1905—*Annus erroribis*, not *Annus mirabilis*

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It is shown that the so-called *Annus mirabilis* papers demonstrate complete disregard of logic, scientific principles and truth. One only sees manipulative adjustment of mathematical expressions, with the aim to have them fit the desired outcome, violating without a second thought even elementary mathematical and physical principles. This fact should be widely disseminated, and any trace of such bad science should be removed from physics and science as a whole, to say nothing of the need to remove propaganda cliché such as *Annus mirabilis* when referring to the particular year (1905) in which such senselessness has been produced. It should be perfectly clear also that there can never be experimental confirmation of these internally contradictory, illogical theories and any claim to the contrary has no merit whatsoever. Informing society about this is of substantial importance because the papers in question are considered unjustifiably as a substantial part of the backbone of contemporary physics and science, as well as the resulting ideology.

Introduction

It will not be an exaggeration to say that the so-called *Annus mirabilis* papers have been promoted to dominate physics of the 20^{th} century. Of these four papers, the so-called Einstein's relativity has been elevated as the most important. Curiously, it is this paper that is the most vulnerable and can be rejected at once. Furthermore, the arguments for its rejection are so categorical and simple that they can be understood by anyone of even basic scientific comprehension. It is one of the rare instances in science whereby truth can be established directly and unequivocally by anyone caring to establish the truth personally, applying the least possible effort, which requires no special training. Indeed, observe without delay in the very pages of ref.[1] that Einstein violates the postulate he himself has formulated as the basis of his "theory". Such violation requires immediate abandonment of the theory, as anyone, even a non-scientist, knows, goes without saying. In defiance of that basic requirement, Einstein serves this violation as a merit, as a contribution to physics.

Unbelievable as the above may sound, what was just said stands right in your face, upon inspection of the paper[1]. One is really stunned when witnessing this never seen before contempt for reason in science, propagated to the heavens as the golden standard of physics. Such improper attitude toward doing science really tempts one to lose the academic tone of the exposé. It would never even cross the mind of the ordinary, honest scientist to allow for such kind of intellectual deformation, let alone commit it. There can hardly be anyone who would find his way in the corridors of academia with such behavior toward research. But, let the facts speak for themselves: According to the postulate in question (point 1 at the beginning of §2 of ref.[1]),

> **1. The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of co-ordinates in uniform translatory motion.**

Yet, as seen, for instance, in §10 of ref.[1], shown here as Fig.1, the fourth set of equations therein, referred to the one of the two coordinate systems in uniform translatory motion, system K, differs from the second set of equations, referred to the other of these two systems in uniform translatory motion, system k—the former contains velocity v (explicitly and implicitly through $\beta = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$; NOTE: to save space, henceforth all quantities are denoted as in the respective papers), while the latter does not contain v, which indicates that the physical law has been affected, in contradiction with the just cited first postulate, also known as the so-called principle of relativity, when Lorentz transformations are applied for the referring of this physical law to coordinate system K (see set of equations 3 in in §10 of ref.[1], shown here as Fig.1). Although cited above, it is instructive to repeat what the postulate demands—the first postulate forbids such affecting of any physical law, including the physical law at hand. Probably it is also worth repeating this—the violation of its own postulate at once invalidates Einstein's relativity in its entirety, despite the fact that, curiously, the first and the second set of equations in in §10 of ref.[1], referred, respectively, to the same two coordinate systems k and K in uniform transltory motion, have not been affected—neither of these two sets of equations contains v, either explicitly or implicitly. This one and only possible way of referring the physical law at hand to k and K was, however, discovered 300 years prior by Galileo. Obeying such an established discovery obviously has not been good enough for Einstein, determined to have his own say in science, no matter at what expense, even at the expense of destroying science itself by doing the unthinkable—disobeying the very thing, the postulate, he himself has vowed to obey.

$$\begin{aligned} u_\xi &= \frac{u_x - v}{1 - u_x v/c^2} \\ u_\eta &= \frac{u_y}{\beta(1 - u_x v/c^2)} \\ u_\zeta &= \frac{u_z}{\beta(1 - u_x v/c^2)}, \end{aligned}$$

and

$$\begin{aligned} \rho' &= \frac{\partial X'}{\partial \xi} + \frac{\partial Y'}{\partial \eta} + \frac{\partial Z'}{\partial \zeta} \\ &= \beta(1 - u_x v/c^2)\rho. \end{aligned}$$

Since—as follows from the theorem of addition of velocities (§ 5)—the vector (u_ξ, u_η, u_ζ) is nothing else than the velocity of the electric charge, measured in the system *k*, we have the proof that, on the basis of our kinematical principles, the electrodynamic foundation of Lorentz's theory of the electrodynamics of moving bodies is in agreement with the principle of relativity.

In addition I may briefly remark that the following important law may easily be deduced from the developed equations: If an electrically charged body is in motion anywhere in space without altering its charge when regarded from a system of co-ordinates moving with the body, its charge also remains—when regarded from the "stationary" system K—constant.

§ 10. Dynamics of the Slowly Accelerated Electron

Let there be in motion in an electromagnetic field an electrically charged particle (in the sequel called an "electron"), for the law of motion of which we assume as follows:—

If the electron is at rest at a given epoch, the motion of the electron ensues in the next instant of time according to the equations

1 $$\begin{aligned} m\frac{d^2x}{dt^2} &= \epsilon X \\ m\frac{d^2y}{dt^2} &= \epsilon Y \\ m\frac{d^2z}{dt^2} &= \epsilon Z \end{aligned}$$ K

where *x*, *y*, *z* denote the co-ordinates of the electron, and *m* the mass of the electron, as long as its motion is slow.

Now, secondly, let the velocity of the electron at a given epoch be *v*. We seek the law of motion of the electron in the immediately ensuing instants of time.

Without affecting the general character of our considerations, we may and will assume that the electron, at the moment when we give it our attention, is at the origin of the co-ordinates, and moves with the velocity *v* along the axis of X of the system K. It is then clear that at the given moment (*t*=0) the electron is at rest relatively to a system of co-ordinates which is in parallel motion with velocity *v* along the axis of X.

From the above assumption, in combination with the principle of relativity, it is clear that in the immediately ensuing time (for small values of *t*) the electron, viewed from the system *k*, moves in accordance with the equations

2 $$\begin{aligned} m\frac{d^2\xi}{d\tau^2} &= \epsilon X', \\ m\frac{d^2\eta}{d\tau^2} &= \epsilon Y', \\ m\frac{d^2\zeta}{d\tau^2} &= \epsilon Z', \end{aligned}$$ no v present k

violation of the first postulate

in which the symbols ξ, η, ζ, X', Y', Z' refer to the system *k*. If, further, we decide that when *t*=*x*=*y*=*z*=0 then $\tau = \xi = \eta = \zeta = 0$, the transformation equations of §§ 3 and 6 hold good, so that we have

3 $$\xi = \beta(x - vt), \eta = y, \zeta = z, \tau = \beta(t - vx/c^2),$$
$$X' = X, Y' = \beta(Y - vN/c), Z' = \beta(Z + vM/c).$$

With the help of these equations we transform the above equations of motion from system *k* to system K, and obtain

4 $$\left.\begin{aligned} \frac{d^2x}{dt^2} &= \frac{\epsilon}{m\beta^3}X \\ \frac{d^2y}{dt^2} &= \frac{\epsilon}{m\beta}\left(Y - \frac{v}{c}N\right) \\ \frac{d^2z}{dt^2} &= \frac{\epsilon}{m\beta}\left(Z + \frac{v}{c}M\right) \end{aligned}\right\} \quad \cdot \cdot \cdot \text{ (A)}$$ v present K

Taking the ordinary point of view we now inquire as to the "longitudinal" and the "transverse" mass of the moving electron. We write the equations **(A)** in the form

$$\begin{aligned} m\beta^3\frac{d^2x}{dt^2} &= \epsilon X &&= \epsilon X', \\ m\beta^2\frac{d^2y}{dt^2} &= \epsilon\beta\left(Y - \frac{v}{c}N\right) &&= \epsilon Y', \\ m\beta^2\frac{d^2z}{dt^2} &= \epsilon\beta\left(Z + \frac{v}{c}M\right) &&= \epsilon Z', \end{aligned}$$

and remark firstly that $\epsilon X'$, $\epsilon Y'$, $\epsilon Z'$ are the components of the ponderomotive force acting upon the electron, and are so indeed as viewed in a system moving at the moment with the electron, with the same velocity as the electron. (This force might be measured, for example, by a spring balance at rest in the last-mentioned

Fig. 1

Another example, which, although not part of the *Annus mirabilis*, but illustrating the recurring problem of the same kind of poor thinking, is found in the observed deceptive substitution, detected in ref.[2] of an expression for a coefficient p_n, obtained from an equality valid at high temperature, namely

$$p_n B_n^m = p_m B_m^n \quad (1)$$

mistakenly replacing the coefficient $p_n = p_m \frac{B_m^n}{B_n^m}$ expressed from eq.(1) valid only at the higher temperature, in the equation valid for low temperature

$$p_n e^{-\frac{\varepsilon_n}{kT}} B_n^m \rho = p_m e^{-\frac{\varepsilon_m}{kT}} \left(B_m^n \rho + A_m^n\right). \quad (2)$$

Equality, eq.(1), however, is not an absolute equality and depends on the temperature; eq.(1) is not valid for the low temperature where the valid equality is eq.(2) and no coefficient expressed in terms of the former can be substituted in the latter, despite the appearance that such substitution provides the result which Einstein likes.

From the above it follows that Einstein has not been able to derive Planck's radiation law in his paper[2] despite the widely spread opinion that he has. Thus, since Einstein's derivation[2] is considered the basis of laser theory but is evidently flawed, as seen above, at this time the laser has no theoretical basis. Lasers are just a technical achievement arrived at due to the technical savvy of certain inventors.

The inevitable conclusion from the above is that Einstein's relativity must be removed from physics in its entirety. The only use physics may have for Einstein's relativity is to use it as categorical proof that Lorentz transformations are non-physical. Therefore, everything having anything to do with these transformations must be removed from physics. Remove the non-physical Lorentz transformations and all progeny such as cosmology, string theories, various projects having to do with gravitational waves, Higgs boson, particle physics, high energy physics and so on lose any scientific basis and therefore have no place in physics. Thus, it should go without saying that, because anything stemming from the Lorentz transformations has no roots in reality, let alone, defying basic logic, in addition, as does Einstein;s relativity, any claim for experimental confirmation of Einstein's relativity and/or any claim connected in any way shape or form with the Lorentz transformations, is out of the question.

Another paper "deriving" $E = mc^2$, also a part of *Annus mirabilis*

In addition to the inability of ref.[1] to derive $E = mc^2$ because, aside from other problems in the derivation in ref.[1], the theory in ref.[1] itself is invalid, this additional *Annus mirabilis* paper compounds the fact that Einstein's relativity cannot derive $E = mc^2$. There is no need to even analyze ref.[3] at all because it draws its conclusions from the equation

$$\ell^* = \ell \frac{1 - \frac{v}{c} cos\phi}{\sqrt{1 - \frac{v^2}{c^2}}}, \quad (3)$$

which is derived using the non-physical Lorentz transformations. As seen above, no physically valid relationship can be derived from a relationship which has no physical meaning, such as the Lorentz transformations.

Analysis of Einstein's paper[4] on Brownian motion

That Einstein's paper[4] cannot derive an expression of Brownian motion from the standpoint of molecular-kinetic theory of heat, as is the intent in §2 of ref.[4], can also be seen straight away. Despite the fact that one can indeed represent a constant C as an exponent of other constants, for instance, acquiring the form $e^{\frac{\frac{3}{2}T}{T}}$, with the intent to factor it out of the integral: $\int\limits_{-\infty}^{\infty} Ce^{-\frac{E}{kT}} dp_1 ... dp_\ell = \int\limits_{-\infty}^{\infty} e^{\frac{\frac{3}{2}T}{T}} e^{-\frac{E}{kT}} dp_1 ... dp_\ell = e^{\frac{\frac{3}{2}T}{T}} \int\limits_{-\infty}^{\infty} e^{-\frac{E}{kT}} dp_1 ... dp_\ell$, pronounced to comprise the probability W entering in Boltzmann's entropy formula $S = klnW$, to produce

$$S = kln \left(e^{\frac{\frac{3}{2}T}{T}} \int\limits_{-\infty}^{\infty} e^{-\frac{E}{kT}} dp_1 ... dp_\ell \right) = \quad (4)$$

$$klne^{\frac{\frac{3}{2}T}{T}} + kln \int\limits_{-\infty}^{\infty} e^{-\frac{E}{kT}} dp_1 ... dp_\ell = \quad (5)$$

$$\frac{\frac{3}{2}kT}{T} + kln \int\limits_{-\infty}^{\infty} e^{-\frac{E}{kT}} dp_1 ... dp_\ell = \quad (6)$$

$$\frac{\overline{E}}{T} + kln \int\limits_{-\infty}^{\infty} e^{-\frac{E}{kT}} dp_1 ... dp_\ell, \quad (7)$$

it still leads to $S = 0$ from Boltzmann's formula. Nothing else different from zero can be produced by playing with the formula and parsing it this way or that, with the intent to devote a whole paragraph to it. Notably, in order for the probability W to make physical sense, it should be

$$\int_{-\infty}^{\infty} Ce^{-\frac{E}{kT}} dp_1...dp_\ell = 1 \tag{8}$$

to begin with. Consequently, after applying Boltzmann's formula, this inevitably leads to

$$S = klnW = kln \int_{-\infty}^{\infty} Ce^{-\frac{E}{kT}} dp_1...dp_\ell = kln1 = 0. \tag{9}$$

Therefore, any further derivation in §2 henceforth makes no sense, and the claims that "[i]t has been shown by this analysis that the existence of an osmotic pressure can be deduced from the molecular theory of heat; and that as far as osmotic pressure is concerned, solute molecules and suspended particles are, according to this theory, identical in their behavior at great dilution" is unsustained.

Further, in §3 of ref.[4], because of

$$\delta F = \delta E - T\delta S = 0, \tag{10}$$

and if $\delta E = -\int_0^\ell K\nu\delta x dx$ and $\delta S = \int_0^\ell k\nu \frac{\partial \delta x}{\partial x} dx$, as the author assumes, then, from eq.(10) we get

$$-\int_0^l K\nu\delta x dx = T\int_0^l k\nu\frac{\partial \delta x}{\partial x}dx. \tag{11}$$

or, if the integrands are continuous functions, we get

$$-K\delta x = kT\frac{\partial \delta x}{\partial x}, \tag{12}$$

which, aside from the correct dimensions $[J] = \left[\frac{J}{K}K\right]\left[\frac{m}{m}\right] = [J]$, is an incorrect equality because a negative quantity cannot equal a positive quantity. Thus, the derivation fails right at this point.

This discrepancy in the signs on the left and on the right of the equality, eq.(12), is a fatal problem in the derivation, even if we do not view as a problem the fact that kT should not be considered the average energy for two degrees of freedom by the equipartition theorem, and think of it as only a coefficient of proportionality for the x-dependent $\frac{\partial \delta x}{\partial x}$, which means also questioning the validity of the equipartition theorem, let alone that kT is not the correct expression for the average energy of single particles according to the equipartition theorem (kT is the average energy of an ensemble of harmonic oscillators, having two degrees of freedom, while the suspended particles are not harmonic oscillators. Note that Einstein himself does not consider the suspended particles to be harmonic oscillators).

In connection with this, it should also be noted that, if one is to think of these particles in a thermodynamic sense (in the thermodynamic limit), one is to inevitably adopt the equipartition theorem, which for a mono-atomic system, such as the one at hand, derives $\frac{1}{2}kT$ as the average energy per particle in the ensemble per degree of freedom, not a function of anything else. Some think that there can be violations of the equipartition theorem when they invoke alleged quantum effects or when the particles are somehow coupled. The discussed system, however, is purely classical, thoughts about quantum effects are out of the question, and the motion of the particles is independent of each other. Therefore, the equipartition theorem should apply in full force to the case observed. However, as seen above, the average energy derived is not $\frac{1}{2}kT$, as expected, but is kT and it is multiplied by an x-dependent function, in conflict with what is known for such systems in terms of energy equipartition. Of course, the mentioned most obvious problem is that what is derived requires that a negative quantity be equal to a positive quantity, which is obviously impossible.

Therefore, the conclusion in §3 of ref,[4] that a coefficient of diffusion in the form

$$D = \frac{RT}{N}\frac{1}{6\pi kP} \tag{13}$$

has been derived and that "[t]he coefficient of diffusion of the suspended substance therefore depends (except for universal constants and the absolute temperature) only on the coefficient of viscosity of the liquid and on the size of the suspended particles" is also unsustained.

Proceeding to §4, one sees that, aside from a trivial exercise to derive the known Fick's second law, presenting the trivial solution of the diffusion equation

$$f(x,t) = \frac{n}{\sqrt{4\pi D}}\frac{e^{-\frac{x^2}{4Dt}}}{\sqrt{t}} \tag{14}$$

nothing much has been accomplished regarding the goals of the study. The above solution would not have been trivial had the coefficient of diffusion D been shown to have a connection to the molecular-kinetic theory. Unfortunately, as seen, D has no connection to anything because the expression offered is derived incorrectly to begin with. Therefore, it has not been shown that "the irregular movements [of particles suspended in a liquid] which arise from thermal molecular movement, and give rise to the diffusion investigated in the last paragraph [§3]".

In the last paragraph, again, because of the fact that the connection of the diffusion coefficient $D = \frac{RT}{N}\frac{1}{6\pi kP}$ has not been sustained, as shown, the claim that the mean value λ_x of displacement of the particles in the direction of the x-axis in time t

$$\lambda_x = \sqrt{2Dt} \tag{15}$$

is in the form

$$\lambda_x = \sqrt{t}.\sqrt{\frac{RT}{N}\frac{1}{3\pi kP}} \tag{16}$$

and that "[t]his equation shows how λ_x depends on T, k and P" is also unsustained.

Analysis of Einstein's paper on specific heat[5]

Einstein's paper on specific heat[5], although not part of the *Annus mirabilis* papers, but considered as having comparable impact on solid-state physics, and therefore its analysis deserving inclusion in this text, is another failed attempt by the author to derive what he calls "the law of energy distribution of black-body radiation" formulated by Planck[6]. The derivation presented in Planck's paper[6] has its own problems, pointed out first by C. I. Noniski[7], which will be discussed elsewhere, but what is done in the paper at hand[5] defies even basic criteria for a scientific study.

Although the problems in the paper at hand begin from the very start, they deserve no analysis once the crucial errors on page 183 of ref.[5] are detected. So, for the sake of argument, we will assume that one reaches that page before abandoning the earlier part of the derivation of the mentioned law.

The erroneous step in question is in the second equality of the second chain of equalities on page 183 of ref.[5], namely,

$$\frac{\int Ee^{-\frac{N}{RT}E}\omega(E)dE}{\int e^{-\frac{N}{RT}E}\omega(E)dE} = \frac{0. + A\varepsilon e^{-\frac{N}{RT}\varepsilon} + A.2\varepsilon e^{-\frac{N}{RT}2\varepsilon}...}{A + Ae^{-\frac{N}{RT}\varepsilon} + Ae^{-\frac{N}{RT}2\varepsilon} + ...} \tag{17}$$

under the condition

$$\int_{\varepsilon}^{\varepsilon+a} \omega dE = \int_{2\varepsilon}^{2\varepsilon+a} \omega dE... = \int_0^a \omega dE = A, \tag{18}$$

The incorrect equality, eq.(17) does not result in the integral quotient being connected in any way to Planck's law $\frac{\frac{R}{N}\beta\nu}{e^{\frac{\beta\nu}{T}}-1}$. The author has failed to recognize that while the right side of eq.(17) indeed leads to $\frac{\varepsilon}{e^{\frac{R}{NT}\varepsilon}-1}$, that same right side does not follow from the left side of eq.(17). Therefore Planck's law cannot be considered as derived. Thus, the suggested further substitution of ε by $\frac{R}{N}\beta\nu$ to obtain Planck's law $\frac{\frac{R}{N}\beta\nu}{e^{\frac{\beta\nu}{T}}-1}$ is a substitution into a formula which has not been derived.

So, the debunking of the theoretical basis of ref.[5] can be contained in a short note.

Everything the author does further, after the shown insurmountable hurdle, which is preventing him from deriving Planck's law, is to make it appear that the known Planck's law is somehow connected to Dulong and Petit's formula $c_v = 3R$ for the specific heat of solids, and giving the appearance of correcting it for anomalous specific heats of some elements.

The author, however, has failed to notice that the formula $\frac{\frac{R}{N}\beta\nu}{e^{\frac{\beta\nu}{T}}-1}$ he uses for his exercise is the expression for the average energy $\overline{\varepsilon}$ of a single resonator, derived by Planck in ref.[6], and is far from the Dulong and Petit formula. The expression

$$\overline{\varepsilon} = \frac{h\nu}{e^{\frac{h\nu}{kT}} - 1} \tag{19}$$

is valid for all 3 degrees of freedom (if 3 and not 2, as is the case, were the number of degrees of freedom of a harmonic oscillator), not for just one degree of freedom which would require multiplying it by 3, as the author of ref.[5] has done.

Now, it is true that one can write the above as

$$\overline{\varepsilon} = \frac{R}{N}\frac{\frac{h}{k}\nu}{e^{\frac{h\nu}{kT}} - 1} \tag{20}$$

as Einstein has done, in order to have explicitly an R, the gas constant, as part of the formula, as a deceptive hint to the Dulong and Petit formula $c_\text{v} = 3R$.

If, on the contrary, eq.(20), the Planck formula itself (!?), is to be considered as some sort of appropriate correction for R to account for the anomalies in specific heat when expressed with the Dulong and Petit rule (what would then be the rule for calculating the specific heat of solids with non-anomalous specific heat), he should have then multiplied this corrected R by 3 to see if this will result in the correct run of the specific heat curve as a function of T (in addition, one wonders, what would then be the rule for calculating the specific heat of solids with non-anomalous specific heat)

$$c_\text{v} = 3R\frac{\frac{h}{k}\nu}{N\left(e^{\frac{h\nu}{kT}}-1\right)} \tag{21}$$

Fig.2, however, shows an entirely different shape of that curve and values of c_v, compared to the shape and values expected from experiment.

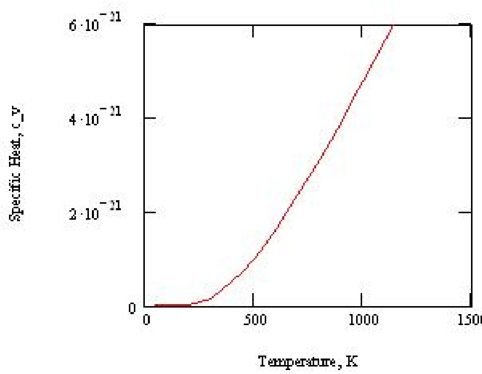

Fig. 2. Run of c_v vs. T curve with corrected R in Dulong and Petit law according to eq.(21).

Thus, the mere appearance of R in the remodeled Planck formula, eq.(20), cannot be a justification to connect this formula to the Dulong and Petit law and claim that, now, because of Dulong and Petit, Planck should have derived for a single resonator

$$\bar{\varepsilon} = 3\frac{h\nu}{e^{\frac{h\nu}{kT}}-1} = 3\frac{R}{N}\frac{\frac{h}{k}\nu}{e^{\frac{h\nu}{kT}}-1} \tag{22}$$

as Einstein claims.

Therefore, if Planck's formula for $\bar{\varepsilon}$ is to be used for determining specific heat, then specific heat should be determined by $c_\text{v} = \frac{d\bar{\varepsilon}}{dT}$ and not by $c_\text{v} = 3\frac{d\bar{\varepsilon}}{dT}$, as Einstein has done. Then, using the real Planck formula for $\bar{\varepsilon}$, the specific heat should be calculated as

$$c_\text{v} = \frac{d}{dT}\left(\frac{h\nu}{e^{\frac{h\nu}{kT}}-1}\right) = \frac{(h\nu)^2 e^{\frac{h\nu}{kT}}}{kT^2\left(e^{\frac{h\nu}{kT}}-1\right)^2} \tag{23}$$

However, if we need to obtain the formula of the derivative in a form whereby the whole expression $\frac{h\nu}{kT}$ is to be the independent variable, as is the third formula from the top on page 186 of ref.[5] we have to divide both the numerator and the denominator by $(kT)^2$ and get

$$c_\text{v} = \frac{d}{dT}\left(\frac{h\nu}{e^{\frac{h\nu}{kT}}-1}\right) = k\frac{\left(\frac{h\nu}{kT}\right)^2 e^{\frac{h\nu}{kT}}}{\left(e^{\frac{h\nu}{kT}}-1\right)^2}, \tag{24}$$

which for 1 mole is

$$c_\text{v} = \frac{d}{dT}\left(\frac{h\nu}{e^{\frac{h\nu}{kT}}-1}\right) = kN\frac{\left(\frac{h\nu}{kT}\right)^2 e^{\frac{h\nu}{kT}}}{\left(e^{\frac{h\nu}{kT}}-1\right)^2} = R\frac{\left(\frac{h\nu}{kT}\right)^2 e^{\frac{h\nu}{kT}}}{\left(e^{\frac{h\nu}{kT}}-1\right)^2}, \tag{25}$$

and if we express R as $1.987\text{cal}\ \ K^{-1}\ mole^{-1}$, it becomes

$$c_\text{v} = 1.987\frac{\left(\frac{h\nu}{kT}\right)^2 e^{\frac{h\nu}{kT}}}{\left(e^{\frac{h\nu}{kT}}-1\right)^2}, \tag{26}$$

which is 3 times less than the quantity shown in the third formula from the top on page 186 of ref.[5]

It is eq.(26) that should be the subject of analysis and comparison with experimental data, not the third equation shown on page 186 of ref.[5]. The correct comparison is shown in Fig.3.

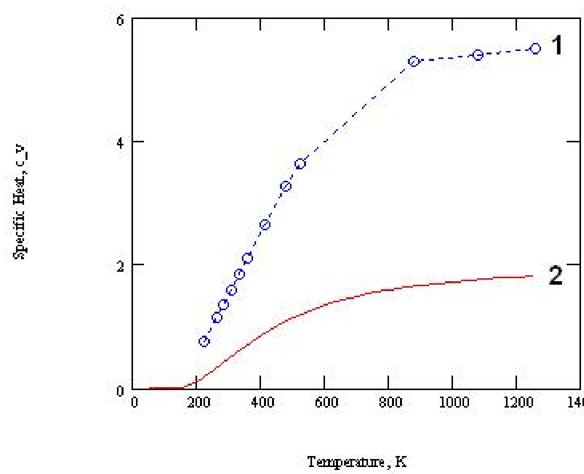

Fig. 3. Comparison of c_v vs. T curve obtained from first and second

column of the table shown on page 190 of ref.[5] (curve 1) with the c_v vs. T curve obtained from eq.(26) (curve 2).

To understand what has been done in Fig.3 we have to find out what is shown in the figure presented on page 186 of ref.[5]. Although Einstein misleadingly states that the dashed curve in the figure on page 186 of ref.[5] "shows the value of expression (8) as a function of $x = \frac{T}{\beta\nu}$", the figure in question shows something quite different—both the theoretical curve (the dashed curve) and the individual points show the calculated, respectively, the experimental values of the specific heat c_v as a function of temperature T.

The y-axis values of the experimental points in the figure presented on page 186 of ref.[5] are the values of the experimental specific heat c_v of diamond taken from the second column of the table shown on page 190 of ref.[5].

The x-axis values in the figure presented on page 186 of ref.[5] are the corrected values for temperature (so that the x-axis span be between the values 0 and 1), whereby the temperature values shown in the first column of the table on page 190 of ref.[5] are multiplied by $\frac{\lambda k}{hc} = 0.00076$. The value of $\lambda = 1.1 \times 10^{-5} m$ in this expression is evaluated by using the third equation (equation (8)) on page 186 of ref.[5], which is $c_v = 3R\frac{\left(\frac{h\nu}{kT}\right)^2 e^{\frac{h\nu}{kT}}}{\left(e^{\frac{h\nu}{kT}}-1\right)^2}$, considering that from the table on page 190 of ref.[5] the experimental value of c_v is 1.838 at temperature 331.3K.

The experimental curve (the dashed curve) in the figure on page 186 of ref.[5] is not at all "the value of expression (8) as a function of $x = \frac{T}{\beta\nu}$" but is the value of the alleged specific heat c_v, calculated from the third equation (equation (8)) on page 186 of ref.[5] for the same value of $\lambda = 1.1 \times 10^{-5} m$, evaluated by using this same third equation (equation (8)) on page 186 of ref.[5], namely, $c_v = 3R\frac{\left(\frac{h\nu}{kT}\right)^2 e^{\frac{h\nu}{kT}}}{\left(e^{\frac{h\nu}{kT}}-1\right)^2}$, again considering that from the table on page 190 of ref.[5] the experimental value of c_v is 1.838 at temperature 331.3K.

So, what we have here is using the experimental data to evaluate λ calculated from the same equation which is supposed to be tested against those same data.

If the correct expression for obtaining the first derivative of $\overline{\varepsilon}$ over T, eq.(26), is used for this purpose, no coincidence of the curves will be observed even if this trick with the wavelength λ is applied. The determining factor is the value of $R = 1.987 cal K^{-1} mole^{-1}$ which, as explained, should not be multiplied by 3.

It is quite noteworthy that both graphs in the figure on page 186 of ref.[5] refer to one single wavelength $\lambda = 1.1 \times 10^{-5} m$. This means that if one decides to ascribe the specific heat to the behavior of resonators of the type Planck has based his view on, then these specific-heat-affecting resonators must have, for each solid, a strictly set single frequency (wavelength) at play for all temperatures studied, even within such a large temperature span as the one at hand. The physical possibility for such constancy of frequency is beyond doubtful.

Having in mind the above fact, namely, that all the data shown in the table on page 190 of ref.[5], as well as regarding the figure on page 186 of ref.[5], concerned with one single wavelength, as well as any reference done in the discussion on the pages 186 through 190 of ref.[5] of effects connected with wavelength, is moot.

Further, of course, various conjectures about the effect of the structure of the solids that can cause anomalies in the specific heat are possible. However, proposing structure effects as the culprit for anomalies has nothing to do with the quantum character of these objects whatsoever.

Analysis of Einstein's paper on photoelectric effect[8]

The goal of all the endeavor in §4 of Einstein's heuristic paper[9] is to prove that light consists of particles which behave like the particles of an ideal gas. If that is the case, it will the conjecture that light consists of individual particles but is not a wave, will have a solid foundation. This goal is set to be accomplished by trying to prove an analogy between the entropy difference $S - S_0 = \frac{E}{\beta\nu} ln \frac{\text{v}}{\text{v}_0}$, characteristic of an ideal gas and the entropy difference $S - S_0$, which is obtained from the expression for the entropy S of radiation he has already derived, namely, $S = \text{v}\varphi(\rho,\nu)d\nu = -\frac{E}{\beta\nu}\left\{ln\frac{E}{\text{v}\alpha\nu^3 d\text{v}} - 1\right\}$, eq.(**??**). Unfortunately, as will be seen, this conjecture is clearly unsustained.

Thus, after the initial confusion in §3 where the author unsuccessfully tries to come up with a formula for the entropy S corresponding to all frequencies of radiation contained in a volume v, by inadequately applying variational calculus, in §4 he proposes an expression for monochromatic entropy valid for entropy for the region between frequencies ν and $\nu + d\nu$:

$$S = \mathrm{v}\varphi(\rho,\nu)d\nu = -\frac{E}{\beta\nu}\left\{ln\frac{E}{\mathrm{v}\alpha\nu^3 d\mathrm{v}} - 1\right\}. \tag{27}$$

Further, in order to form the desired difference $S - S_0$, he writes this expression, eq.(27), for another volume, v_0, failing to notice that the new expression must read

$$S_0 = \mathrm{v}_0\varphi(\rho,\nu)d\nu = -\frac{E_0}{\beta\nu_0}\left\{ln\frac{E_0}{\mathrm{v}_0\alpha\nu_0^3 d\nu} - 1\right\} \tag{28}$$

instead of

$$S_0 = \mathrm{v}_0\varphi(\rho,\nu)d\nu = -\frac{E}{\beta\nu}\left\{ln\frac{E}{\mathrm{v}_0\alpha\nu^3 d\nu} - 1\right\}, \tag{29}$$

which is the equation we see in §4. The dependence of ν of a standing wave on the dimensions of the enclosure is well known from the wave theory: $\nu = \frac{c}{2Ln}$. However, if he had used the correct eq.(28) instead of eq.(29), he would not have been able to carry out the convenient cancelations of E and ν, which differ for v and v_0, a convenient cancelation which would have yielded as a result the needed $S - S_0 = \frac{E}{\beta\nu}ln\frac{\mathrm{v}}{\mathrm{v}_0}$ and that would have served as proof that the radiating resonators in question behave as an ideal gas. Unfortunately, because, after changing the volume from v to v_0, the frequency changes from ν to ν_0, and, respectively, energy changes from E to E_0 and that prevents the convenient cancelations, which leads to a much more complicated expression for $S - S_0$ than the expression $S - S_0 = \frac{E}{\beta\nu}ln\frac{\mathrm{v}}{\mathrm{v}_0}$ valid for an ideal gas, brings the conclusion that, contrary to Einstein's impression, the behavior of radiating resonators modeling the radiation contained in volume v has nothing to do with the behavior of an ideal gas.

This failure to connect radiation to the thermodynamic behavior of an ideal gas leads further to the failure to connect radiation to Boltzmann's principle involving individual movable points and to claim that the probability W in the Boltzmann formula comprises the expression

$$W = \left(\frac{v}{v_0}\right)^{\frac{N}{R}\frac{E}{\beta\nu}}. \tag{30}$$

This problem has been pointed out by Nauenberg in ref.[10]. However, it is considered in ref.[10] as only a gap in the theory. As shown here, this is a crucial problem regarding the scientific justification that radiation behaves "as if it consisted of mutually independent energy quanta", a crucial problem laid in the theory as early as §4 of the paper.

Standalone §8 in Einstein's paper on the photoelectric effect[8]

Having seen that all paragraphs §1 through §7 have failed to justify the conjecture that light has anything to do with particles, §8 stands on its own, applying this unjustified claim to the case of the photoelectric effect.

The above-seen failure to justify theoretically the quantum character of light makes the relations given in §8 only a rehash of relations known earlier from the experimental works of Stoletov[11] and Lenard[12] (see Fig.2 on p. 162 of ref.[12]).

It should be noted, however, that there is nothing unusual in the view that energy is transferred and exchanged in portions, including in the case of the photoelectric effect. On the contrary, this view is contained most naturally in classical mechanics and physics. This intuitively qualitatively clear fact has been shown quantitatively by C. I. Noninski in his paper[7], which will be the subject of discussion elsewhere.

Conclusion

This study explores a major part of the fundamentals which are considered to be the basis of 20th century physics. The discovered flaws in these fundamentals are of far-reaching importance, which makes it contingent upon the scientific community to disseminate it as widely as possible so that they be corrected sooner rather than later.

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