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Re-assigning Boltzmann's Constant

also a re-assignment of Avogadro's constant

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Boltzmann's constant has the value 1.38×10^{-23}J/K or 8.62×10^{-5}eV/K. It comes from the ideal gas law

pV = NkT

Where N is the number of gas molecules and k is Boltzmann's constant. If you have read my photon papers, the information above should already jog something in your head. If it doesn't, consider the extremely low number the constant represents. Wikipedia tells us to read the above equation like this:

The left-hand side of the equation is a macroscopic amount of pressure-volume energy representing the state of the bulk gas. The right-hand side divides this energy into N units, one for each gas particle, each of which has an average kinetic energy equal to kT.

First of all, what is "pressure-volume energy"? This is a clue to the state of these equations. Since a gas exerts 3D pressure, pV is simply a force, not a "pressure-volume energy." But let us leave that for now and look at the constant k. Most people assume that since molecules are very small, they would be expected to have such small kinetic energies. But 10^{-23}J is way too small even for molecules. The smallest molecules are only about 10^{-10}m, or 10^{-10} below our own macroscopic size. So k can't be the kinetic energy of each molecule, as they imply. The variables N and k can't go together as they have defined them, since k is way to small for N.

This is true even at STP, where the energy of the single gas molecule would be something like 10^{-20}J. Remember that one single infrared photon (heat) has an energy of about 10^{-19}J. Since any gas is being driven by large numbers of photons, the gas molecules could hardly have a total energy 10,000 times less than one photon, or even 10 times less.

Notice that they are assigning the kinetic energies one-to-one to each molecule. They say, "each of which has an average kinetic energy...." That can't work. We have a fudge here, which means the equation is hiding something important.

What it is hiding is the photon and the charge field. I have shown that heat is actually a function of the ever-present charge field, and that anytime we have molecules or ions in motion, we have photons driving them. But since photons are so tiny, we can detect them only indirectly. We see only the motions of the larger particles.

This means that Boltzmann's constant really applies to the photons. It applies to Maxwell's displacement field, not the molecular field. We get the hint straight from the number, which is close to what I have calculated for the average energy of the charge photon. Problem is, it is a bit too small for the energy of the photon, by a factor of about 10^2. The energy of the charge photon is closer to 10^{-20}J. Which is why they include the absolute temperature in the equation.

Notice they tell you that "each gas particle has a kinetic energy of kT." They are expressly shoving k and T together, as you see. So that part of the equation is also fudge. We already have pressure and volume in the equation, so having temperature in it as well is redundant. Just think about it: If you know what gas you have on hand, in what amount, and the pressure and the volume, you already know the temperature, so having T in the equation is sort of like having p and V in the equation twice. It makes no physical sense.

There is no reason to write the energy of the particle per degrees Kelvin, except to fudge the equation by about 300. As written above, T is only in the equation as a correction to Nk. Since in most normal situations "at the macrolevel," T will have a value of around 300, this has the effect of raising the numerical value of k by that amount. In other words, if we actually combine k and T at ideal conditions (STP), we get a value of about 4 x 10^{-21}J. That's roughly half the energy of my charge photon, so we can already see the current equation is simply masking a rough charge field equation, in the form

$pV = NE_\gamma$

We can also write that like this

$pV = Nm_\gamma c^2$

We should have known the ideal gas law can't work as written, since it contradicts the Stefan-Boltzmann law, in which energy is proportional to T^4. That's right: the Boltzmann constant contradicts the Stefan-Boltzmann equation. Ironic, no? Here we insert degrees Kelvin as if every degree is equal to every other, but we know from the Stefan-Boltzmann equation that isn't true. I will told we are measuring heat and pressure here due to the motion of the gas, not to blackbody radiation; but since I am showing that the photon or charge field is also involved here, there must be a link they have missed.

Both are heat or radiation equations, but in one energy is changing directly with temperature, and in the other energy is changing to the 4^{th} power. Given that, it should be obvious why the ideal gas equation only works at one temperature (STP).

So, anyway, if we express the gas equation as a charge field equation, N then becomes the number of charge photons present in the sample, not the number of gas molecules. And since we are following the photons, not the gas molecules, this explains very simply why the composition of the gas never mattered to the ideal gas law. The gas is just along for the ride, and intermolecular collisions never determined the energy field here. What determines both the field and the energy is the photons present, and the photons are always the same size (within certain temperature limits—see below).

We should have always known that, since the number of molecules N said to be present in gasses was always far too high. For instance, consult this current solution of a given problem, where 1.28×10^{22} molecules of CO_2 are calculated to compose a gas in only about half a liter. Since a CO_2 molecule is about 3 angstroms across, it is pretty easy to calculate the gas density of this sample. That is 3×10^{-8} cm, so a line 1cm long could contain about 33 million. Cubing that gives us 3.7×10^{22}. Existing edge to edge, that many CO_2 molecules would completely fill 1mL. So 1.28×10^{22} would fill .346mL. Therefore by current calculations, they are finding CO_2 at about one part in a thousand at STP. At first that may sound feasible, but it isn't. To get you to see this as efficiently as possible, I will ask you to remember that water concentrations of things like fluoride, arsenic, or cadmium are measured in parts per billion or even trillion. So molecules don't have to be in high concentrations to be very effective. Your body can detect and be poisoned by some things at a part per trillion. That isn't homeopathy, that is known science. We get more evidence of this if we remember that liquids are now calculated to have molecular densities a hundred times higher than gasses, which puts them at about one part per 10. And solids are calculated to be denser still, with many average solids calculated to have molecules existing pretty much edge to edge.

This is a big problem because other experiments indicate solids are much less "solid" than that. Even the densest solids have been found to be in lattice structures where the molecules aren't anything close to edge to edge. A large part of the structure of solids has been found to be due to charge linkages, and though these linkages aren't necessarily compressible in normal circumstances, they aren't very short linkages, either. This is precisely why solids remain porous to photons, neutrinos, wireless, and so on. They actually contain fantastic amounts of void. Therefore, these intermolecular distances and numbers are not right at all. Avogadro's number was misassigned long ago, and no one has ever corrected the assignment. New data has just been fit to old assignments.

Let me return to a previous paragraph, to underline and extend something very important. I have said that because the defining field here is the photon field, not the molecular field, this explains why the composition of the gas isn't important. As you know, we only need to know the amount of gas present, not the kind of gas. This has seemed strange to many people, and even Avogadro initially found it curious. But since I have just shown that it is actually the amount of *charge* we have present that matters, the whole thing is no longer curious. Charge is always charge, and it doesn't change its composition with different gasses, so the same amount of charge will always act the same. The particular gas was always just like a boat in a stream—the charge field being the stream—and since the stream is much more powerful than the boat, we can ignore the kind of boat that is floating. The boat is just a signal of stream strength, but as a matter of total energy, the boat is negligible. In measuring the boats, we thought we were measuring the boats, but we were actually measuring the stream. Since the boats are not self-propelled, everything they do is determined by the stream.

Which brings us to Avogadro. Avogadro's constant is roughly the inverse of Boltzmann's constant, so of course by correcting one I must correct the other. Historically, Avogadro's constant preceded Boltzmann's constant by several decades, the method being discovered by Loschmidt in 1865. Avogadro, Loschmidt, and all others based their theories and calculations on the assumption that only molecules—*and no other particles*—were in a sample of gas. So of course they gave the energy, weight, number and size to the gas molecules. After all, what else could be in there?

Charge was known at the time of Avogadro in about 1810, but not well. It certainly wasn't known as the main force at the quantum level, since there was no quantum level then. In Loschmidt's time it still wasn't known, except to a few who knew of Maxwell's displacement field. And you know what, it *still* isn't known as a real field, since up to this day charge has remained virtual. That is precisely why Avogadro's number and Boltzmann's number are still assigned to the molecules. Physicists now understand that charge exists in the gas, but they think it only exists as some sort of virtual potential between proton and electron. Since charge doesn't exist for them as a real field of particles, they have never felt compelled to include it in these equations. Not only do they not count up charge photons, they don't include charge energy or potential either. They utterly ignore charge in all ways, and try to solve by assuming that the gas is energizing itself by collision with itself. Heat is then defined circularly, by assuming that the motion of the gas is both the cause and the effect of heat.

But after all I have written over the past decade, we should now see that the reality of the charge field has been proven. That being the case, we have a second field of real particles in this problem. We have the gas molecules *and* we have a sea of real charge photons. Although the masses of these photons is nearly negligible (around 10^{-37}kg), and their local radius makes them far too small to detect directly (around 10^{-25}m), their energy is not negligible, neither as a sum nor individually. Because each photon is traveling and spinning c, each one has a considerable energy—an energy that we have seen is represented by about 300k (Boltzmann's constant times 300).

This being the case, we now have the ability to express these equations mechanically, with no limit to ideal conditions and no need to fudge them with "quantum mechanical" manipulations (van der Waals forces: London, Debye, Keesom, etc.).

What I mean by that is the current solution to this problem of extending the ideal gas law to all temperatures includes various van der Waals manipulations, and none of those manipulations brings the charge field or real photons into the solution. Since they fail to do that, we know they must be fudged.

We will look more closely at those manipulations in upcoming papers, but for the time being I want to ignore the fudged solutions and try to give you the bones of a correct one. I have already written the ideal gas law as a rough charge field equation above, but we have a lot of work left to do. As usual, I will fine-tune and debug that equation not by tacking things onto it, but by making explicit the things it must already contain. In other words, I will do what I have done with dozens of other historical equations, expanding it and showing that one number must apply to more than one thing, or that one variable must be extended into two, which can then vary in more than one way.

If we raise either the density of the photons or the molecules, we have to account for the volume lost to the higher density. Since neither photons nor molecules are point particles, volume must be lost to the presence of these real particles. What is this lost volume?

$V_L = N2r_\gamma + M2r_M$

where M is the number of molecules present. Neither one of those terms is negligible, although they are both often treated as such. So let's add that term to our equation:

$p(V - V_L) = Nm_\gamma c^2$
$p(V - N2r_\gamma - M2r_M) = Nm_\gamma c^2$

That gets us closer to a complete equation, but I will be told I still haven't included the effects of photons on one another. We know that as energy increases, we not only get a more dense charge field, we also get higher energy photons. Photons don't come in just one energy, they come in a wide range. I haven't included that yet, have I?

Well, yes, I have, although not explicitly. That fact is included in the number N. You see, we can express the increasing energy of the photon field *either* as an increasing density of standard photons, *or* as an increasing energy of each photon. Since I have shown that real photons gain energy by stacking on new spins, thereby increasing their effective radius, this mechanism will increase energy *and* increase the volume occupied by the photon. So it acts to increase density, you see. Bigger photons take up more space and so they seem denser. **We have a double density increase**. A denser charge field causes more photon-photon edge hits, which causes more spin stacking, which gives us larger photons. We have more photons and we have bigger photons, at the same time.

How do we represent that in our equation? Obviously, we have to expand the variable V_L once again to include this extra loss of volume. If we stack a second spin on our standard charge photon, we double the radius. The photon is now spinning end-over-end. Therefore, each photon will take up twice as much space as before.

This new spin will be added all at once to the field, at some given energy level. So the equation must be quantized. Below that energy level, we won't need the new lost-volume term, but above it, we will. And there will have to be many steps represented, since the photon can stack on a third spin and so on. At a high enough energy level, the photons will become electrons, and a perfect equation should be able to represent that as well. So to start with, we must have something like this:

$p(V - 2^n N2r_\gamma - M2r_M) = Nm_\gamma c^2$

That is the simplest way to import my quantum spin equation into the gas laws. As you see, I just added a 2^n to the N term, to indicate what energy level we have. If n=0, we are at the lowest photon energy level, with axial spin only. Level n=1 will indicate an x-spin or end-over-end spin. Level n=2 will indicate a y-spin, and so on.

You will say, "But that requires we *know* what level we are at in any experiment. We don't know that, because we don't currently know anything about expressing gas laws in terms of photons." But if you study my equations (and previous papers), you will see we can calculate all that. Since we can measure p and V directly, and since we know r_γ, m_γ and c, we can back-calculate N and n. So I think this is very near a working equation. Also, you should remember that we know how to measure the energy of different light. I have equations that relate photon energy to radius, and since we can measure the energy in the experiment, we can calculate the radii of the photons present. The energy will tell us how many spins our photons have, and therefore how large they are.

Among other things, this incorporation of my quantum spin equation allows the new equation to more closely match the Stefan-Boltzmann law, which I mentioned above. Not only does it show the link between the gas equations and the blackbody equations—by showing the charge field beneath both—it shows how energy is a function of a *power* of the temperature. Now that since we have a 2^n term in the equation, the energy will no longer follow temperature directly, as in the ideal gas law. Instead, it will follow temperature to some power, and that power will rise as temperature rises. This means that even the Stefan-Boltzmann law is only an approximation, and that it tells us only part of the story.

If you compare my last equation to the Stefan-Boltzmann equation, you see an explanation of not only the rise by temperature, you see the reason for the big fall:

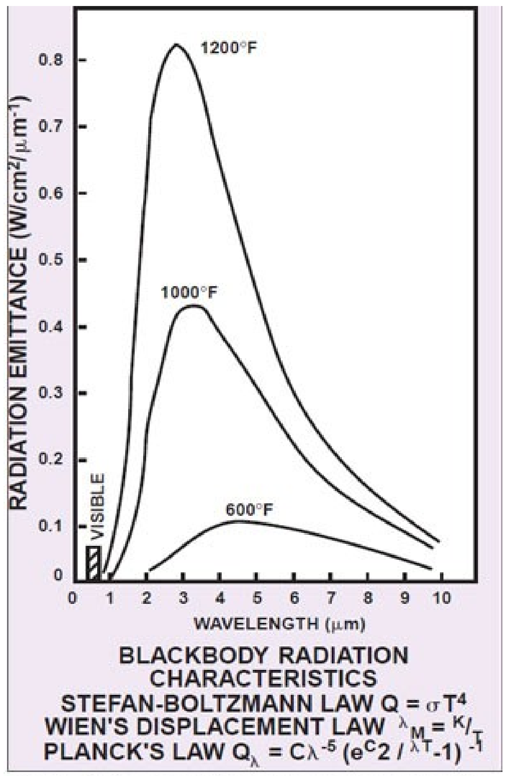

Figure 1: As shown in curves representing the distribution of energy emitted by blackbodies

As [my quantum spin equations]() show, photons that stack on a fifth spin become electrons. At that point, they can no longer maintain a speed of c in the field, since they have grown too large. They suffer too many collisions, and so we see the steep fall in energy after the peak.

The above graph even shows that, in a close analysis. Look at the top two curves. They aren't smooth. Both have a small turning point at about 6.5 µm. That is where the power is changing from 3 to 4, I assume. The Stefan-Boltzmann equation should be to the 4^{th} power only above that turning point.

The biggest question mark in that last equation is now the variable M. If Avogadro's number is no longer telling us that, how do we calculate it? Can we write M as a function of these other variables? Not really, but we can use a related trick to calculate it. We have found from my dark matter calculations that matter is recycling 19.19 times its own mass in charge every second. Therefore, minus pressure and volume considerations (which are represented elsewhere in the equation), the photon field must have 19 times the energy of the baryon field. We will see below that this gives us a way to calculate M.

A close reader will say, "Hmm. If photons are so small, both in radius and mass, how can they take up any volume at all in the container? They shouldn't even register as either volume or density in your equations." That seems like a good question at first, because if we do the calculations, we find that we should be able to fit about 10^{68} photons in our half liter, edge to edge. Before I answer that question, I will point out that is precisely why they get ignored in current equations. Despite having relatively huge energies and effects, they *seem to* take up almost no space in the field. Even if we use my radius and mass instead of zero, they seem at first to be negligible in the field.

In this way, they act exactly like WIMP's or hidden sector particles. With almost no mass or radius, they disappear in the field equations. They show up only as energy. But since we have a mass/energy equivalence, charge photons end up supplying around 95% of the mass/energy of the universe. In this way they are both massive and "weakly interacting." As we are seeing, they aren't *really* weakly interacting, since they basically drive *all* motions and interactions. But because we haven't included them in our equations—like this gas equation—they can seem to be weakly interacting. We should say the are invisibly interacting. Up to now, they have been interacting beneath or behind our old field equations, and so have been out of sight—hence "hidden".

They are "hidden sector," as you see, since Maxwell's displacement field has been hidden behind the more famous E/M field equations since the 1860's. We have long known about the charge field, but since it has never been mechanically assigned to anything, it was as good as hidden.

But let us answer the question asked, and answer it very fully. This answer will either intoxicate you or infuriate you, depending on how *status quo* you are, but I think it will shock everyone. My reader said that such tiny photons would not even register as a field density. If the photons are too small to register, we wouldn't need to subtract out their volume, would we? So we can now see that equation is still incomplete. We need to look closer at how real photons *would* fill a volume. Above, I said if we stacked them edge to edge, we could fit 10^{68} of them in our container. But to stack them like that, we would have to stop them, wouldn't we? We would not only have to stop them moving, we would have to stop them spinning, since the spins might offset, catch, and cause problems. Since in real life situations, that isn't what is happening, we should ask how photons really fill a volume. Obviously, they fill it while going c and spinning c. That is where we get the c^2, as I have shown previously. And since volume V is on the left side of our equation, it must stand for our measurement at our level of existence. It is a macro-measurement, as even Wikipedia admits. Well, we measure or see photons to have what we call wavelengths, and I have shown these wavelengths are caused by the photon's motions. In other words, to get a macro-wavelength, we multiply the photon radius by c^2. Or, from our perspective, *it looks like* the photon radius has been stretched out by c^2. The photon's motion relative to us stretches out *our* measurement of the radius. So the radius looks c^2 larger than it is, and we call the stretched-out radius the wavelength.

Now, given that, I think you can see that—over time—the photon will inhabit a space defined by that wavelength, not by its local radius or mass. So if we want to calculate how much volume a single photon takes up in our container, we need that radius. So our equation has to be corrected like this:

$$p(V - 2^n N 2 r_\gamma c^2 - M2r_M) = Nm_\gamma c^2$$

I added a c^2 to the radius on the left side, to indicate the motions of the photon.

Previously, I have shown that the charge photon has a radius of about 10^{-25}m. If we scale that up by c^2, we get a wavelength of about 10^{-8}m. So about a million of those fit on a 1cm line, and about 10^{18} in

1mL. If we go back to our problem concerning CO_2 in a 475mL container, we find that container would be filled with about 5×10^{20} photons, disregarding CO_2 altogether.

You really have to let that sink in for a few moments. Because it means that if we include the motion of the photon over time, the photons are actually larger than the molecules. Simply as a matter of volume, the photons take up more space in the container than the molecules. And that is due to the wavelength of the photon. This means that as a matter of volume, any container of gas is mainly filled by the charge field photons. It is the photons that fill the container, cause the pressure, and create the heat. The molecules are just along for the ride.

I have already heard from one reader, who took this to mean that the photons were standing waves, filling the container edge to edge with their spins. No. The photons are still going c, so they are not standing. In fact, we require the velocity c and time passing to get the photons to fill that volume. As we have seen, if the photons were "standing", their radii and spins wouldn't be stretched relative to us by their motions, and their total volume would be negligible. The photons aren't standing, and neither are the waves. Since in a closed container, the motions of the photons will be turning back on themselves due to collisions, the waves *may be expressed* in some maths as standing. But if we stick to the mechanics, nothing is standing. If the photons were really taken to be standing, their energy levels would drop dramatically, and none of this could be explained at all.

I expect other confusion, since many readers won't see how the motion of photons alone allows them to occupy more volume. So let us simplify the problem, looking at speed alone, and looking at people instead of photons. Let us say that I am Quick Claude, and I can do everything ten times faster than Slow Sally. Well, if you track Sally and I over any time period, I will be in ten positions for every one position Sally hits. If Sally and I are limited to a linear motion, I will cover a line ten times longer in the same time period. If Sally and I travel randomly in three dimensions, I will still "occupy" a lot more volume than her over any time period.

A lot of people think "occupy" means to be in a place at an instant. But real objects are in motion, and field equations are equations of motion. In those equations, there are no instants. We study intervals, as here, not instants. And given a velocity and a real time, a real object "occupies" a line or a volume, not just a position. In this way, a faster object can take up more volume, even though locally it may be much smaller. The photon is much much smaller than other real particles, but its speed and spin allow it to act much larger.

I will be asked, "Then why don't we detect it as this large particle? Why haven't we ever realized these big photons are in those containers with the gas?" Actually, we do know it. We just don't know we know it. We know that photons have large wavelengths, and we can measure them easily. We know about the photon and its "size." We just haven't realized that the wavelength implies a larger volume. I didn't realize it until I wrote this paper, and I have been studying the photon for years. I have nuzzled that knowledge many times, but never fully embraced it as I have here. I knew it, but didn't *realize* what it meant for problems like this one. The same can be said for heat. We know the gas has heat, we know heat is in the infrared, and that infrared applies to photons; and yet we have never made the jump and put real photons in the container with the gas to explain it. Many things have prevented us from doing that before now, including the belief that photons have no mass or radius, the belief that old equations and theories already completely explained gasses, and so on. But it should always have been obvious that the gas wasn't energizing itself. When we raised the temperature, we had to be adding something to the gas, and it clearly wasn't *more gas*. Yes, the density inside the container rises with temperature, but it could never have been the density of the gas, since we weren't adding gas. When you turn up the flame on a container of CO_2, new CO_2 isn't entering the container by some magic. What is entering the container is more charge, and since charge is real photons, and since real photons occupy space, you are going to be increasing the density inside the container.

I will be told that by my velocity argument, faster molecules will also occupy more space in the same time, adding to density. That is true, but it doesn't explain the increase in speed. What is causing the molecules of gas to move faster when we raise the temperature? If we follow the current explanation, we have no *mechanism* for the increase in speed. If we want to increase my speed mechanically, we have to push me somehow. What is pushing the molecules to move faster? You see how the current answer is an answer without a mechanism. “Higher temperature causes molecules to move faster.” That is an answer with no physical content, since we aren't told *how*. But with my theory, we have a mechanical answer. If the molecules increase their speed, it is because we have added photons to the container. More photons means more collisions, more pushing, and higher speed for molecules. Heat is basically denser charge, either because we have added photons, or because the photons we already had are getting bigger (by stacking on new spins).

That is why I have both terms in my equation. We have to follow *both* the molecules and the photons. In upcoming papers, I will show how to expand my equation even more. To do that, we will have to rewrite all the so-called van der Waals corrections to the ideal gas law, using photon-molecule interactions. Hopefully you can already see how my field gives us many more degrees of freedom to play with, while keeping everything mechanical. We won't need any of the fudges currently used to extend the historical gas laws.

I think you can now see why the mainstream has been avoiding the charge field like a plague. They have been hiding behind virtual photons, gauges, and other misdirection for more than a century, and it is because they haven't wanted to do this work I am doing. What I am doing is both difficult and unpopular, and it wasn't less difficult or unpopular 50 years ago. Overthrowing these old assumptions basically falsifies everything we have been taught for more than a century, and the textbooks will have to be rewritten from the ground up. Physicists and chemists have therefore preferred to ignore the problems many of them probably knew to exist, keeping what they had as a comfort. I have already made comment on that sort of thinking in many other places and won't do it again here. I will only say that I never found any comfort in things that don't make sense. I would rather have an open question than an obviously faked solution. And best of all is a straightforward mechanical solution.

Although this paper is just a first attempt, it lays the problem on the table and suggests the outline of a solution. The important thing is that am replacing “quantum mechanical” solutions to this problem with real mechanical solutions. Please notice that my solution above is not mathematical or heuristic only. I solve by following the real particles in the field, and their real motions. All variables are assigned, and there are no mystical constants, no virtual particles or fields, and no other modern fudges. Although the equations above require more corrections and extensions, those corrections and extensions must also be physical, mechanical, and logical.