the general science journal

Derivation and Generalization of Planck's Formula

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Planck's formula $E = hf$ is not correct for the total electromagnetic spectrum.

Magnetic wave equation: $$B = B_0 \sin\left[\frac{4\pi^2}{x^2}\left(c^2t^2 - x^2\right)\right]$$

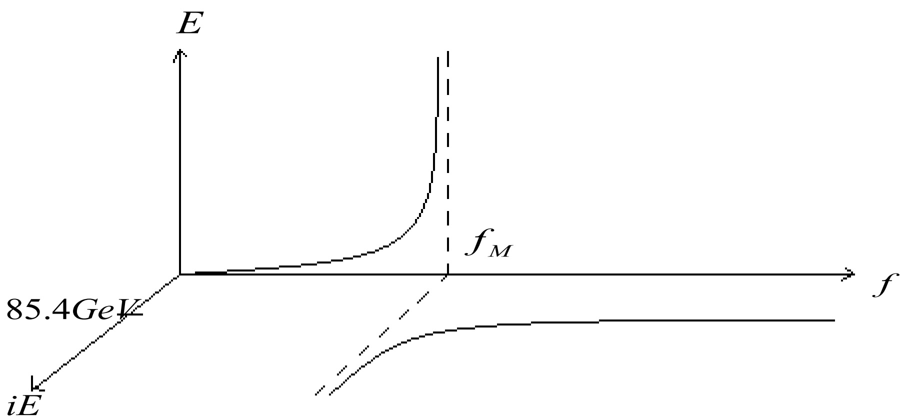
Energy of the magnetic field: $$E = \frac{B^2x^3}{2\mu_0}$$

$$E = \frac{x^3}{2\mu_0}B_0^2 \sin^2\left[\frac{4\pi^2}{x^2}\left(c^2t^2 - x^2\right)\right] \quad \text{and} \quad c^2t^2 - x^2 = k$$

$$\Leftrightarrow \quad E = \frac{x^3}{2\mu_0}B_0^2\frac{16\pi^4k^2}{x^4} \quad \Leftrightarrow \quad E = \frac{16B_0^2\pi^4k^2}{2\mu_0 x}$$

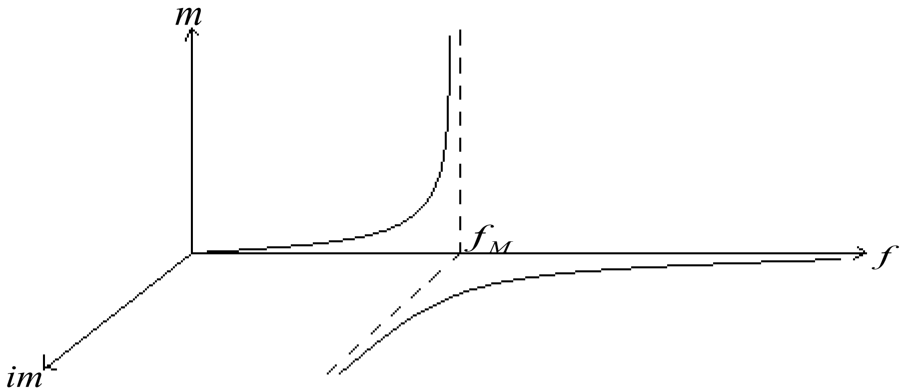
And $$x = \frac{w}{f} \quad \Leftrightarrow \quad E = \frac{c}{w}hf$$

General Planck's formula: $$E = \frac{c}{\sqrt{c^2 - kf^2}}hf$$



$$m(c^2 - kf^2) = \frac{chf}{\sqrt{c^2 - kf^2}} \quad \Leftrightarrow$$

$$\Leftrightarrow \quad m = \frac{chf}{(c^2 - kf^2)^{3/2}}$$



$$E^2(c^2 - kf^2) = c^2 h^2 f^2 \quad \Leftrightarrow$$

$$\Leftrightarrow \quad f = \frac{Ec}{\sqrt{c^2 h^2 + E^2 k}}$$

And $\quad m^2(c^2 - kf^2)^3 = c^2 h^2 f^2 \quad \Leftrightarrow$

Mass-energy equation: $\quad \frac{E}{m} = \frac{c^4 h^2}{c^2 h^2 + E^2 k}$

For E<<85.4GeV $\quad \Leftrightarrow \quad \frac{E}{m} = c^2$

For $E = i\frac{ch}{\sqrt{k}} \quad \Leftrightarrow \quad \frac{E}{m} = \infty$