

## IYL 2015 : CELEBRATING THE PHOTON

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### Prologue

In the celebration of 2015 as the International Year of Light and Light-based Technologies (IYL 2015) on the basis of the UN General Assembly Resolution No. 68/221 Dated 20 December 2013 ([www.light2015](http://www.light2015)), the term 'photonics', which rhymes with 'electronics', is the key theme. Just as electronics is the science and technology of electron, the well-known constituent of matter and the source of electricity, photonics is the science and technology of a particle called 'photon'. In the language of modern science, photon is the quantum or particle of light. Light is used for various purposes beginning with everyday household activities to food production and preservation, computing, telecommunication, fabrication technologies, health sciences, study of cosmos, research into fundamental structure of matter, etc. etc. Almost everyday, new applications of light are coming up. Looking at the current and emerging scenario it is felt that photonics is likely to dominate the developments in the present century similar to electronics dominating the twentieth century. The purpose of the article is to take a simple look at some interesting characteristics of photon, the hero of the IYL 2015 celebration. We will see that photon not only constitutes light it also plays a key role in sustaining life as we know.

### The Photon Story

Let us begin the story with the simplest of the atoms namely the hydrogen atom, which is composed of a single positively charged proton and a single negatively charged electron kept together but separated by the Coulomb force of attraction. In modern (quantum) science, the Coulomb force is said to be mediated by a particle or quantum called photon, the same one referred to above. Photon is thus the carrier of the Coulomb force or what is more generally known as electromagnetic force. Though photon is not a constituent particle like electron or proton, it is the one that bonds the electrons in an atom with its nucleus and makes the atom possible. Photon is a fundamental particle in its own right and its properties are determined by the characteristics of the electromagnetic force, which is considered as one of the four fundamental forces of nature.

Photon is the generic name given to 'energy quantum' or 'quantum of radiation' or 'atom of radiation' or 'particle of radiation'. Max Planck in his attempt to explain the behaviour of radiation of a black body in 1900 had, for the first time, assumed that electromagnetic radiation is emitted and absorbed by the walls of the black body in packets of energy of definite amounts (which he called 'energy elements') instead of continuously in the form of electromagnetic waves as has been the thinking till then. His successful re-conceptualization of energy was extended by Einstein in 1905 to explain the phenomenon of photoelectric effect (emission of electrons by metals when electromagnetic

