Hypotetical Quantum of Temperature

Email: ***bzivlak@gmail.com***

Abstract. After examining the relationships in the universe, is determined a hypothetical quantum temperature and then obtained temperature of cosmic microwave background radiation (CMB). It is rejected an explanation of that temperature as a result of the relic radiation from the Big Bang.

Keywords: hypothetical quantum temperature, geometric mean, Planck oscillator, Planck temperature

Introduction

In the kinetic theory of gases, we observe the collision of gas molecules in a closed container. Here, we consider that the Universe is closed, rather limited system. But while the walls of the container are closed, the Universe is limited by natural laws rather than their shape or physical boundaries. Logarithm is a key mathematical apparatus that restricts all natural phenomena in the Universe, including the number of collisions which is important for temperature. Here, consideration will be determined by the number of collisions hypothetical quantum temperature and the temperature of the microwave background radiation.

Introduce here terms: microstates and macrostates and multiplicity of the macrostate by quoting [1]. *„We first introduce the very fundamental statistical ideas of microstates and macrostates. Given a system (e.g., a gas), we view it as built from some elementary constituents, (e.g., molecules). Each constituent has a set of possible states it can be in. The thermodynamic state of the system (which characterizes the values of macroscopic observables such as energy, pressure, volume, etc.) corresponds to many possible states of the constituents (the molecules). The collection of states of all the constituents is the microstate. To keep things clear, we refer to the macroscopic, thermodynamic state as the macrostate. The vast disparity between the number of possible macrostates versus microstates is at the heart of thermodynamic behavior! The number of distinct microstates giving the same macrostate is called the multiplicity of the macrostate. The multiplicity is a sort of microscopic observable which can be assigned to a macrostate".*

Significant temperatures

Let us start with the Planck temperature (we use CODATA 2010 values):

$$T_{pl}=\frac{m_{pl}c^2}{k_B}=\sqrt{\frac{\hbar c^5}{Gk_{\mathbf{B}}^2}}=1.416833\,555*10^{32}K \qquad \mathbf{(1)}$$

The temperature occurs as a result of collisions by mass particles and we assume that the following applies:

1. ***Planck temperature is a measure of the maximum number of simultaneous collisions in the Universe.***

So let's try to explain all collisions in the universe into its component parts. Determine the average number of simultaneous collisions C based on the following reasoning:

We use: N=6.38707718E+121, that is the number of Bošković points in the Universe [2, p7], or the number of Planck oscillator, which is often used term.

Determination of the number of structures and their collisions would require knowledge of the number of atoms, the number of each individual molecule, etc ... Fortunately, nature is rational, so that the number of macrostate and the number of their multiplicities for Universe are simpler to determinate than all particular microstates. Now assume for Universe:

2. ***Number of macrostates is a function of the number of Planck oscillators (2):***

$$d = \log_2\left(\sqrt[3]{N}\right) = 134.8761518 \qquad \textbf{(2)}$$

Number of multiplicities we distribute equally for any particular macro state. Number of collisions schedule on **2π** Planck oscillators (**2πN**). Here is multiplied with **2π** because there is interaction with the environment, therefore with complex structures, so we have:

3. ***Number of macro state multiplicities is the geometric mean between the number of Planck oscillator and 2π, (3):***

$$m = \sqrt{2\pi * N} = 2.003277053 * 10^{61} \qquad \textbf{(3)}$$

Note that $\sqrt{2\pi N}$ is first member in product of Stirling's approximation for factorials [3].

When, in the kinetic theory of gases we say that we do not know how it moves every single molecule in the container but we assume that the number of collisions is distributed equally to all degrees of freedom, we proceed as we say here, where we assume that the collisions in a limited Universe apportioned in relation to the number of Planck oscillator according to the formula (3).

We can the number of collisions of complex structures in the Universe viewed through binomial coefficients. But already the general example in (4) shows that there is an enormously large numbers. For large numbers such as N, the result can no longer take computable values even using Stirling's approximation [3]. Also challenging is the task to set formula for the universe as a whole.

$$\left(\frac{n}{m}\right) = \frac{n!}{(n-m)!m!} \qquad \textbf{(4)}$$

Therefore, we have from (2) and (3) that the average number of collisions **C** is:

$$C = d * m = \log_2(\sqrt[3]{N}) * \sqrt{2\pi N} = 2.701942999 * 10^{63} \qquad \textbf{(5)}$$

Whence we have (6):

$$T_{hq} = \frac{T_{pl}}{C} = 5.243758123 * 10^{-32} K \qquad \textbf{(6)}$$

That we call:

4. ***hypothetical quantum of temperature.***

Let's calculate, the geometric mean of the Planck temperature and hypothetical quantum of temperature:

$$T_{bg} = \sqrt{T_{pl} * T_{hq}} = T_{pl} * (2\pi N)^{-1/4} * [\log_2(\sqrt[3]{N})]^{-1/2} = 2.725716871\mathrm{K} \quad \textbf{(7)}$$

We got:

5. ***The temperature of the microwave background radiation is a geometric mean of Planck temperature and hypothetical quantum of temperature.***

As the product of the upper temperatures is constant, $T_{pl}*T_{hg}$ = const, it is also true:

6. ***Planck temperature and hypothetical quantumof temperatures are opposites.***

The above results, to get an easier view when the temperature scale was such that Tbg = 1 by definition. Then it would be the value of Planck's temperature and hypothetical quantum temperatures differ only in the sign of the exponent.

Also can be said:

7. ***The temperature of the microwave background radiation is the opposite of itself.***

$$T_{bg} = \sqrt{T_{bg} * T_{bg}} \quad \textbf{(8)}$$

From the above formulas and also follows

8. ***There is no absolute zero temperature, or complete absence of movement.***

We note that in all the preceding square roots did not take into account the negative value of the results because the physical meaning of temperature, is connected with the number of collisions that can not be negative.

A hypothetical quantum temperature is not the minimum temperature, even as the Planck temperature is not the maximum.

The next significant temperature we get by formula (9):

$$T_f = T_{pl} / N^{1/6} = 7.0865546333\mathrm{E} + 11\,\mathrm{K} \quad \textbf{(9)}$$

And its opposite temperature in relation to $\mathbf{T_{bg}}$ (10):

$$T_n = T_{hq} * N^{1/6} = 1.048398389\mathrm{E} \text{ - } 11\,\mathrm{K} \quad \textbf{(10)}$$

The geometric mean of (9) and (10) is evident with the use of (7):

$$\sqrt{T_f * T_n} = \sqrt{T_{pl} * T_{hq}} = T_{bg} \quad \textbf{(11)}$$

Note only that the $\mathbf{T_f}$ is very close to Hagedorn temperature [4]. This temperature can be obtained by formula:

$$T_f = m_f T_{pl} / m_{pl} \quad \textbf{(12)}$$

where $\mathbf{m_f}$ - fundamental mass [5] and the Planck mass is $\mathbf{m_{pl}}$. The temperature $\mathbf{T_n}$ likely to have important physical significance, as many could better than me to explain.

Assumptions 1., 2. and ***3.*** lead to temperature of the cosmic microwave background radiation is not a relic of the past but is geometric mean of all the temperatures.

Conclusion

Examining the number of collisions in the Universe we got in (7), the temperature value of 2.7257K which should be geometric mean of all temperatures in the Universe. Agreement of this value with the value of the temperature of the cosmic microwave background radiation (CMB) is such that it supports the validity of the reasoning that led to the formula (2) and (3).

Result (7), except as geometric mean temperature can also be interpreted as a boundary between the temperature of less than T_{bg}, of voids in the Universe and greater than T_{bg} in parts of the Universe where there is matter.

Assumptions ***1., 2.*** and ***3.*** by Formulas **(2), (3)** and **(5),** produce attitudes ***4. - 7.*** and formulas **(6)** and **(7)**, whose validity further may be confirmed or refuted.

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References:

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