On the emission and absorption of long-range exchange particles

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May 11, 2021

Abstract

Anisotropic emission of photons is considered. It is found that the interaction strength increases as the photon emission goes from spherical, to circular, to beam-like. Anisotropic gravitation is also considered.

1 Dimensional reduction of the electromagnetic field

In this paper we use Planck units, where $c = G = \hbar = k_B = \epsilon_0 = 1$.

Consider an isotropic photon emitter at the origin of 3D space $(0, 0, 0)$. Also, consider a sphere-shaped photon absorber at position $(0, 100, 0)$, with a radius of 1.

Numerically, it is found that the inverse normalized interaction strength is 41152.3. That is, when the photon emission goes from spherical (e.g. perfectly isotropic) to beam-like (e.g. perfectly anisotropic), the interaction strength increases by a factor of 41152.3. See Fig 1. Note that the interaction strength is isotropic.

Similarly, when the photon emission is circular, the inverse normalized interaction strength is 315.259. See Fig 2. Note that the interaction strength orthogonal to the circle's plane reduces as the photon emitter goes from spherical to circular.

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Finally, when the photon emission is beam-like, the inverse normalized interaction strength is 1 (by definition). See Fig 3. Note that the interaction strength for all angles other than head-on reduces as the photon emitter goes from spherical to beam-like.

Altogether, these results are not surprising; it is all about the simple counting of the ray-sphere (e.g. photon-absorber) intersections. The only assumption is that the temperature and the number of degrees of freedom are at least conserved, if not then increased, as the photon emitter goes from spherical, to circular, to beam-like. It is otherwise axiomatic: anisotropic photon emitters increase in interaction strength.

Of course, for distances much larger than 100, where the photons form what is practically a plane wave, it is possible to analytically obtain the inverse normalized interaction strength for a spherical photon emitter

$$I = \frac{A_{\text{sphere}}}{A_{\text{circle}}} = \frac{4d^2}{r^2}, \tag{1}$$

where d is the absorber distance from the origin, and r is the absorber radius. For a circular photon emitter, the corresponding equation is

$$I = \frac{L_{\text{circle}}}{L_{\text{line}}} = \frac{\pi d}{r}. \tag{2}$$

For a beam-like photon emitter:

$$I = 1. \tag{3}$$

2 Dimensional reduction of the gravitational field

Can matter be coaxed into becoming an anisotropic graviton emitter? Do we already see this in the Universe? Is this the origin of the so-called dark matter in large-scale, gravitationally-bound systems?

Can this research direction answer the question of whether or not gravitation is electromagnetic in nature?

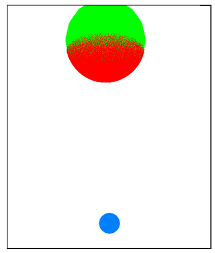

Figure 1: Blue spherical emitter at $(0, 0, 0)$. Green absorber at $(0, 4, 0)$. Ray-sphere intersection locations are coloured in red. A relatively low number of the photons emitted are absorbed.

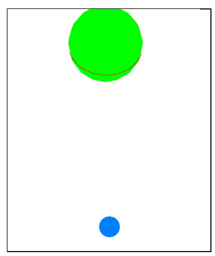

Figure 2: Blue circular emitter at $(0, 0, 0)$. Green absorber at $(0, 4, 0)$. Ray-sphere intersection locations are coloured in red. A relatively high number of the photons emitted are absorbed.

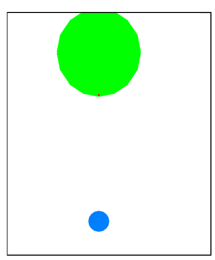

Figure 3: Blue beam emitter at $(0, 0, 0)$. Green absorber at $(0, 4, 0)$. Ray-sphere intersection location is coloured in red. 100% of the photons emitted are absorbed.