OPINION

New interpretation of Planck constant and Boltzmann constant

Kay Zum Felde

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ABSTRACT

Recently we have estimated new values for the Planck constant and the Boltzmann constant. We are going to interpreted them.

INTRODUCTION

Using Einstein's equation with a metric being a four dimensional sphere, we received new geometrical values of Planck's constant h and Boltzmann's constant k [1].

Those values are:

$$h = \frac{1}{4\pi}\frac{J}{Hz}, \tag{1}$$

$$K = \frac{1}{8\pi}\frac{J}{K}. \tag{2}$$

Since Einstein's equation basis is geometrical, the constants should be interpreted geometrically. (1) is interpreted as the spin of a Dirac fermion. The value 4π supports the result of Dirac's equation interpreting a Fermion being a four-dimensional spinor. Moreover both equations, Dirac and Einstein, are describing nature being relativistic.

Equation (1) is extracting the frequency of a Dirac Fermion, i.e., 4π. Interestingly the temperature is a geometrically quantity. Moreover the term (2) is disclosing temperature to be proposed to be made of gravitons. Gravitons are proposed to be quantities that emitted by connecting two Fermions by doubling the frequency of a Fermion, i.e., 8π. F.e., a graviton is going to be emitted by the creation of a electron positron pair.

Interpretation

Our solutions of Einstein's equation are demanding quantized values for:

$$E = \bar{h}\omega \qquad \omega = 4\pi\nu, \nu = 1, 2, 3, ..., \tag{3}$$

$$E = kT, \qquad T = 8\pi n, n=1, 2, 3.... \tag{4}$$

We are observing that Einstein's equation of General Relativity is applicable to describe microscopic physics. Our considerations are revealing that Einstein's equation is more fundamental as known yet. Furthermore we are observing that Einstein's equation and thermodynamics reveal being exactly the same. In order to proof this we are departing from thermodynamics, i.e.

$$dF = d(E - TS) = -SdT - pdV + \mu dN, \tag{5}$$

Identifying S = k, dV = 0 and μ = U/N. We receive, inserting those values, with $dH = \bar{h}\omega$:

$$\bar{h} = -kT + U. \tag{6}$$

Einstein's equation for this particular problem, using the metric of a four dimensional sphere, e.g.,

$$x = \cos\phi \cos\psi \cos\eta \tag{7}$$

$$y = \cos\phi \cos\psi \sin\eta \tag{8}$$

$$z = \cos\phi \sin\psi \tag{9}$$

$$ct = \sin\phi, \tag{10}$$

with U is a number, with physical unit Joule, defining the quantity interaction energy.

We have two quantities identifying the R.H.S. of Einstein's equation, which now has the form, with Gμν = 1:

$$U = 8\pi T_{\mu\nu} = \bar{h}\omega - kT. \tag{11}$$

More general any Dirac fermion can emit and absorbed photons and gravitons. Only spin is needed to be conserved. F.e., a Dirac fermion can at the same time emit two photons of same spin while absorbing a gravitation. Moreover it can emit a photon that elsewhere is going to be absorbed. Too it is possible that a Dirac fermion emits a graviton that is going to be absorbed by a different fermion.

We are now going to discuss the graviton. It is easy to just make the graviton responsible for carrying temperature, since the formula of Einstein reveals it mathematically. It is well known that a system of fermions just is emitting and absorbing photons. Just a system is reversal in time and thus reversible. Reversible systems don't show temperature.

If we take into account that it is theoretically possible that a graviton interacts with the vacuum and is absorbed by the vacuum causing the creation of a electron positron pair. This is a spontaneous process. Considering Einstein's theory of light we conclude that the spontaneous emission of a photon is causing temperature since the spontaneous emission is disturbing the controlled process of

Independent scientist, Wiener Strasse, 13260599 Frankfurt am Main, Germany E-mail: kay13lalaguna@gmail.com

Correspondence: Kay Zum Felde, Independent scientist, Wiener Strasse, 13260599 Frankfurt am Main, Germany E-mail: kay13lalaguna@gmail.com

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emissions and absorptions which would be just resulting in conservation of spin.
Spontaneous processes in microscopic physical systems are still a riddle. Somehow gravitons are influencing a thermodynamically system. We consider now a system of two Dirac fermions A,B. A is emitting a graviton. B has at least two choices. First it can absorb the graviton and will increase its energy $E = \bar{h}\omega$ by 8π. On the other hand it could emit two photons. Moreover A could emit one photon and B will absorb it.

Now what is causing irreversibility? Of cause spontaneous processes. We are going to try a new ansatz. If we look back to our simple system A, B. A has several possibilities to react on the arrival of a graviton.

(11), doesn't reveal a specific mechanism from which we can deduce how it would response. According to the nature of the equations and our considerations it is somehow common sense that there's the actual of line that we are making a step closer to extract reality by the following statement:

Proposition 1
Our considerations are leading to the fact that temperature is destroying reversibility. Naturally this is done by gravitons identified as carrier of temperature. Moreover the essence of the actual point of view of us is that nobody knows exactly how a fermion is going to react on, f.e., a graviton while arriving from B.

Thermodynamics of the System
We depart from:

$$dF(\mathrm{T},\mathrm{N}) = -S(\mathrm{T},\mathrm{N})dT + \mu(T, N)dN. \quad (12)$$

$$\bar{h}d\omega = -kdT + \mu dN \quad (13)$$

$$= -\left(\frac{\partial H}{\partial T}\right)_N dT + \left(\frac{\partial H(T,N)}{\partial N}\right)_T dN \quad (14)$$

Thermodynamics says that dH < 0 I and s becoming zero defining equilibrium, when (12) is minimum, i.e., dH = 0.
Inserting our results from (12) follows dω = 0. That means the system has its equilibrium when T is constant and the number of particles is not changing anymore.
From thermodynamics we know that temperature is a so-called intensive quantity. That means a thermodynamically system is in equilibrium when its intensive quantities become at every point in the system the same value.
Temperature is yet known as a macroscopic quantity. We have learned that gravitons transfer temperature. Temperature is quantized, since set- ting dω = 0 it follows from (13):

$$T = 8\pi NU. \quad (15)$$

CONCLUSIONS

We have examined our results. Gravitons are carrying temperature. Our system shows an equivalence of thermodynamics and Einstein's equation of General Relativity. They are revealing that a system of Dirac fermions is emitting and absorbing photons and gravitons. In order to conserve spin absorption of a graviton causes the emission of two photons or a graviton. Moreover a photon can be emitted by a Dirac fermion and absorbed by an- other Dirac fermion.

Equilibrium is reached when dω = 0. Then temperature is proportional to the product of the number of fermions and the energy of the fermions.

Temperature is responsible for the destruction of reversibility. Without temperature the system would be just count emissions and absorptions of photons where spin is conserved and thus total energy is conserved. The system is a harmonic oscillator and energy is conserved forever.
Temperature is yielding to a system where several processes can happen. Equilibrium is reached when no photons aren't emitted and absorbed. It follows that only gravitons are moving around. Since they carry temperature and they are conserved, the system has temperature.

A black body in equilibrium shows only temperature. No photon is moving around what results that the body is black.

REFERENCES

1. K. zum Felde; J. Pure Appl. Math 2023;7(2); 89