

# About Photons and Anti-Photons

by Paul R. Gerber

Gerber Molecular Design, Margaretenweg 14, CH-4310 Rheinfelden

Email: [Paul.Gerber@moloc.ch](mailto:Paul.Gerber@moloc.ch)

- 10.14 Properties of specific particles
- 11. General theory of fields and particles
- 95.30.Sf Relativity and gravitation
- 98.80.-k Cosmology

## Abstract

It is argued that photons and anti-photons are different entities in the sense that they react oppositely to a gravitational field. Explicitly, photons experience a redshift when moving away from a star, and are further red-shifted when moving towards a (supposed) anti-matter star. Analogously, anti-photons gain energy when moving towards a matter-star. However, we are unable to see anti-photons, and thus, cannot observe possible galaxies that are built up of antimatter and shine in anti-light. The ensuing consequence is, that we observe that about half the volume of the universe is not populated by stars, but consist of so-called voids. But, in fact, these voids must contain an equivalent population of anti-stars [1] which consist of anti-matter and, thus, shine by emitting anti-photons which are invisible to us.

## Preliminaries

To every occurring elementary particle there must exist an anti-particle. There are a set of properties that are different for particles and anti-particles, which assume opposite values for the two species. However, some of those properties may have the value of zero, identical for both species. In particular, it is considered common wisdom that for this reason there is no way to distinguish a photon from a anti-photon. Here, we intend to challenge this wisdom. The following considerations are based exclusively on the theory of special relativity, though augmented with the concept of anti-gravitons which yields the correct planetary orbits [2]. In contrast to the claim of the (incorrect [3,4]) ‘Theory of General Relativity’, dispersion of light during its gravitational deflection is a regular effect in special relativity.

## On Anti-Photons

It is generally assumed that a photons antiparticle is again a photon, with identical properties. This (erroneous) believe originates in the analogy to massive spin-one particles, which can be brought to rest and for which then there exist continuous rotations which transfer a given spin state to the one of opposite spin orientation such that every intermediate state is an allowed state. For photons such a

continuous transformation does not exist, which signifies that the two rotation handednesses are actually distinct properties that cannot be transferred to each other (in contrast to massive particles). The reason for this actual classification is that a photon can never be brought to rest, and consequently also has only two polarization states [5].

In addition, it is rather unfortunate that photons are assigned a helicity value, restricted to values +1 and -1, which hides the fact that their angular momentum, which always points parallel to the propagation direction, can assume arbitrary values different from zero. Thus, photons are best characterized by their chirality value, which can assume any positive or negative value, but never zero. This, because for a supposed value of zero there is no photon any more! In this sense photons and anti-photons are different entities distinguished by the sign of their chirality value. Therefore, it is an incorrect statement that photons and anti-photons are the same particles. The sign of a photons chirality value can never change spontaneously, and thus, distinguishes photons from anti-photons.

Furthermore, photons and anti-photons react oppositely to gravitational fields. A field parallel to the movement direction that accelerates a photon decelerates an anti-photon and vice versa for a antiparallel field. Of course, acceleration signifies here an increase of the photons wave number. Furthermore, a field pointing perpendicular to a photons movement direction leads to a change of its propagation direction, again opposite for the two spin orientations.

Clearly, these elementary processes which introduce changes in photon propagation must go hand in hand with changes in the gravitational field in order to obey momentum conservation. The next section describes the corresponding consequences for the elementary scattering events.

A further consequence of the difference between photons and anti-photons is that there must also exist two distinct types of ‘cosmic electromagnetic background radiation’, corresponding to the two photon polarizations.

## **On Partners of Scattering Events**

Graviton conservation requires that the elementary scattering events that lead to gravitational deflection of light consist of simultaneous emission of a graviton and a anti-graviton by a photon, or alternatively to the absorption of such a pair. Further, possible elementary processes are (inelastic) scattering of a graviton or anti-graviton by a light quantum. In earlier work [1] we have estimated that for a light quantum crossing a galactic bulge the probability that graviton and anti-graviton (or any of the above mentioned pairs) of an elementary scattering process originate both from a galactic star is vanishingly small. Thus, the scattering partner of a galactic (anti-)graviton is always a (anti-)graviton from the direction-unspecific cosmic gravitational background radiation (in equilibrium with the corresponding  $2.73^{\circ}$  cosmic electromagnetic analog [6]).

Furthermore, thermal gravitons, having spin 0 [7], are unable to carry away the substantial amounts of angular momentum, needed to provide a recognizable amount of switches from photons to anti-photons. This, in particular, because the momentum possibly carried away by a graviton must also go to zero as its energy tends towards zero [4]. Consequently, spin-flips of photons, caused by the very low-energy thermal gravitons must be extremely unlikely!

## **Conclusion**

It is shown that photons can be distinguished from their anti-particles. The reason for this fact is that they have zero rest-mass, and thus, travel with the speed of light. This property implies that their angular momentum vector (spin 1) has only the two longitudinal components. There is no way to

achieve a change from a spin parallel to the photons moving direction to the antiparallel state, except by going through zero. But a photon with zero angular momentum is no photon anymore. Thus, the two rotation senses actually define two types of photons. This shows up, in particular, in the reactions to a gravitational field, which is always opposed for the two rotation states.

## References

1. Gerber P. R., (2024), Zwicky's Coma-Observation and MOND, viXra:2404.0137
2. Gerber P. R., (2022), Mercury in a Quantum-Gravitational Field, viXra:2212.0038, and (2023), J. Phys. Astron. 11(4), p 333
3. Gerber P. R., (2025), What's Wrong with General Relativity?, viXra:1502.0067
4. Gerber P. R., (2025), On Damping of Light in Cosmos and the Quasar Misunderstanding, viXra:2507.0106
5. <https://en.wikipedia.org/wiki/Photon>
6. Gerber P. R., (2025), Stability of Globular Clusters, viXra:2511.0042
7. Gerber P. R., (2022), Cosmological Redshift from Light Acceleration, viXra:2210.0118