Photon equation dimensional:

For the photon equation we assume the hypothesis that the instant value of light quanta H(r.z,t) is proportional to light intensity and satisfies the equation:

$$\frac{R}{r}\Delta H(r,\theta,z,t)=\frac{1}{c^2}\frac{\partial^2 H(r,\theta,z,t)}{\partial t^2} \quad (1)$$

Where R is a fixed distance, the same as in the graviton equation. With the initial condition for photon H(z=R) = 0 with z cylindrical symmetry so the initial value is null for a cylindrical surface of a cylinder of radius R, a constant of distance equal to R = $3.567\cdot 10^{22}$ m. In cylindrical coordinates with z-axis symmetry the Laplacian for the photon is considered that be invariant of θ (z-axis symmetry):

$$\Delta H_2(r,z)=\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_2(r,z)\big)}{\partial r}\right)+\frac{\partial^2 H_2(r,z)}{\partial z^2} \quad (2)$$

$$\frac{R}{r}\left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_2(r,z)\big)u(t)}{\partial r}\right)+\frac{\partial^2 H_2(r,z)u(t)}{\partial z^2}\right)=\frac{1}{c^2}\frac{\partial^2 H_2(r,z)u(t)}{\partial t^2} \quad (3)$$

With the method of separation of variables $H_2(r,t)$ not null $H(r,z,t)=H_2(r,z)\cdot u(t)$ (4)

$$\frac{R}{rH_2(r,z)}\left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_2(r,z)\big)u(t)}{\partial r}\right)+\frac{\partial^2 H_2(r,z)u(t)}{\partial z^2}\right)=\frac{1}{c^2}\frac{\partial^2 u(t)}{\partial t^2}$$

Thus we split it into two equations: $\frac{R}{r}\left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_2(r,z)\big)}{\partial r}\right)+\frac{\partial^2 H_2(r,z)}{\partial z^2}\right)=b^2H_2(r,z)$ (5)

And $\frac{1}{c^2}\frac{\partial^2 u(t)}{\partial t^2}=b^2$, (6)

$$\left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_2(r,z)\big)}{\partial r}\right)+\frac{\partial^2 H_2(r,z)}{\partial z^2}\right)-\frac{rb^2H_2(r,z)}{R}=0 \quad (7)$$

With the initial value at the limit $H_3(1/R)=R$ and $H_3(R)=0$;

$$\left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_3(r)H_4(z)\big)}{\partial r}\right)+\frac{\partial^2 H_3(r)H_4(z)}{\partial z^2}\right)-\frac{rb^2H_3(r)H_4(z)}{R}=0 \quad (8)$$

$$\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_3(r)H_4(z)\big)}{\partial r}\right)-\frac{rb^2H_3(r)H_4(z)}{R}=-\frac{\partial^2 H_3(r)H_4(z)}{\partial z^2} \quad (9)$$

$$\frac{1}{rH_3(r)}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_3(r)\big)}{\partial r}\right)-\frac{rb^2}{R}=-\frac{\partial^2 H_4(z)}{H_4(z)\partial z^2} \quad (10)$$

$$\frac{1}{rH_3(r)}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_3(r)\big)}{\partial r}\right)-\frac{rb^2}{R}=-\nu^2 \quad (11)$$

Hence $\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial\big(H_3(r)\big)}{\partial r}\right)+H_3(r)(-\frac{rb^2}{R}+\nu^2)=0$ (12)

$$r\frac{\partial^2\big(H_3(r)\big)}{\partial r^2}+\frac{\partial\big(H_3(r)\big)}{\partial r}-(\frac{r^2b^2}{R}-\nu^2 r)H_3(r)=0 \quad (13)$$

And $\frac{\partial^2 H_4(z)}{\partial z^2}=-\nu^2H_4(z)$ (14)

With sinusoidal solution $H_4(z)=\sin(\nu z+\varphi)=\sin\left(\frac{E}{h}z+\varphi\right)$ where ν is pozitive constant(15)

Considering the photon energy E=h·ν and we have the wave pulsation of ν·z thus $\frac{E}{h}=\nu$ (16)

So we have: $H_4(z)=\sin\left(\frac{E}{h}z+\varphi\right)$ (17)

with dependence on z-axis: $H_4(z)=\sin\left(\frac{E}{h}z+\varphi\right)$ where h = Planck constant, E photon energy, and φ the phase **with $H_4(z)$ and u(t) a dimensional function**;

The other initial value for equation (7) is referring to the initial velocity of the photon which is c the speed of light all the time hence d = 1· $[L^{-3/2}]$for the dimensional reason we have:

$$\frac{df(r,z,t)}{dt}=\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial t}+\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial r}\cdot\frac{\partial r}{\partial t}+\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial z}\cdot\frac{\partial z}{\partial t}=c\cdot d \quad (19)$$

$$c\cdot d=\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial ct}+\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial r}+\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial z}\cdot\frac{\partial z}{\partial t} \quad (20)$$

Divide by "c" both members of the equation:

$$\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial ct}+\frac{\partial[u(t)H_3(r)H_4(z)]}{c\partial r}\cdot\frac{\partial r}{\partial t}+\frac{\partial[u(t)H_3(r)H_4(z)]}{c\partial z}\cdot\frac{\partial z}{\partial r}\frac{\partial r}{\partial t}=d \quad (21)$$

But $\frac{\partial z}{\partial r}=0$ and $\frac{\partial r}{\partial t}=c$, so: $\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial ct}+\frac{\partial[u(t)H_3(r)H_4(z)]}{\partial r}=d$ (22)

$H_4(z)H_3(r)\frac{\partial u(t)}{\partial ct}+u(t)H_4(z)\frac{\partial[H_3(r)]}{\partial r}=d$ for t = 0 and d = 1· $[L^{-3/2}]$ (23)

$$H_3(r)\frac{\partial u(t)}{\partial ct}+u(t)\frac{\partial[H_3(r)]}{\partial r}=\frac{1}{H_4(z)} \qquad (24)$$

Thus as above according to (10-13) we have to solve the equation:

$$r\frac{d^2(H_3(r))}{dr^2}+\frac{d(H_3(r))}{dr}+(-\frac{r^2b^2}{R}+\left(\frac{E}{h}\right)^2 r)H_3(r)=0 \qquad (25)$$

With the initial value at the limit $H_3(1/R)=R$ and $H_3(R)=0$;

$$\frac{d^2(H_3(r))}{dr^2}+\frac{d(H_3(r))}{r\cdot dr}+(-\frac{r\cdot b^2}{R}+\left(\frac{E}{h}\right)^2)H_3(r)=0 \qquad (26)$$

The equation r y'' + y' + r y = 0 cannot be solved in terms of elementary functions. Where: $\nu=\frac{E}{h}$

But for $R=3.567\cdot10^{22}$ m and wavelength of 300nm frequency of 10^{15} Hz and r between 1/R < r < R we can neglect them $\frac{rb^2}{R}$ and we have approximately the equation: $\frac{d^2(r\cdot H(r))}{dr^2}+\nu^2 H(r)=0$ equation (27);

With boundary condition can be solved with Maple bc:= $H_3(R)=0$, $\frac{d\left(H(\frac{1}{R})\right)}{dr}=R$ Thus the solution is $H_3(r)$

$$H(r,z,t)=-H_3(r)\left(\sin\left(\frac{E}{h}z+\varphi\right)\right)u(t) \qquad (29)$$

From (23) we have $H_4(z)H_3(r)\frac{\partial u(t)}{\partial ct}+u(t)H_4(z)\frac{\partial[H_3(r)]}{\partial r}=1$ (d unitary) where we know all the functions except u(t). Thus equation (24): $H_3(r)\frac{\partial u(t)}{\partial ct}+u(t)\frac{\partial[H_3(r)]}{\partial r}=\frac{1}{H_4(z)}$

Thus, we solve the equation, and we have EOWF hence Photon => we divide $H_3(r)/r$ with d unitary of dimension $[L^{-3/2}]$ the final solution approximative of the photon onduscular wave function $H_3(r)H_4(z)\cdot u(t)/r$ of dim $[L^{-3/2}]$ with C2 normed constant and _C1 as in file http://michaelvio.orgfree.com/PhotonA.pdf

Viktor T. Toth: *"However, an important milestone was the development of the Proca theory (named after Romanian physicist Alexandru Proca) in the late 1930s. This was the theory of massive vector mesons in nuclear physics; the corresponding classical theory, known nowadays as Maxwell—Proca theory, is the massive alternative of Maxwell's theory. "* Does the photon have rest mass <>0? it could be a rough estimation of the rest mass is ~$1.41\cdot10^{-9}$ eV/c^2. Let's take o photon of wavelength equal to 620nm thus an energy of 0.5eV. A magnetron thus a pion π^+ , π^- has a rest mass of around 0.00678eV/c^2 see the http://michaelvio.orgfree.com/Magnet.pdf

The energy of a magnetron of f=100Mhz is E=hm·f so also 0.5eV, but hm/h equals $4.79461495\cdot10^6$ thus rest mass of 620nm photon should be around ~1 - $2\cdot10^{-9}$ eV/c^2. http://michaelvio.orgfree.com/grating.pdf

Thus, we have for massless photon equation (30):

$$Photon := \frac{1}{r}\left(\left(\frac{b\,R\,\mathrm{BesselY}(0,kR)\,\mathrm{BesselJ}(0,kr)}{k\left(\mathrm{BesselY}\left(1,\frac{ka}{R}\right)\mathrm{BesselJ}(0,kR)-\mathrm{BesselJ}\left(1,\frac{ka}{R}\right)\mathrm{BesselY}(0,kR)\right)} - \frac{\mathrm{BesselJ}(0,kR)\,b\,R\,\mathrm{BesselY}(0,kr)}{k\left(\mathrm{BesselY}\left(1,\frac{ka}{R}\right)\mathrm{BesselJ}(0,kR)-\mathrm{BesselJ}\left(1,\frac{ka}{R}\right)\mathrm{BesselY}(0,kR)\right)}\right)\left(\frac{k}{C2\sin(\nu z+\phi)\left(\frac{d^2}{dr^2}H(r)\right)}+e^{-\frac{\left(\frac{d^2}{dr^2}H(r)\right)c^2 t}{H(r)}}\,C1\right)\right)$$

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