6/8/2015

Dear Dr. Ward,

If true, the conclusions of the manuscript would be of highest scientific significance.

However, I'm afraid that the basis for these conclusions is more a complete lack of understanding of thermodynamics than actual science. Not only do you disagree with hundreds of modern climate scientists, you also challenge some findings that form the basis of modern physics and that were made by some of the greatest names in science. I should hope that in this "one against many" situation, you may at least take into account the possibility that you may be wrong and the many be right...

The paper contains so many incorrect statements that I cannot list them all here. I will just elaborate briefly on the most important error right at the start of the line of arguments presented.

It can be represented by the following sentence in the abstract: "These frequencies and amplitudes of oscillation on the surface of matter transmit thermal energy through air and space as electromagnetic radiation." This, and corresponding statements in lines 5 to 9 on page 4:

Thermodynamics describes heat in motion. Heat is not a physical thing, but it is the result of physical motion of frequency and amplitude of oscillation. The motion of atomic components produces electrical charge. Electrical charge in motion induces an electric field. The motion of an electric field at a given frequency induces a corresponding magnetic field. The motion of the magnetic field in turn induces an electric field, transmitting electromagnetic radiation.

and in lines 22 to 24 on page 9,

The frequencies and amplitudes of light originate from the frequencies and amplitudes of the atomic oscillators on the surface of the radiating body.

are fundamentally incorrect! The emission and absorption of electromagnetic radiation is driven by very different processes on the atomic and molecular level, that determine the energy (and thus frequency and wavelength) of the radiation. Molecular vibrations are only one of these processes, and the energies involved are almost exclusively restricted to the infrared portion of the electromagnetic spectrum. It is interesting that other processes responsible for the emissions and/or absorption of higher energy radiation are actually mentioned in the text and in table 1 (e.g. ionization, dissociation), and that ozone is stated to absorb UV radiation even though this process clearly does not happen according to the rules laid out by the aforementioned statements.

Another fundamentally wrong statement is the notion in the caption of Figure 5 that "net radiative energy, however, is proportional to frequency only, not to amplitude, bandwidth, or amount".

In conclusion, I suggest to carefully read some of the cited references, plus some basic textbooks of thermodynamics, physical chemistry, or similar. If you do this, you may even be convinced that it might be wise to remove the website and restrain from publishing the book that were both mentioned in your cover letter.

Best regards,

Marc von Hobe

6/8/2015

Dear Dr. von Hobe,

I sincerely appreciate your willingness to consider my paper: **The thermodynamics of climate change**.

The fundamental conclusion of this paper is that global warming is caused by ozone depletion, not greenhouse gases. This is because net radiative energy at the microscopic level is proportional to frequency only ($E=h\nu$). Thus the thermal energy reaching Earth when ozone is depleted (at wavelengths around 0.31 µm) is 48 times more energetic, 48 times hotter, than the energy absorbed most strongly by carbon dioxide around the 14.9 µm absorption peak. You know well that ultraviolet energy causes sunburn and skin cancer; something no amount of infrared radiation can do. You also know that you get much hotter standing in sunlight, bathed in ultraviolet radiation, than in moonlight, bathed in infrared radiation from Earth.

Given your leadership role in RECONCILE and career trying to understand ozone depletion, I was hoping for an interested and careful read. While you choose to simply disagree, citing the sentences where I state my conclusions most clearly, you do not provide any scientific argument for why I am wrong.

The whole point of this paper is to provide, very carefully, the scientific evidence for these conclusions based not only on basic thermodynamics but also on extensive basic physical observations as follows:

1. Thermal energy within matter (internal energy) is frequency. The capacity of matter to hold thermal energy is directly proportional to the number of degrees of freedom of the bonds holding the matter together.
2. The energy of an atomic oscillator is equal to the Planck constant times the frequency ($E=h\nu$) as postulated by Max Planck in order to write Planck's law. There is no net displacement of mass in an atomic oscillator, so kinetic energy is not a function of mass. Mass does play a role in determining the frequencies of the normal modes of oscillation of each degree of freedom. $E=h\nu$ is fundamental to all atmospheric photochemistry where it represents the "chemical" energy absorbed from electromagnetic radiation via resonance to cause changes such as photo-dissociation or photo-ionization. It is also fundamental to understanding the photoelectric effect as discussed by Einstein (1905).
3. Planck's empirical law describing the broad spectrum of electromagnetic radiation observed to be radiated from the surface of solid matter shows that when you heat matter, you increase the amplitude of oscillation at every frequency over a broad spectrum of frequencies and you increase the frequency with the highest amplitude.
4. A specific frequency of electromagnetic radiation is transmitted, as is well known for any radio signal, by the motion of charge on the antenna of the transmitter and is received by a receiver tuned to resonate at that specific frequency.
5. Electromagnetic radiation from the sun, for example, when absorbed by solid matter, causes an increase in the amplitude of oscillation at every frequency over a broad spectrum of frequencies and increases the frequency with the highest amplitude, causing an increase in temperature, the inverse of #3 above.
6. I discuss in detail in Section 5, why the physical properties of electromagnetic radiation are very, very different from the physical properties of waves in matter.

This is all very basic physics just organized in a slightly different manner.

You state:

"The emission and absorption of electromagnetic radiation is driven by very different processes on the atomic and molecular level, that determine the energy (and thus frequency and wavelength) of the radiation. Molecular vibrations are only one of these processes, and the energies involved are almost exclusively restricted to the infrared portion of the electromagnetic spectrum."

You seem to be talking about absorption of electromagnetic energy by a gas molecule. In this case, the molecule is only able to absorb oscillatory energy via rotational, vibrational, and electronic transitions where the vibrational transitions are dominantly in the infrared for greenhouse gases. As you know, gas molecules absorb very limited amounts of energy, along very limited spectral lines, in narrow bandwidths, leaving most of the energy in the electromagnetic field. Solid matter, on the other hand either absorbs or reflects all frequencies dependent on the relative amplitudes at each frequency. This is, incidentally, one reason why, at the microphysics level, the small amount of energy actually absorbed by greenhouse gases cannot have any significant effect on Earth's temperature. Macroscopic temperature of solid matter results from microscopic oscillations at every frequency over a broad band.

I note that a major problem faced by RECONCILE is explanation of the substantial decrease of Arctic ozone in 2011 and your search for "additional mechanisms for ozone destruction." A major part of my work, only alluded to in this physics paper, is showing how chlorine and bromine emitted even by small volcanic eruptions cause much more ozone depletion than CFCs but for less than a decade after each eruption. See the top graph on ozonedepletiontheory.info/ozone-depletion.html to see the relationship since 1927. Also check out ozonedepletiontheory.info/warm-drought-2012.html which explains the relationship between ozone depletion and minimum temperature in Toronto, Canada, especially during 2011 and 2012. The purpose of my extensive, fully referenced website is to provide the detail to scientists who really want to understand the basis for my conclusions and their implications.

Even if you are not willing to think deeply about the science in this paper, you may learn a great deal that is very relevant to RECONCILE from my website and from my 58-minute YouTube talk at tinyurl.com/ozonedepletiontheory.

Best wishes,
Peter

6/10/2015

Dear Peter,

I do not reject papers so easily, and certainly not because "I simply disagree". In fact, I did read your paper very carefully, and I rejected it because the very basic laws of physics were misinterpreted throughout the paper, and these misunderstandings seem to be the basis for your conclusions.

It is true that the energy of a single photon in the UV at 0.31 µm is 48 times more energetic than a single photon in the IR at 14.9 µm. However, if you have 48 photons in the IR, they will about equal the total energy of 1 UV photon. Of course, light doesn't really come in particles, but the model of photons as quanta of light or energy is a very useful one. It is useful, because it does in fact explain why summing up or integrating energies over larger wavelength regions can yield rather high energies but do not normally change the wavelength as you seem to suggest in your Figure 3 (note that it is in fact possible to combine two photons into a new one of higher energy, but that's a complicated experiment and does not happen in the atmosphere).

In that Figure, you give energies as eV, which typically is a unit of energy used for single photons, and you rarely see an integrated energy amount given in eV. But the fact that regardless of the wavelength you will need more than a single photon from the sun to warm the Earth becomes immediately apparent if you convert the units to Joule: the roughly 5 eV of a UV photon correspond to 8e-19 J. The change in temperature that this amount of energy would cause on almost anything is not actually measurable!

If this bit of math is too complicated, then let’s go back to the warm skin - sunburn line of arguments. I admit that the word "sunburn" can easily lead to misunderstandings, because "burn" makes us think about heat. However, it is NOT the thermal energy of the UV photons that makes our skin burn, but rather chemical changes that the UV radiations causes in the biomolecules inside our skin.

And if your argument that UV light makes us feel hotter than IR light because it is 48 times more energetic was correct, then X ray light should make us feel even hotter still, because it is more than 100 times more energetic than UV light. Obviously you have never been X-rayed before. Trust me: I have been, and I survived it and did not feel hot at all, in spite of the >100 eV radiation hitting my body.

And if it really was the UV that made us feel hot on a sunny day, then why do we still feel just as hot wearing sun protection, or just behind a glass window that filters out UV radiation even better than the ozone layer? That's one of many questions left unanswered in your manuscript.

But I have the feeling that all these very scientific arguments will not convince you, so I suggest you carry out an experiment to actually compare for yourself the heating power of UV vs. IR radiation:

You need to organize a UV lamp (e.g. a deuterium lamp) and an IR lamp. Ideally, both should have approximately the same output power given in Watts. You should then repeat the following procedure with both lamps (I suggest starting with the IR lamp):

Turn the lamp on and place your face right in front of the lamp, and remain in that position until you start feeling uncomfortably hot (as long as you do not feel the heat, you should not get sunburned, provided your theory is correct).

Because both lamps will not be 100 % monochromatic and also emit small amounts of light at other wavelength, it would be best to place a UV filter (normal glass will do) in front of the IR lamps, and an IR filter that lets UV pass through (this is more difficult but not impossible to get) in front of the UV lamp.

Now, if you need to withdraw from the UV lamp within seconds and can stay under the IR light for a long time, you can proudly tell me that you were correct...

...if I'm correct, you might stay under the UV lamp for a very long time, and after that, you may not be able to tell me about the result.

Cheers,

Marc

6/11/2015

Dear Marc,

Thank you for the response. Now we can begin to talk real physics.

You express views of electromagnetic radiation (EMR) that are very widely held but that are, based on my extensive research, incorrect. In your discussion of UV and X-rays, for example, you miss the concept of dosage, the length of time of exposure to the radiation. Something very important to the concept of energy. Major doses of X-rays are focused on cancer cells in order to destroy (burn) them, but extremely small doses of X-rays are used to take pictures of your innards because they are high enough energy to penetrate your body but are only turned on for microseconds, not enough time to damage (burn) your body. Similarly sunburn is proportional to the time you spend in bright sunlight or in a tanning machine. Dosage and action spectrum are functions of time. It takes time to actually raise the temperature of any bit of matter and to cause a chemical reaction. Burning (the damaging of matter) occurs when you raise the temperature of matter long enough above some threshold similar to the dissociation or ionization threshold described in Figure 1.

As I wrote on line 3, page 11: Richard Feynman et al. (1963) wrote on page 4-2 of the famous Feynman Lectures on Physics: "**It is important to realize that in physics today, we have no knowledge what energy is. We do not have a picture that energy comes in little blobs of a definite amount.**" Two years later, Feynman won the Noble Prize because of his contributions to quantum electrodynamics, the interaction of EMR with matter, the quantum approach to the interaction of solar energy with Earth. The concept of photons thinks of EMR as little blobs of energy of a definite amount. So do the radiation computer codes used in all climate models.

So what is energy? Coopersmith (2010) builds on Feynman's ideas about energy to conclude that energy is "what makes things happen." Energy is "the 'go' of the universe." Energy causes things to happen around us. No change is possible without utilizing (converting the form of) some energy. Thus energy is not a thing "in little blobs of a definite amount." Energy describes the condition or state of a thing; the 'go' of a thing. Physicists like to define energy as the ability to do work and to define work as force times displacement. This definition, however, does not apply to thermal or chemical energy. You get energy from digesting food and this allows you to do work. Plants absorb energy from the Sun, allowing them to grow. Fossil plants contain energy that we can utilize when we burn coal. The amount of energy something possesses refers to its capacity to cause change. Higher energy typically causes more change in a shorter period of time.

So what is thermal energy? I spend a lot of time in the paper showing that thermal energy is oscillation. When you heat matter, you cause the bonds holding the matter together to oscillate at higher frequencies and higher amplitudes. The capacity of matter to contain heat is a function of the number of degrees of freedom available in the bonds to oscillate. Thermal energy in solid matter is oscillations of the bonds. This is all basic thermodynamics available in any good textbook. When a molecule of gas absorbs radiant energy, the frequency and amplitude of the normal modes of oscillation of its bonds increase. Gas molecules absorb thermal radiation by absorbing frequency from the electromagnetic field. For thermal radiation to warm a body of matter, the energy absorbed must increase the amplitudes and frequencies of the internal oscillations of the bonds holding the matter together. Thermal energy in solid matter is frequency with a certain natural amplitude that is a function of temperature (Planck's law). Thermal energy absorbed by gas molecules or matter is frequency. Thermal energy radiated by solid matter must be frequency as detailed in Planck's law. I also explain in detail how the physical properties of EMR are extremely different from the physical properties of waves in matter. If you disagree with these conclusions, then please explain to me physically your understanding of what thermal energy is, what radiation is, what spectral lines of absorption are, and how energy flows.

$E=h\nu$ is the kinetic energy of an atomic oscillator as explained in my paper. Planck and Einstein said this long ago. There is no net motion of mass in an oscillator. Mass affects the frequency, but not the kinetic energy. $E=h\nu$ is not the energy of a photon as commonly assumed because photons are not physical things as I explain. It took me many years to understand $E=h\nu$ and its implications. It does not come easily because of prior training, but in hindsight, it is perfectly obvious.

I am well aware of who and how many people I disagree with and the fact that many are far smarter than I. But we know a lot more today about atoms, electromagnetism, etc. than we knew in 1865 (Maxwell) or 1900 (Planck) or 1905 (Einstein). And quantum mechanics gave up early on the need to be physically intuitive, something that bothered both Planck and Einstein until their deaths. I have spent nine years systematically trying to understand precisely what is happening physically. I have questioned in detail many assumptions made, especially in greenhouse-gas theory, and found that many do not stand up to the scrutiny. I have shelves of books and have accessed more than 10,000 papers, all of which are within feet of my desk. Being retired, I have been able to dedicate the vast majority of my time and energy to the process. I have also spent a great deal of time looking for any evidence that I might be wrong. I am pretty confident that when good scientists understand what I have said in this paper, many will hit themselves up the side of the head and say "Dah! How could we have missed this for so long?"

To understand this paper, the reader has to accept that I am coming to conclusions that do not square with what they currently understand or believe. Then they can look at my evidence and decide how well my conclusions are supported. I am prepared to defend these conclusions to the top atmospheric chemists and physicists of the world as well as the top physicists. One thing I like about the ACP review process is that many more than usual will get a chance to weigh in.

I would be happy to burrow deeper into the physics here if you wish.

Sincerely,

Peter

6/12/2015

Dear Peter,

There is no need to repeat what you wrote in your paper over and over again in lengthy emails. I have actually read your paper, so I am aware of your interpretation of the laws of physics and some of the old experiments upon which they are based.

If you write "You express views of electromagnetic radiation (EMR) that are very widely held but that are, based on my extensive research, incorrect.", what kind of research exactly have you carried out? To simply say "this is all wrong" has nothing to do with research. If you challenge such fundamental laws of nature, I would expect you to present some new experimental evidence to prove your point (such as the experiment with irradiating your body that I suggested in my last email).

But for starters, you could answer some of my questions concerning the obvious experimental evidence that seems to contradict your conclusions:

Why do I still feel very hot wearing sunscreen, but in spite of all that heat (to which I occasionally expose myself for many hours lying on a beach) do not get sunburn?

And why is the Earth climate always cooling for a couple of years following major volcanic eruptions (such as Pinatubo), even though volcanic eruptions tend to promote ozone depletion (note that this has little to nothing to do with the halogens emitted by the volcano, but rather with the enhanced particle load that fosters the stratospheric halogen chemistry that actually leads to ozone destruction)? According to your theory, the Earth should be warmer following such events!

Measurements show that UV radiation levels at the Earth surface were indeed higher than normal after Pinatubo, so why was the mean surface temperature lower? It just doesn't fit, does it?

Cheers,
Marc

6/12/2015

Marc,

Why do I still feel very hot wearing sunscreen, but in spite of all that heat (to which I occasionally expose myself for many hours lying on a beach) do not get sunburn?

Sun screen works primarily by absorbing UV light. The sunscreen is in thermal contact with your skin. Thus your body with sunscreen on it is still absorbing the same amount of thermal energy, but the absorption of the sunburning frequencies is being done by the sunscreen rather than your skin.

Some sun screens reflect or scatter up to 10% of the UV radiation. Even if a sunscreen could reflect all of the UV, visible violet radiation is still much hotter than your body temperature. In terms of color temperature, UV-B at 0.31 µm is 9300K, the UV-A/violet boundary around 0.4 µm is 4100K, the red/infrared boundary around 0.7 µm is 770K, and the IR at the 14.9 µm absorption peak for CO_2 is around 194K, your body being around 310K. Now radiation with some color temperature, can destroy the absorbing molecule, but it does not raise the temperature of the body to the color temperature because temperature is a broadband thing described by Planck's law. However, the hottest incoming radiation can warm a body is its color temperature, again from Planck's law.

And why is the Earth climate always cooling for a couple of years following major volcanic eruptions (such as Pinatubo), even though volcanic eruptions tend to promote ozone depletion?

This is explained in Section 7, page 22, and in Figure 7 and extensively on my website and in most of my presentations linked to my website. What got me working on climate 9 years ago was trying to understand how major warming at the end of the last ice age was precisely contemporaneous with the largest amount of volcanism recorded in the GISP2 borehole beneath Summit Greenland. This did not make sense given that essentially all major volcanic eruptions recorded historically caused cooling of around 0.5oC or more for 2 to 3 years.

The issue gets down to the clear distinction I draw between effusive volcanism causing warming and explosive volcanism causing cooling. This is what has driven climate throughout geologic history. Erupting or degassing volcanoes of all sizes deplete ozone causing warming. Explosive volcanoes, however, large enough to inject megatons of SO_2 and H_2O into the lower stratosphere, cause formation of sulfuric acid aerosols that grow large enough to reflect and scatter sunlight. The aerosols have a bigger effect than the ozone depletion. But it also takes months for the aerosols to spread globally and to grow large enough. This is well documented in the case of Pinatubo. Warming of northern continents during the winter following Pinatubo was observed clearly (Robock, A., 2002, Pinatubo eruption: The climatic aftermath: Science, v. 295, no. 5558, p. 1242-1244, doi:10.1126/science.1069903).

Incidentally, as the particle sizes of the aerosol grow, the primary radiation to be reflected and scattered is that with the shortest “wavelength”, i.e. highest frequency, i.e. UV-B.

Sincerely,

Peter