer differences. The mass obtained using the time period 8.64 G years is approximately 1.35 times the mass obtained with the reduced Planck constant. The mass values given in the Table make it clear that the quantum mass may lie somewhere in the mass range 5.98×10^{-74} kg-7.37×10^{-51}) kg that quantifies discrete masses in the universe of size ≤8.64 G ly. Except for energy, no mass form exists beyond the universe of size ≥8.64 G ly. Due to the lack of experimental evidence and the unavailability of suitable instruments until recently, it was not possible to ascertain the correct value of the least mass. An in depth study may ensure the accuracy of the minimum mass in the future. In accordance with the charge-matter principle, wherever mass is present, there are electric charges. The present calculation also predicts the existence of an electric charge of an unknown value less than the electronic and quark charges.

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Conflict of Interest

The author declares no conflict of interest in the article.

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