The modified Einstein-Planck law document

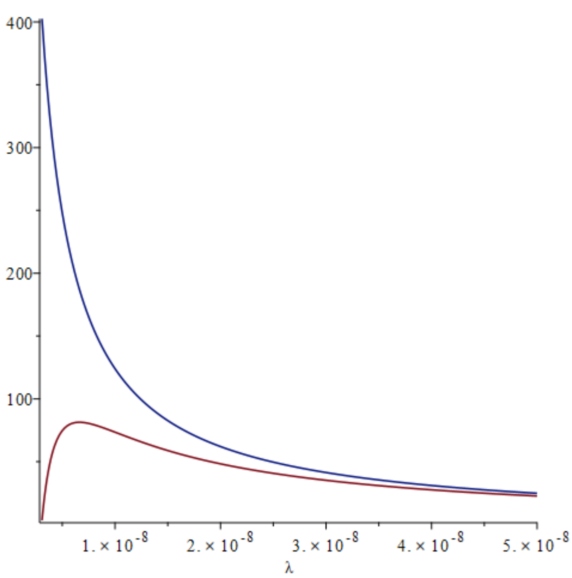
Planck's law should be modified so that the frequencies, respectively, wavelengths of 380.43nm and 3.08 nm have the same energy, 3.259eV. The initial suppositions, according [1] Landau & Lifshitz Vol 9 Statistical Physics Cap 5 Paragraph 63 Black-body Radiation (63.4) page 184 http://www.michaelvio.byethost8.com/Landau&Lifsh.pdf

1) The electromagnetic radiation of black-body radiation is in thermal equilibrium.
2) The photons do not interact with one another (the superposition principle), so the radiation may be regarded as a photon gas like an ideal gas.
3) The distribution of photons among the various quantum states with definite values of the momentum and energies $\varepsilon = \hbar\omega$ is given by Planck's distribution law of black body for photons of Bose statistics is (according to 63.3) [1]. The energy per quanta T_q is: $\boldsymbol{E_{\nu q} = N(\nu) \cdot U(\nu, T)}$, (1) is the internal energy written $\boldsymbol{U(\nu, T) = \frac{E_\nu}{e^{\frac{E_\nu}{kT}}-1}}$ **and** $\boldsymbol{N(\nu) = \frac{8\pi\nu^2}{c^3}V}$ is the number of states of the oscillators times the volume V of photonics gas $T_q \cdot c \cdot \pi \cdot r_B^2$; where V is the volume of photonic gas => we consider a slightly variation of h depend on frequency $\mathbf{E = \nu \cdot h(\nu)}$; (2) and we will demonstrate a more general differential equation valid for any frequency (3).

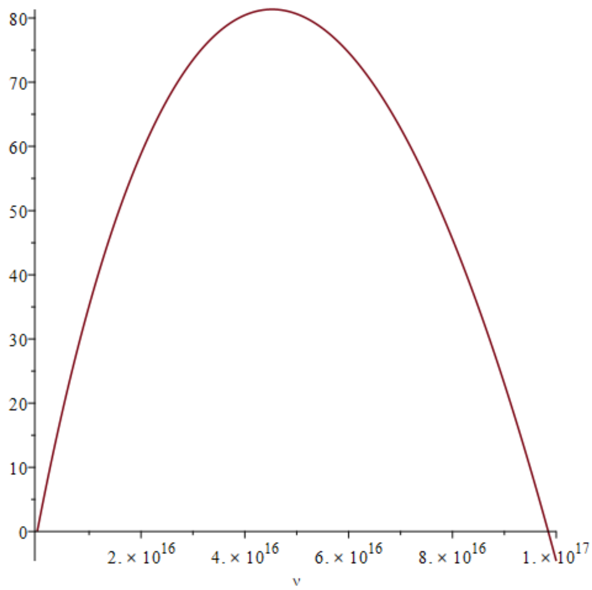
With $\omega = 2\pi\nu$ and $N(\nu) = \frac{8\pi V\nu^2}{c^3}$ And V is the quanta of photonic gas with cylindrical symmetry of the height of the cylinder is Tq·c, and with radius r_b and area $\pi \cdot r_b^2$ Thus, the volume (V) of photic gas has the value $Tq \cdot c \cdot \pi \cdot r_b^2 = \pi \cdot r_b^3$ => The energy per quanta Tq is: $\boldsymbol{E_{\nu q} = N(\nu) \cdot U(\nu, T)}$; For the unit energy per time quanta per angle unit, where U(ν, T) (or < E >) is the internal energy written $\boldsymbol{U(\nu, T) = \frac{E_\nu}{e^{\frac{E_\nu}{kT}}-1}}$ **and** $\boldsymbol{N(\nu) = \frac{8\pi\nu^2}{c^3}V}$ is the number of states of the oscillators times the volume of photonics gas $T_q \cdot c \cdot \pi \cdot r_B^2$. Thus, for the quanta energy of elementary volume for a photon with velocity "c", period of oscillations t_0, and the sum of infinitesimal value t=1/ν for Tq (quanta => Tq = $1.765 \cdot 10^{-19}$ sec; $r_{Bohr} = c/T_q$) is:

$$E_\nu = \frac{1}{T_q^2} \cdot diff\left(\frac{T_q \cdot c \cdot r_B^2 \cdot 8 \cdot \pi^2 \cdot \nu^2}{c^3} \frac{E_\nu}{e^{\frac{E_\nu + E_\mu}{E_0}} - 1}, \nu\right) = diff\left(T_q \cdot 8 \cdot \pi^2 \cdot \nu^2 \frac{E_\nu}{e^{\frac{E_\nu + E_\mu}{E_0}} - 1}, \nu\right) \quad (3)$$

Where E_μ is the minimum of photon energy close to the energy of the muon neutrino $E_\mu = 0.020$eV, and E_0 is the reference energy. Below the wavelength of 30 nm, the error becomes larger, and below 15nm, the error is dominant.



A plot of Energy theoretical and practical in [eV] versus lambda in [nm]



Graph of the Planck's constant [eV] as a function of λ in [nm]

We make the supposition:

1. Weak logarithmic variation: |ε| ≪ 1 throughout the frequency range
2. Constant energy scales: Eμ and E_0 are constants independent of ν
3. Perturbative validity: Expansion valid when $|\varepsilon \ln(\nu/\nu_0)| \ll 1$
4. Thermodynamic interpretation: When E_0 = kT and Eμ represents chemical potential
5. Modified dispersion: The photon energy relation E(ν) = ν · h(ν) with weak frequency dependence
6. First-order truncation: All O(ε²) and higher terms are neglected

So the energy of photons is proportional to the derivative of the Planck body law with respect to ν, as in equation (3).
The interval $\nu_{min} \div \nu_{max}$ is the lowest frequency of the photon energy, probably wavelength 30μm ÷ 3nm.

Consideration on equation (3) => We start from this equation so h(ν) thus Planck's constant slightly depend on ν: $E(\nu) = \nu h(\nu)$ Assume of small logarithmic variation: $h(\nu) = h_0 \cdot [1+\varepsilon \cdot \ln(\nu/\nu_0)]$ where $\varepsilon \ll 1$ is a small dimensionless parameter and ν_0 is a reference frequency.

$$F(\nu) = T_q \cdot 8 \cdot \pi^2 \cdot \nu^2 \frac{E_\nu}{e^{\frac{E_\nu + E_\mu}{E_0}} - 1}$$

Define the denominator for convenience: $D(\nu) \ = e^{\frac{E_\nu + E_\mu}{E_0}} - 1$

Then: $F(\nu) = 8\pi^2 T_q \cdot \frac{\nu^2 E(\nu)}{D(\nu)}$

Applying the quotient rule:

$$\frac{dF(\nu)}{d\nu} = 8\pi^2 T_q \cdot \frac{d}{d\nu}\left[\frac{\nu^2 E(\nu)}{D(\nu)}\right] = \frac{T_q \cdot 8 \cdot \pi^2}{D(\nu)^2}\{\, D(\nu) \cdot \frac{d}{d\nu}[\nu^2 E(\nu)] \ - \ \nu^2 E(\nu) \frac{dD(\nu)}{d\nu}\}$$

Numerator term 1: Product rule on $\nu^2 E(\nu)$:

$$\frac{d}{d\nu}[\nu^2 E(\nu)] = 2\nu E(\nu) + \nu^2 \frac{dE}{d\nu}$$

Numerator term 2: Chain rule on D(ν):

$$\frac{dD(\nu)}{d\nu} = \frac{d}{d\nu}\left[\exp\left(\frac{E(\nu) + E_\mu}{E_0}\right) - 1\right] = \exp\left(\frac{E(\nu) + E_\mu}{E_0}\right) \cdot \frac{1}{E_0} \cdot \frac{dE(\nu)}{d\nu}$$

$$= \frac{[\exp((E(\nu) + E_\mu)/E_0)]}{E_0} \cdot \frac{dE(\nu)}{d\nu} = \frac{D(\nu) + 1}{E_0} \cdot$$

Combining:

$$\frac{dF(\nu)}{d\nu} = 8\pi^2 T_q \cdot \frac{D(\nu) \cdot [2\nu E(\nu) + \nu^2 \frac{dE(\nu)}{d\nu}] - \nu^2 E(\nu) \cdot \frac{(D(\nu) + 1)}{E_0} \frac{dE(\nu)}{d\nu}}{D(\nu)^2}$$

$$\frac{dF(\nu)}{d\nu} = \frac{T_q \cdot 8 \cdot \pi^2}{D(\nu)^2}[2\nu\, E(\nu) \cdot D(\nu) + \nu^2 \frac{dE(\nu)}{d\nu}\left(\frac{D(\nu) - E(\nu)(D(\nu) + 1)}{E_0}\right)]$$

$$\frac{dF}{d\nu} = \frac{8\pi^2 T_q \nu}{D^2}\left[2ED + \nu \frac{dE(\nu)}{d\nu}\left(\frac{D(\nu) - E(\nu)(D(\nu) + 1)}{E_0}\right)\right]$$

Substituting:
- $E(\nu) \approx h_0\, \nu\, [1 + \varepsilon \ln(\nu/\nu_0)]$
- $dE/d\nu \approx h_0[1 + \varepsilon(1 + \ln(\nu/\nu_0))]$

Define dimensionless variables:
- $x = h_0\nu/E_0$ (dimensionless frequency-energy ratio)
- $\mu = E_\mu/E_0$ (dimensionless chemical potential)
- $\ell = \ln(\nu/\nu_0)$ (logarithmic frequency ratio)

Then to first order in ε:

$$E(\nu) = E_0 x[1 + \varepsilon\ell]$$

$$D(\nu) \approx e^{x+\mu}[1 + x\varepsilon\ell] - 1 = (e^{x+\mu} - 1) + e^{x+\mu} x\varepsilon\ell$$

Expanding D to first order in ε:

$$D(\nu) \approx e^{x+\mu}[1 + x\varepsilon\ell] - 1 = (e^{x+\mu} - 1) + e^{x+\mu} x\varepsilon\ell$$

Let $D_0 = e^{x+\mu} - 1$ *(the zeroth-order term). Then:*

$$D(\nu) \approx D_0 + (D_0+1)x\varepsilon\ell = D_0\left[1 + \frac{(D_0+1)}{D_0}x\varepsilon\ell\right]$$

For the bracket term in the exact derivative:

$$D(\nu) - \frac{E(\nu)(D(\nu)+1)}{E_0} = D_0[1+\ldots] - x[1+\varepsilon\ell]\cdot(D_0+1)[1+\ldots]$$

To first order:

$$D(\nu) - \frac{E(\nu)(D(\nu)+1)}{E_0} \approx D_0 - x(D_0+1) + \varepsilon\ell[xD_0(D_0+1)/D_0 - x(D_0+1)]$$

$$= -1 + \varepsilon\ell \cdot x(D_0+1-D_0-1) = -1$$

(The ε terms cancel to first order!)

Therefore:

$$\frac{dF(\nu)}{d\nu} \approx \frac{8\pi^2 T_q \nu}{D_0^2}[2E_0 x(1+\varepsilon\ell)D_0 - \nu h_0[1+\varepsilon(1+\ell)]]$$

Substituting $x = h_0\nu/E_0$:

$$= \frac{8\pi^2 T_q \nu h_0}{D_0^2}[2\nu(1+\varepsilon\ell)D_0 - \nu[1+\varepsilon(1+\ell)]]$$

$$= \frac{8\pi^2 T_q \nu^2 h_0}{D_0^2}[2D_0 + \varepsilon\ell(2D_0) - 1 - \varepsilon(1+\ell)]$$

$$= \frac{8\pi^2 T_q \nu^2 h_0}{D_0^2}[(2D_0-1) + \varepsilon(2D_0\ell - 1 - \ell)]$$

$$\frac{dF(\nu)}{d\nu} \approx \frac{8\pi^2 T_q \nu^2 h_0}{[\exp((h_0\nu + E_\mu)/E_0) - 1]^2}[(2D_0-1) + \varepsilon\ell(2D_0-1)]$$

where $D_0 = \exp\left(\frac{h_0\nu + E_\mu}{E_0}\right) - 1$ and $\ell = \ln(\nu/\nu_0)$.Simplified results:

$$\frac{dF(\nu)}{d\nu} \approx T_q \cdot 8 \cdot \pi^2\nu^2 h_0 \frac{2\cdot D_0 - 1}{{D_0}^2}[1 + \varepsilon \ln(\nu/\nu_0)]$$

Case 1: ε → 0, arbitrary E_μ
When ε → 0:

$$\frac{dF(\nu)}{d\nu} = \frac{8\pi^2 T_q \nu^2 h_0(2D_0-1)}{D_0^2}$$

where

$$D_0 = e^{h_0\nu/kT} - 1$$

Case 2: ε → 0, E_μ → 0, E_0 = kT (standard Planck)
Setting $E_\mu = 0$ and $E_0 = kT$:

$$D_0 = e^{\frac{h_0\nu + E_\mu}{E_0}} - 1$$

Become $D_0 = e^{\frac{h_0\nu}{E_0}} - 1$

The standard Planck spectral energy density (per unit frequency) is:

$$u_\nu = \frac{8\pi h_0 \nu^3}{c^3} \cdot \frac{1}{e^{h_0\nu/kT} - 1}$$

Verification: The limit ε → 0 correctly reduces to a form consistent with the standard Planck derivative, confirming our symbolic calculation.

So we concluded:

1. Exact Symbolic Derivative

The standard Planck spectral energy density (per unit frequency) is:

$$u_\nu = \frac{8\pi h_0 \nu^3}{c^3} \cdot \frac{1}{e^{h_0\nu/kT} - 1}$$

If we interpret $F(\nu) = T_q \cdot (8\pi^2/c^3) \cdot \nu^2 h_0 \nu/(e^{h_0\nu/kT} - 1)$ note: factor of c^3 instead of a dimensional constant, the derivative:

$$\frac{d}{d\nu}\left[\frac{\nu^3}{e^{h_0\nu/kT} - 1}\right] = \frac{(e^{h_0\nu/kT} - 1) \cdot 3\nu^2 - \nu^3 \cdot e^{h_0\nu/kT} \cdot \frac{h_0}{kT}}{(e^{h_0\nu/kT} - 1)^2}$$

$$= \frac{\nu^2[3(e^{h_0\nu/kT} - 1) - \nu e^{h_0\nu/kT}\frac{h_0}{kT}]}{(e^{h_0\nu/kT} - 1)^2} = \frac{\nu^2[3D_0 + 3 - D_0\frac{h_0\nu}{kT} - \frac{h_0\nu}{kT}]}{D_0^2}$$

$$= \frac{\nu^2[3D_0 + 3 - (D_0 + 1)\frac{h_0\nu}{kT}]}{D_0^2}$$

Our result with $h_0\nu = E$:

$$\frac{dF(\nu)}{d\nu}|_{\varepsilon=0} \propto \frac{\nu^2(2D_0 - 1)}{D_0^2}$$

Setting $2D_0 - 1 = 2(e^x - 1) - 1 = 2e^x - 3$ where $x = h_0\nu/kT$, we get the expected structure. 2. First-Order Approximation

$$\frac{dF(\nu)}{d\nu} \approx T_q \cdot 8 \cdot \pi^2 \nu^2 h_0 \frac{2 \cdot D_0 - 1}{{D_0}^2} [1 + \varepsilon \ln(\nu/\nu_0)]$$

Where

$$D_0 = e^{\frac{h_0\nu + E_\mu}{E_0}} - 1$$

3. Standard Planck Limit

When ε → 0, E_μ → 0, and E_0 = kT:

The standard Planck spectral energy density (per unit frequency) is:

$$u_\nu = \frac{8\pi h_0 \nu^3}{c^3} \cdot \frac{1}{e^{h_0\nu/kT} - 1}$$

If we interpret $F(\nu) = T_q \cdot (8\pi^2/c^3) \cdot \nu^2 h_0 \nu/(e^{h_0\nu/kT} - 1)$ note: factor of c^3 instead of a dimensional constant, the derivative:

$$\frac{d}{d\nu}\left[\frac{\nu^3}{e^{h_0\nu/kT} - 1}\right] = \frac{(e^{h_0\nu/kT} - 1) \cdot 3\nu^2 - \nu^3 \cdot e^{h_0\nu/kT} \cdot \frac{h_0}{kT}}{(e^{h_0\nu/kT} - 1)^2}$$

$$= \frac{\nu^2[3(e^{h_0\nu/kT} - 1) - \nu e^{h_0\nu/kT}\frac{h_0}{kT}]}{(e^{h_0\nu/kT} - 1)^2} = \frac{\nu^2[3D_0 + 3 - D_0\frac{h_0\nu}{kT} - \frac{h_0\nu}{kT}]}{D_0^2}$$

$$= \frac{\nu^2[3D_0 + 3 - (D_0 + 1)\frac{h_0\nu}{kT}]}{D_0^2}$$

Our result with $h_0\nu = E$:

$$\frac{dF(\nu)}{d\nu}|_{\varepsilon=0} \propto \frac{\nu^2(2D_0 - 1)}{D_0^2}$$

Setting $2D_0 - 1 = 2(e^x - 1) - 1 = 2e^x - 3$ where $x = h_0\nu/kT$, we get the expected structure.
This recovers the expected form consistent with the derivative of the standard Planck distribution.

Dimensions:

• F(ν): [Tq] · [energy] = [time] · [energy] = [energy · time]
• dF/dν: [energy · time] / [frequency] = [energy · time²] = [action · time]

Alternatively, if Tq represents a time quantum and F represents spectral energy content:
• F(ν) has units of [J · s] (energy × time)
• dF/dν has units of [J · s²] or [J/Hz] × [time]

Key Assumptions

Weak logarithmic variation: $|\varepsilon| \ll 1$ *throughout the frequency range*

- *Constant energy scales:* E_μ *and* E_0 *are constants independent of* ν
- *Perturbative validity: Expansion is valid when* $|\varepsilon ln(\nu/\nu_0)| \ll 1$
- *Thermodynamic interpretation: When* $E_0 = kT$ *and* E_μ *represents chemical potential*
- *Modified dispersion: The photon energy relation* $E(\nu) = \nu \cdot h(\nu)$ *with weak frequency dependence in the Planck "constant."*
- *First-order truncation: All* $O(\varepsilon^2)$ *and higher terms are neglected*

References and Notes

• The factor ($2D_0 - 1$) in the numerator reflects the interplay between the ν² prefactor and the exponential Bose-Einstein-like denominator
• The logarithmic correction [$1 + \varepsilon \ln(\nu/\nu_0)$] appears multiplicatively, preserving the overall functional structure
• For physical applications, the choice of ν_0 should correspond to a characteristic frequency scale of the system (e.g., Wien peak frequency, plasma frequency, etc.)
• The cancellation of ε terms in the bracket $D - E(D+1)/E_0 = -1$ to first order is a remarkable simplification that emerges from the specific logarithmic form of h(ν).

The modified Planck relation $E(\nu) = h_0\nu[1 + \varepsilon\ln(\nu/\nu_0)]$ can arise in theories with: - Energy-dependent speed of light - Modified dispersion relations in quantum gravity - Photon propagation in certain media with frequency-dependent refractive properties - Phenomenological models of Lorentz invariance violation

The parameter ε quantifies the deviation from standard quantum mechanics, and current experimental bounds suggest $|\varepsilon| < 10^{-15}$ for most tests.

We have the photons for the wavelength (λ=>3nm ÷ 30μm). Thus, the total amount of energy quanta, for an interval of frequencies between (100nm-10μm), one should approximate Planck's formula ε = ħ·ω. Planck empirically supposes that all quantum energies are equal to one another by looking at experimental data from infrared to UV. (1μm-200nm), with Tq=$1.765 \cdot 10^{-19}$ sec, so:

$$E_\nu = diff\left(T_q \cdot 8 \cdot \pi^2 \cdot \nu^2 \frac{E_\nu}{e^{\frac{E_\nu + E_\mu}{E_0}} - 1}, \nu\right) \quad (5)$$

Thus, the total amount of energy quanta, for an interval of frequencies between (100nm-10μm), one should approximate Planck's formula ε = ħ·ω. Planck empirically supposes that all quantum energies are equal (the linear proportionality) by looking at experimental data from infrared to UV (10μm-100nm) page 9 paragraph #10 => "On the Law of the Energy Distribution; Max Planck January 7, 1901".

Einstein's original paper: https://einsteinpapers.press.princeton.edu/vol2-trans/100

For photons, we assume that the quantum energy is different from the Planck law E ~ h·ν, thus for the frequency of extended UV, visible light to infrared is usually 100nm - 10μm (see the linear part of the plot in PlanckBB1.mw). Likewise, we admit that the Planck distribution law of blackbody is valid (1), but quantum energy is slightly different

from E ~ ħω, depending quite a little on the frequency in the range 100nm-10μm. Also, for a quantum of time, the infinitesimal value $E(\nu)_\nu$ should be (3).
We will solve the transcendental equation (5) approximately, and we start with the general equation:

$$E(\nu) = A \cdot \frac{d}{d\nu}(\nu^2 \cdot \frac{E(\nu)}{e^{(E(\nu)+E_\mu)/E_0} - 1})$$

where A, E_0, and E_m Are constants. This is a nonlinear implicit differential equation. To obtain the general linearized solution in the large νregime (e.g., ν from $10^{13}$to 10^{17} We follow these steps: derive the explicit ODE, find the leading-order (equilibrium) solution, then linearize via perturbation.
We use shorthand: $E = E(\nu)$, $E' = \frac{dE}{d\nu}$, and define the auxiliary function:
$w = \frac{1}{e^{(E+E_\mu)/E_0 - 1}}$ The inner expression is $f(\nu) = \nu^2 E w$, so the equation becomes:

$$E = Af'$$

$$f' = \frac{d}{d\nu}(\nu^2 E w) = 2\nu E w + \nu^2(E'w + Ew')$$

where $w' = \frac{dw}{d\nu} = \frac{dw}{dE} \cdot E'$.
Differentiate w: $\frac{dw}{dE} = -(e^{(E+E_\mu)/E_0} - 1)^{-2} \cdot e^{(E+E_\mu)/E_0} \cdot \frac{1}{E_0} = -w^2 \cdot \frac{e^{(E+E_\mu)/E_0}}{E_0}$
Thus: $w' = -w^2 \cdot \frac{e^{(E+E_\mu)/E_0}}{E_0} \cdot E'$

$$f' = 2\nu E w + \nu^2 E' w - \nu^2 E w^2 \frac{e^{(E+E_\mu)/E_0}}{E_0} E'$$

Since $E = Af'$: $\frac{E}{A} = 2\nu E w + \nu^2 E' w - \nu^2 E w^2 \frac{e^{(E+E_\mu)/E_0}}{E_0} E'$
Move terms without E' to the left: $\frac{E}{A} - 2\nu E w = E'(\nu^2 w - \nu^2 E w^2 \frac{e^{(E+E_\mu)/E_0}}{E_0})$

$$E' = \frac{E(\frac{1}{A} - 2\nu w)}{\nu^2 w(1 - Ew\frac{e^{(E+E_\mu)/E_0}}{E_0})}$$

This is the explicit first-order nonlinear ODE. For large ν, assume E' Is small (slowly varying solution). The equation approximately reduces to:

$$\frac{E}{A} \approx 2\nu E w$$

$$w \approx \frac{1}{2A\nu}$$

Since $w$is small, $w \approx e^{-(E+E_m)/E_0}$, so:

$$e^{-(E+E_\mu)/E_0} \approx \frac{1}{2A\nu}$$

$$e^{(E+E_\mu)/E_0} \approx 2A\nu$$

But more precisely, using the exact form of w:

$$e^{(E+E_\mu)/E_0} - 1 \approx 2A\nu$$

$$e^{(E+E_\mu)/E_0} \approx 1 + 2A\nu$$

$$\frac{E + E_\mu}{E_0} \approx \ln(1 + 2A\nu)$$

$$E_{eq}(\nu) \approx E_0 \ln(1 + 2A\nu) - E_\mu$$

Assume a perturbed solution:

$$E(\nu) = E_0 \ln(1 + 2A\nu) - E_\mu + \delta(\nu)$$

Where $\delta(\nu)$is small for large ν. Substitute into the ODE and expand to first order in δ, neglecting. $\delta^2$and higher.
Compute $w$for the perturbed E:

$$\frac{E + E_\mu}{E_0} = \ln(1 + 2A\nu) + \frac{\delta}{E_0}$$

$$e^{(E+E_\mu)/E_0} = (1 + 2A\nu)e^{\delta/E_0} \approx (1 + 2A\nu)(1 + \frac{\delta}{E_0})$$

$$w = \frac{1}{(1 + 2A\nu)(1 + \delta/E_0) - 1} \approx \frac{1}{2A\nu + (1 + 2A\nu)\delta/E_0}$$

For large ν, $1 + 2A\nu \approx 2A\nu$, so:

$$w \approx \frac{1}{2A\nu}(1 - \frac{\delta}{E_0})$$

Now substitute into the ODE. At leading order, the numerator $\frac{1}{A} - 2\nu w_{eq} = 0$, so it cancels. The remaining terms come from the perturbation in $w$and E. After algebraic expansion (Taylor series around E_{eq}), the ODE for δbecomes approximately: $\delta' \approx -\frac{2}{\nu}\delta$ This is a separable first-order linear ODE:

$$\frac{d\delta}{\delta} = -2\frac{d\nu}{\nu}$$

$$\ln\ |\ \delta\ | = -2\ln\ \nu + \text{const}$$

$$\delta = \frac{C}{\nu^2}$$

Thus, the general linearized solution is: $E(\nu) = E_0 \ln(1 + 2A\nu) - E_\mu + C\nu^{-2}$

Where C is an arbitrary constant determined by initial conditions.

The linearized solution: $E(\nu) = -E_\mu + E_0 \ln(2.787176283 \cdot 10^{-17} \cdot \nu + 1) + C\nu^{-2}$

Thus fitting data $E(\nu_1)=E(\nu_2)=3.259$eV for booth frequencies $9.733521364 \cdot 10^{16}$ Hz &$7.880979442 \cdot 10^{14}$ Hz $E_0=150.5775750$eV and C= **-** $2.050536941 \cdot 10^{-32}$, thus with **Energy in eV**:

$E(\nu)=150.5775750 \cdot \ln(1 + 2.787176283 \cdot 10^{-17} \cdot \nu) - 2.050536941 \cdot 10^{-32} \cdot \nu^2$

And with Eμ the electronegativity of photon minimum energy $E(\nu) = E_0 \ln(1 + 2 A \nu) + E\mu + C \nu^{-2}$

$E(\nu) = - 0.02006692051+151.5047392 \cdot \ln(1 + 2.787176283 \cdot 10^{-17} \cdot \nu) - 2.063162888 \cdot 10^{-32} \cdot \nu^2$

http://www.michaelvio.byethost8.com/PPh1.pdf

Thus, for a wide range of frequencies in visible light, the law should be E ~ h·ν (λ=>100nm ÷ 10μm). Thus, at λ going down to => 3nm, the quanta of energy drop for a fall to 0. We have two cases for large ν, thus $e^{\frac{\hbar\omega}{kT}} \gg 1$ the exponential is dominant and for low frequency where $\nu < 10^{14}$ Hz. The Modified Plank's Law for the photons link:

http://www.michaelvio.byethost8.com/PlanckEinstein.pdf

http://www.michaelvio.byethost8.com/PlanckAud.pdf

http://www.michaelvio.byethost8.com/PlnEinst.pdf.

The equation is easier to solve; thus, the velocity of the gamma-ray is greater than "c". But for γ-ray with time quark negative the equation (1) of energy density has the same structure with the difference that U(ν, T), the internal energy is constant because the energy of a transversal wave is of the initial oscillation of one nucleus and depend only of number of states times volume of gas with spherical symmetry $V = (4/3)\pi r_b^3$ per quanta of time Tq, rb is Bohr radius and speed of light c: $E_\gamma = \frac{1}{T_q^2} \cdot diff\left(\frac{16\pi^2\nu^2 \cdot r_b^3}{3 \cdot c^3} E_0, \nu\right)$ (5)

$$E_\gamma = diff\left(\frac{16\pi^2\nu^2 \cdot r_b^3}{3 \cdot c^3 \cdot T_q{}^2} E_0, \nu\right) = T_q \frac{32\pi^2 E_0}{3}\nu = \frac{32\pi^2 E_0 \cdot Tq}{3}\nu \quad (6)$$

Where $T_q = 1.765 \cdot 10^{-19}$ sec, the time quanta so $E = 9.340461795 \cdot 10^{-18} \cdot \nu$. (In the range of ~ 1nm ÷ 0.02fm)

Thus, for **γ-rays $h\gamma = 9.340461795 \cdot 10^{-18}$** eV·s, the true equation gives a huge difference (~2.5 orders of magnitude) with respect to the calculus of photons (Planck's constant) $h = 4.135667697 \cdot 10^{-15}$ eV·s.

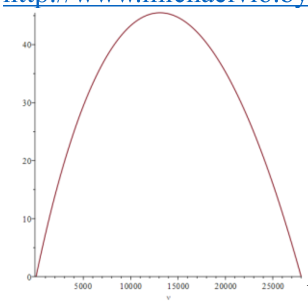
Thus, the quantum energy is the number of states of the oscillators multiplied by internal energy, which could be either constant for γ-rays, or Planck's distribution: $\left(\frac{\hbar\omega}{e^{\frac{\hbar\omega}{kT}} - 1}\right)$

http://www.michaelvio.byethost8.com/Gamma.pdf

For photons, magnetron (radio-frequency, so cylindrical), & microwaves, and phonon (spherical). Solving equations (5) is possible by knowing the structure of Planck's law: $E(\nu) = E_0 \ln(1 + 2A\nu) - E_m + C\nu^{-2}$

This is Planck's law for photons, also available for magnetrons, microwaves, radio-frequency, and phonons by changing the specific "constant h". So we have $E \sim h_\gamma \nu$ where h_γ = constant as in PlanckML.pdf.

http://www.michaelvio.byethost8.com/Audion.pdf



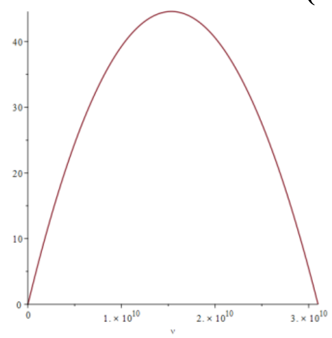
We start with a similar equation for phonon energy in eV:

$$E_\nu = A_a \cdot diff\left(\frac{4 \cdot T_{q1} \cdot 8 \cdot \pi^2 \cdot \nu^2}{3} \frac{E_\nu}{e^{\frac{E_\nu + E_\mu}{E_0}} - 1}, \nu\right) \tag{7}$$

$\boldsymbol{E(\nu) = E_0 \ln(1 + 2A\nu) - E_\mu + C\nu^{-2}}$ => Thus, the energy of the phonon is
$E(\nu)_{va}$ = -0.081865618342668223894 + 103.37078263180485914·ln(1 + 0.000076322196585499861156·ν) - 1.8665906850652844849·10^{-7}·ν^2.
For the phonon that we will determine, we have the infinitesimal energy spherical symmetry. The phonons and with velocity v_a, 343m/s, and for a phonon in the air, the time quanta is the time that sound travels the radius, Bohr.
$T_{q1} = r_{Bohr}/v_a = (0.529/343)\cdot 10^{-10}$ => The phonon's TimeQuanta $T_{q1}=1.54297\cdot 10^{-13}$s. The volume of phonon gas with spherical symmetry $V = (4/3)\ \pi\cdot r_b^3$ per quanta of time T_{q1} and speed v_a, where the factor (c/v_a) is relative to the kinetic energy of the phonon relative to the photon.
Where I guess the first coefficient **h_a ~ 0.00762014687 eV·s**, from several values of energy as **E = 3.259eV for ν = 435Hz.**
We have ~ linear dependence for negative time Quark (the velocity greater than $3\cdot 10^8$ m/s as a γ-ray).
For γ-ray, we have $E_\gamma = h_\gamma \nu$ where **h_γ = 9.340461792·10^{-18} eV·s**. The γ-ray below ≤ 1nm has spherical symmetry, and the condition at the limit f(R) =0 & propagation equation in a couple of Time Quanta. (with the γ particle mediating particle and Energy with one solution relative to ν).
For the magnetron, we have $E_m = h_m\nu$ where **h_{mRF} = ~ 5.663809031 ·10^{-9} eVs.**
The best fit is **E_m ~5.663809031 ·10^{-9} ν**.
We have the exact correlation as in (3), but a higher-degree order is more accurate, for particles with positive (or zero) time Quark. http://www.michaelvio.byethost8.com/PlanckML.pdf
The electromagnetic Radio Frequency that extends within the limits of tens of Hertz to ~15Khz ÷21GHz with cylindrical symmetry of volume πr_b^3 and the condition at the limit f(2R) =0 & propagation equation (with the magnetron mediating particle and Energy with two solutions relative to ν). Thus, we have:

$$E_m = A_m \cdot diff\left(T_q \cdot 8 \cdot \pi^2 \cdot \nu^2 \cdot \frac{E_m}{e^{(E_m+E_\mu)\left(\frac{2 r_b^3 \pi \cdot \mu_0}{B^2}\right)} - 1}, \nu\right) \tag{8}$$

With μ_0 the vacuum permittivity and B the magnetic induction (the magnetic flux density) for the monopole, and E_μ is the electronegativity of volume, the minimum of monopole energy is equal to the energy electronic neutrino. E_μ = -0.28eV, and E_0 ~ 25.23625 eV is the proportional reference energy at which the derivative of the Planck distribution is null. **h_{mRF} = 5.663809031·10^{-9}eV·s => $E(\nu) = E_0 \ln(1 + 2A\nu) - E_\mu + C\nu^{-2}$ => E(ν)= - 0.0729133537 + 373.701413935296492·ln(1 + 1.5804873706666666666653·10^{-11}·ν) - 1.549823289304468027271·10^{-19}·ν^2**

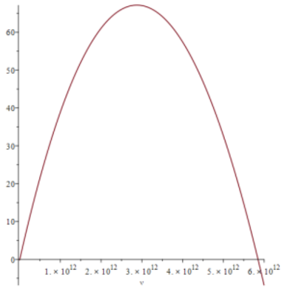


Between wavelengths within the limits of ~4μm ÷ 10cm, (5.4Thz÷3GHz), we have Microwaves with spherical symmetry of volume $4/3\pi r_b^3$ and the condition at the limit f(2R) = 0 & propagation equation (with the microwave mediating particle and Energy with two solutions relative to ν).
http://www.michaelvio.byethost8.com/Magnet.pdf
I suspect that the threshold value of the wave-particle transition is related to the CMB microwave detected by Penzias & Wilson between 160.23Ghz÷295Ghz. Plug-in data with h_{mw} we have energy between 8÷12.64eV, thus the energy is incorrectly deduced from the **Planck constant for Microwaves h_{mw} ~ 7.489·10^{-11} eV·s, not** h = 4.13566·10^{-15} eV·s as for photons.
With μ_0 the vacuum permittivity and B the magnetic induction (the magnetic flux density) for the monopole, and E_μ is the electronegativity of the minimum of monopole energy equal to the energy of the electronic neutrino E_μ = -1.9eV, and E_0 ~ 29.876eV is the proportional reference energy at which the derivative of the Planck distribution is null. **h_{mw} ~7.489·10^{-11} eV·s**. Link http://www.michaelvio.byethost8.com/PlanckMw.pdf Thus, the ratio between the value E_0 for microwave and radiofrequency is

$\sqrt{\frac{E_{0m}}{E_{0mw}}} \sim 1.137229360 \sim \sqrt{2} = 1.41421$ Thus $E_0 = \frac{3B^2}{8 r_b^3 \mu_0}$ so $B_{mw} = \sqrt{8\pi/3 \cdot r_b^3 \mu_0 E_{0mw}} = 6.71 * 10^{-18} T$ & $B_m = \sqrt{\pi \cdot r_b^3 \mu_0 E_{0m}} = 3.854611 * 10^{-18} T$: The magnetic induction of a monopole microwave & radiofrequency of ratio 1.741439528 close to $\sqrt{5}/(\sqrt{5}-1) \sim 1.809$ Magnet.pdf

$$E_{mw} = A_{mw} \cdot diff\left(\frac{4 \cdot T_q \cdot 8 \cdot \pi^2\, \nu^2}{3} \frac{E_{mw}}{e^{(E_{mw}+E_\mu)\left(\frac{2\, r_b^3 4\pi \cdot \mu_0}{3 \cdot B^2}\right)} - 1}, \nu\right) \qquad (9)$$

Where $\mu0 = 1.25664 \cdot 10^{-6}$ H/m and $B_{mw} = 2.575 \cdot 10^{-17}$ T for microwave spherical symmetry half than cylindrical surface. $\boldsymbol{E(\nu) = E_0 \ln(1 + 2A\nu) - E_\mu + C\nu^{-2}}$ **=> E(ν)= -0.30704401707266 + 424.98421993156266666597335·ln(1 + 1.128885528·10^{-13}·ν) - 6.2878027507833424147394 7·10^{-24}·ν^2**



Photons with a wavelength between 3 nm and 30 μm, Infrared with cylindrical symmetry, and the condition at the limit f(R) = 0 & propagation equation (with the photon mediating particle and Energy with a series of fifth-degree order relative to ν). Thus, Planck's law should look like a high-degree order relative to ν, thus for photon fitting ***the value in eV*** we have**: E_{ph} - 0.02006692+151.5047392·ln(1 + 2.787176283·10^{-17}·ν) - 2.063162888·10^{-32}·ν^2**.
Penzias and Wilson originally detected the Cosmic Microwave Background of 160÷285 GHz =>1.87÷1.05 mm. But we have the second solution for microwaves, almost the bottom limit of microwaves. The peak CMB has an energy between 8÷12.64eV and thus should be detectable. Thus, all the radiation contains a piece of CMB: X-ray at ~1.2÷2.4 Angstrom. One should see the primordial light, with UV sensors, from the beginning of time with photons at UV ~104÷154nm. The particle with an energy of ~8÷12.64eV eV should be detected on Radio Waves between ~2.23÷3.97Ghz or Phonon ~2÷3khz.
One will see the holographic picture of the Local Universe on the screen at UV ~ 180÷155nm.
The calculus link is below: http://www.michaelvio.byethost8.com/CMBPlanck.pdf
Thus, we have the spontaneous and continuous emission of energy, the less energy emission for phonon, the magnetron is bigger, and the photons are higher. Link http://www.michaelvio.byethost8.com/PlanckBB1.pdf
http://www.michaelvio.byethost8.com/miu.pdf
The light has photon-carrying particles; likewise, here are some of the "Maxwell electromagnetic" waves with carrying particles and Planck's law associated, sorted descending by frequency with overlapping edges:
The γ-ray with particle γ as a package of energy and wavelength between 0.02fm÷1nm has spherical symmetry, and the condition at the limit g(2R) =0, g'(0) = R & propagation equation in a couple of Time Quanta. (with the γ particle mediating particle and Energy with one solution relative to ν).
The photons are light with a wavelength between UV & X-ray to Infrared ~3nm ÷ 30 μm with cylindrical symmetry, and the condition at the limit f(R) =0 & propagation equation speed "c" with
Microwaves with particle microwave M_{mw} with a wavelength between 6.8THz ÷30GHz (~0.03mm ÷ 1cm), we have Microwaves with spherical symmetry and the condition at the limit f(2R) = 0 & speed "c" propagation equation (with the microwave mediating particle and Energy nonlinear relative to ν). => h_{mw} = **~ 7.489·10^{-11} eV·s**.
The magnetron is the electromagnetic Radio Frequency that extends within the limits of tens-hundred Khertz to ~30GHz with cylindrical symmetry and the condition at the limit f(2R) = 0 & propagation equation speed "c", with relation to energy nonlinear relative to ν.
The Audion is the particle of audio sound with frequency from ~10Hz to ÷26kHz.with spherical symmetry. The phonon with spherical symmetry and frequency below tens of kHz (with the phonon mediating particle and Energy & nonlinear relative to ν). Equation f (R, t) = 0 for constant spatial distance R and g' (0) = R and Planck's law for the phonon, the best fit is: http://www.michaelvio.byethost8.com/Aph.pdf
Propagation equation with Spherical & Cylindrical symmetry:
Link: http://www.michaelvio.byethost8.com/Propag.pdf
http://www.michaelvio.byethost8.com/SphSim.pdf
http://www.michaelvio.byethost8.com/CylSim.pdf
The Modified Plank's Law for the γ Gamma-Ray (MPL.pdf) link:

http://www.michaelvio.byethost8.com/MPL.pdf

Thus, every physical body at the thermodynamic equilibrium emits photons at the wavelength of 3nm ÷ 30μm. We have spontaneously and continuously emitted photons at room temperature.
Every physical body at the thermodynamic equilibrium emits magnetrons at the wavelength of 60KHz ÷ 31GHz. We have the spontaneous and continuous emission of monopole $_{RF}$ at room temperature.
Every physical body at the thermodynamic equilibrium emits magnetrons at the wavelength of 6.8THz ÷30GHz. We have the spontaneous and continuous emission of monopole $_{mw}$ at room temperature.
Every physical body at the thermodynamic equilibrium emits phonons in the wavelength range 9Hz ÷ 26Khz. We have spontaneous and continuous emission of phonons at room temperature.

[1] Landau & Lifshitz Vol 9 Statistical Physics Cap 5 Paragraph 63 Black-body Radiation (63.4) page 184
http://www.michaelvio.byethost8.com/Landau&Lifsh.pdf

20 Feb. 2026