

Gravity or Quantum of Action for each Boson

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Abstract: This paper presents estimations of parameters of phonon, photon and graviton – which all represent boson family, derived with assumption that each of them has its own set of constants in Planck’s formula for boson gas in thermal equilibrium.

Phonon, photon and graviton are all from boson family. There are more bosons, of course, but these three are most familiar to modern scientific society.

The universal formula of boson gas energy in thermal equilibrium state was constructed by Max Planck.

$$B(f, T_K) := \frac{2 \cdot \pi \cdot h \cdot f^5}{c^3} \cdot \frac{1}{e^{\frac{h \cdot f}{k_b \cdot T_K}} - 1} \quad \text{or} \quad B(\lambda, T_K) := \frac{2 \cdot \pi \cdot h \cdot c^2}{\lambda^5} \cdot \frac{1}{e^{\frac{h \cdot c}{\lambda \cdot k_b \cdot T_K}} - 1}$$

It’s pleasant that there is no boson mass in his formula explicitly. Graph of formula is curve with maximum, in coordinate system “power density (W/m³) - frequency (Hz)”.

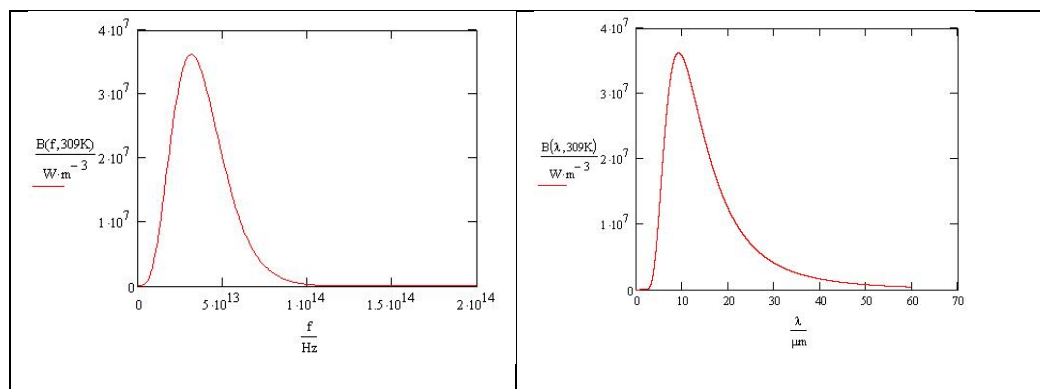


Fig.1. Spectrum of a black body according to Planck's formula for a gas of photons at 309 K.

But I like coordinates “power density (W/m³) – length (m)” more. Length and frequency are connected by universal, suitable for all occasions, relation Speed=Length*Frequency. For example, Winston Kock also preferred wavelength, because a lens, with certain number of wavelengths fit in its diameter – lens aperture – is equally suitable, giving same ray, both for photons and phonons with same wavelength, despite their frequencies differ by many orders of magnitude [1]. Interesting.

The formula has 5 parameters. Two of them we call variables: frequency (length) and temperature, we can change and measure them. And other three we call constants: Boltzmann constant, speed and quantum of action, we can’t change them. Last two of them, for photon, we call light speed and Planck’s constant.

Boltzmann constant we assume the same for all bosons – now everyone agree that it’s suitable for any gas consisting of any particles or quasi-particles in thermal equilibrium.

Temperature – we choose 309 K. It is approx. 36 °C, the temperature of human body. This choice is forced by self-preservation instinct, selfish interest; the human is the measure of all things.

Here I give three other parameters for each boson at Plank’s curve maximum:

Phonon:

Frequency $5.2 \cdot 10^3$ Hz (~ 6.8 cm), speed $3.53 \cdot 10^2$ m/s, quantum of action $4 \cdot 10^{-24}$ J·s.

Photon:

Frequency $3.2 \cdot 10^{13}$ Hz (~ 9.37 mcm), speed $2.998 \cdot 10^8$ m/s, quantum of action $6.626 \cdot 10^{-34}$ J·s.

Graviton:

Frequency $7.02 \cdot 10^{35}$ Hz (~ 0.013 picometers), speed $9 \cdot 10^{21}$ m/s, quantum of action $3 \cdot 10^{-56}$ J·s.

All clear with photon and phonon speed, they are in all reference books. For the phonon and photon, various physical models of the blackbody are known. In Fig. 2, an example of a black body model for a photon gas is the bremsstrahlung spectrum of X-rays [2].

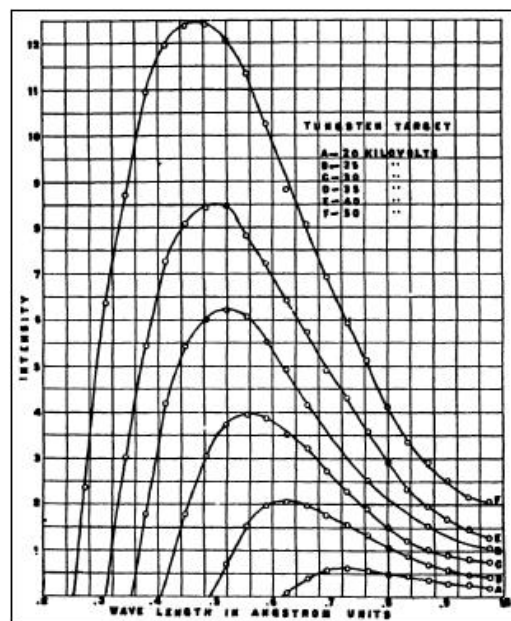


Fig.2. The bremsstrahlung power spectrum as example black body x-ray radiation [2].

For graviton speed, there are only estimations, made from various considerations available to man.

People usually rely on, I underline this, not trust, but rely on estimations published in rating journals of the planetary science community. So I cite here, disguised as nonsense, the estimation from article of Boris Mikhailovich Bolotovskiy and Vitaly Lazarevich Ginzburg at UFN [3]. According to observation data for pulsar NP 0532 in the Crab Nebula the travel speed of “superlight spot” is $12 \cdot 10^{21}$ m/s.

Also, I note interesting to me fact of Boris Mikhailovich attention to works of Oliver Heaviside [4], who had very original and, it looks, survivable ideas about gravitation. But, it's no wonder for genius.

I personally prefer estimation made by "common sense" reason, combined with as much as possible view on the problem, like ...all is discrete and connected to all here and now... Many sentences can be cited about this – from Hermes Trismegistus to Benoit Mandelbrot. Such vision is cultivated by wise system analysts, and philosophers of course, but they are not able to measure, to evaluate, to put into numbers. From Russian system analysts, David Solomonovich Kontorov [5] and Vladimir Viktorovich Artyukhov [6] attract by their style of statements, their attitude and emotionality. Of course, there are many others interesting too, but not all were managed to resonate with.

I used the estimation from following "common sense" logic:

A star is structural element of our Galaxy, similar to a cell of a terrestrial organism.

The number of stars in our Galaxy is 3 orders lower than number of cells in 70 kg weight human body.

Hence, a human in his complexity, is no less than the Galaxy, and it is attractive to use him as analogous model of the Galaxy, especially, in certain way, him, in other words we are, its part.

Disturbance transit time at nervous system from man's heel to head is about 0.1 second. So, the same time interval is necessary to communicative, control disturbance in the Galaxy to travel the distance equal to its diameter. Dividing the Galaxy diameter by 0.1 second, we get the estimation of graviton speed I used. An analogue of the golden rule of mechanics for forces and velocities of rigidly related events.

I like the statement ... in a complex system, any signal are to be communicative, control... there are simply no strength, no energy, no possibilities for any others. But, of course, these strength, energy and possibilities can be from other system, which has its own goals. It is enough to remember twitch of cut frog leg in the experiment of Luigi Galvani.

Now about boson masses. The estimation is based on Einstein equation, where frequency, speed and quantum of action of each boson are taken as they given before.

Mass of phonon is $1.672 \cdot 10^{-25}$ kg. It is approximately equal to mass of cluster of 3 molecules of air.

Mass of photon is $2.359 \cdot 10^{-37}$ kg.

Mass of graviton is $2.6 \cdot 10^{-64}$ kg. According to most authoritative, by citation index, review [6] the estimation range is 10^{-55} - 10^{-64} kg. At fig.3, there is a part of Mathcad-list with calculation for graviton by Plank's formula.

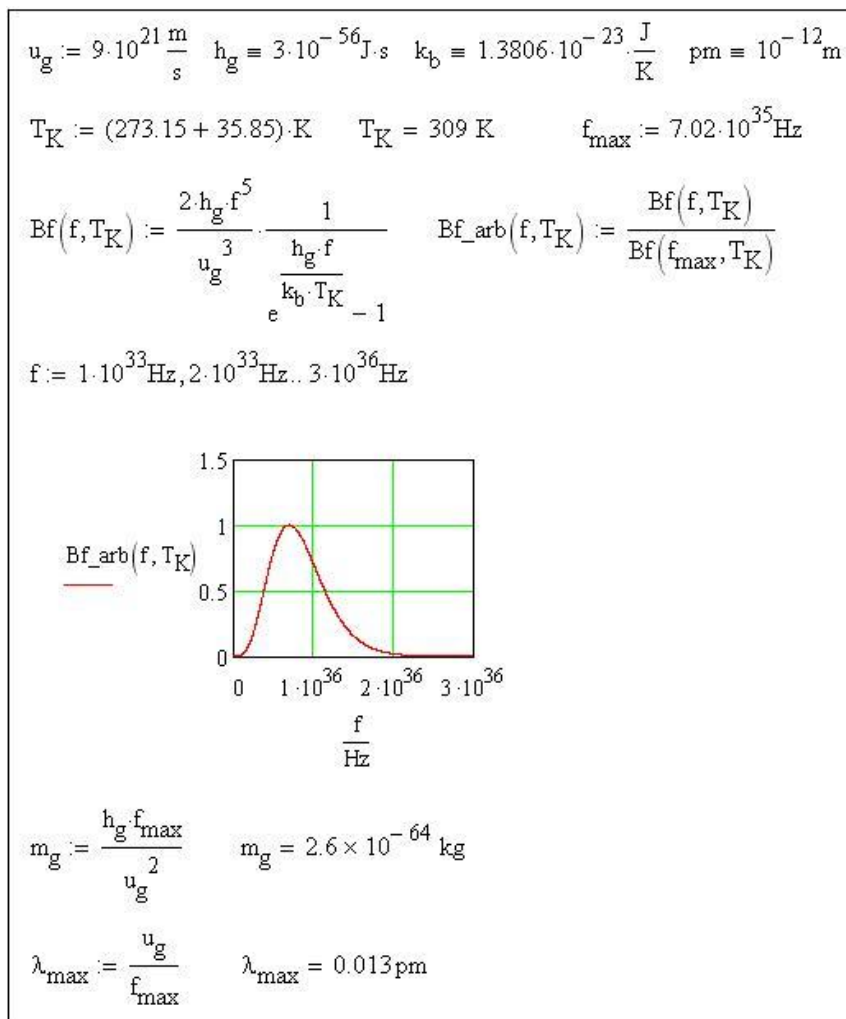


Fig.3. Estimation of the parameters of the graviton by Plank's formula at 309 K.

The practical interest of presented material is clear – try to master graviton frequency band (wavelengths).

The method is known in acoustic and radio regions – transformation and modulation. The carrier frequency is too hard nut to crack for our teeth now, or, rather, for eyes and ears, but low-frequency fringe, superposed frequency, can be dealt with. Carrier frequency generator looks to be constructed on internuclear transitions pumping – same as laser, but inside the atomic nucleus. Maybe, colliders are needed exactly for this? Curious, at what point on starry sky projection the main axis of CERN LHC is pointed to? In general, there are many frighteningly interesting problems and question, to my view. And, maybe, everything is deeper?

It's interesting, how human perceptions matched inside, and with our World (atmospheric transparency windows). There is the example of ranges matching of visible light and audible sound [8]. The same estimations for graviton gives the conclusion that for it at 309K there is corresponding photon with frequency 741 MHz (~40 cm) and phonon with frequency 1 mHz (~350 km). Frequency 740 MHz, and doubled 1480MHz – is amazing, wonderful. Maurice Maeterlinck [9] could say that we build “honeycombs”, “cells” here on Earth – GPS, GLONASS, cellular network- not only for ourselves.

And bit more about Gravity. The only known to man natural process, which includes mass “change” and “transformation” - is radioactive decay. The only radioactive isotope compatible with human is potassium-40. Potassium and sodium ions provide nerve conduction, the so-called sodium-potassium pump. Interesting, if man’s food ration will be constructed with potassium compounds stripped from potassium-40, then how does it affect on nerve conduction, how does organism respond, how does our World perception change? In general, it will be interesting to experiment with nuclear clock inside us. Many neutrinos with mass almost the same as of a graviton are produced during the decay of potassium-40. Perhaps, there are more similarities between neutrino and graviton than differences.

The questions make us glad, don’t let us to be bored, but give us many causes to laugh, first of all at ourselves.

Here, we laugh at the Ancients, at their beliefs of flat World. But we ourselves live, in a certain sense, in a flat world, just look from a side to our flat solar system, with its asteroid belt-shell, and then we have only to smile and continue to spin endlessly, with all our might. And, maybe, under might beyond us? ...It’s Gödel's theorem, dr. Watson...

Literature

1. Kock W.E. Sound Waves and Light Waves ((1965)
2. X-Rays And Electrons. A.H. Compton (1926)
<https://archive.org/details/in.ernet.dli.2015.163722>
3. Bolotovskiy B.M., Ginzburg V.L. Cerenkov effect and the Doppler effect when driving sources at a rate faster than light in a vacuum, UFN, Vol.10, issue 4, 1972, p.580.
<https://ufn.ru/ru/articles/1972/4/a/>
4. Bolotovskiy B.M. Oliver Heaviside (1985).
5. Druzhinin V.V., D.S. Kontorov. Systems Engineering (1985)
6. Artyukhov V.V. Ladybug or subject, knowing Matter (2004-2005)
7. Photon and Graviton Mass Limits. A.S. Goldhaber, M.M. Nieto (2010)
<http://arxiv.org/pdf/0809.1003v5.pdf>
8. Communication of wavelengths of visible light and audible sound. A. Benditsky, A. Kovalev (2008). http://www.photonics.su/files/article_pdf/2/article_2635_131.pdf
9. Maurice Maeterlinck. The Life of the Bee (1901) last p.
<http://www.gutenberg.org/files/4511/4511-h/4511-h.htm>