# What is Dark Matter?



*Abstract*

This article conjectures that, more energetic than the cosmic gamma photons, there should exist dark photons and Planck photons. Also, similar to the cosmic microwave background radiation (CMB), there should exist a 'cosmic dark photons background' (CDB). Dark photons may be the particles of the elusive dark matter.

The photon frequency available is continuous and has no upper or lower bound. There is no finite lower limit or upper limit on the possible energy of a photon. However, going by observations, the most energetic photons are the cosmic gamma photons with a wavelength of 10^-15m. The least energetic are the Very Low Frequency (VLF) radio photons with a wavelength of 10^5m.

## PHOTONS - classification as per their wavelengths:

| | |
|---|---|
| Radio photons | 10^5 to 10^-1m. |
| Microwave photons | 10^-1 to 10^-3m. |
| Infrared photons | 10^-3 to 10^-6m. |
| Optical photons | 10^-6 to 10^-7m. |
| Ultraviolet photons | 10^-7 to 10^-9m. |
| X-ray photons | 10^-9 to 10^-11m. |
| Gamma photons | 10^-11 to 10^-13m. |

## *Planck Photons, Dark Photons and Zero Point Photons*

- *Theoretically, the most energetic photon that can exist in the universe will have a wavelength equal to the Planck length (1.6162 x 10^-35 m) and possess Planck energy. One can call this a* ***Planck photon****.*

- *And, a photon with the least energy will correspond to a photon with a temperature close to zero kelvin. This can be termed as a* ***zero point photon*** *(ZPP).*

The cosmic zero point photons (ZPP) are a constituent of the vacuum energy of free space and the spacetime fabric of the cosmos. A vacuum, strictly speaking, is a physical state totally devoid of particles of matter and of radiation (photons). Such a vacuum does not exist in practice.

The CMB (cosmic microwave background) photons have a temperature of 2.7 K, a wavelength of 1.1mm and the density is 411 photons per centimeter cube.

## *Dark Photons*

Photons with frequency or energy more than gamma and less than Planck photons can be called dark photons. They may be the particles of the elusive dark matter.

A *Black Hole* will consist mainly of Planck and dark photons. *A Planck photon will emit MeV, GeV or TeV gamma photons and transform into PeV, EeV, ZeV or YeV dark photons.*

Ordinary matter is matter that emits or reflects radiation or photons, that is, radio photons, microwaves, infrared, visible light, ultra-violet, x-rays or gamma photons.

The photon has several properties that distinguish it from all other subatomic particles. It is the only elementary particle wherein a high-energy photon can transform /split into two or more low energy photons (down-conversion) and vice versa (up-conversion). This transformation conforms to the laws of conservation of momentum and of energy.

A photon down-converter is a device that splits a high-energy photon into two or more low-energy photons. When a photon reaches the down-converter, it excites an electron into a higher energy level. But the electron returns to its ground state via an intermediate energy level, and emits a lower energy photon at each stage. Three-photon down-conversion is also observed. A visible-light photon (wavelength 405 nm) splits up into two infrared photons (wavelength 810 nm).

Photon up-conversion is a process which occurs when a material is photo-excited by two or more low-energy photons resulting in the emission of a higher energy photon.

Semiconductors with radiatively efficient impurities can potentially act as up or down-converters. A crystal of beta barium borate (BBO) can split an ultraviolet photon of wavelength 390 nm into two infrared photons of wavelength 780 nm. The two down-conversion photons have orthogonal polarization.

In the Sun, a gamma photon in the radiation zone, on its way to the photosphere, transforms into a hundred thousand visible light optical photons during its journey through the turbulent conduction zone.

## *Spacetime*

*Spacetime is an ideal photon gas consisting of Planck photons, dark photons, gamma photons, X-ray photons, ultraviolet photons, visible light photons, infrared photons, microwave photons, radio photons and zero point photons. The statistical distribution of these photons will depend on the spacetime curvature or the photon energy momentum density.*

## The Cosmic Photon Background Radiation [1,2] consists of:

Cosmic *Radio* photons background radiation (CRB)
Cosmic *Microwave* photons background radiation (CMB)
Cosmic *Infrared* photons background radiation (CIB)
Cosmic *Optical* photons background radiation (COB)
Cosmic *Ultraviolet* photons background radiation (CUVB)
Cosmic *X-ray* photons background radiation (CXB)
Cosmic *Gamma* photons background radiation (CGB) and the

Cosmic *Dark* photons background (CDB) besides the

Cosmic *Neutrino* background (CNB or CvB)

The cosmic microwave background radiation at millimeter wavelength was the first to be discovered and has been extensively studied. A dark photon is like a tiny black hole and does not reflect radiation like ordinary matter does. We live in a sea of dark photons.

The CDB might never be observed directly. However, a dark photon when it moves from a stronger to a weaker gravitational field will undergo down conversion into gamma photons which further results in an electron-positron pair creation.

The first results from the space-borne Alpha Magnetic Spectrometer (AMS-02) confirm an unexplained excess of high-energy positrons in Earth-bound cosmic rays [3]. Positrons are originating from all parts of the sky equally, to 95 percent likelihood—meaning their flux is isotropic.

“We live in a sea of dark matter,” says Michael Salamon, who runs the AMS program for the U.S. Energy Department.

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