

The Dispersion of the Light by a Prism of Glass

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José Francisco García Juliá

jfgj1@hotmail.es

The dispersion of the white light by a prism of glass in its constituent colors proves that the light is a wave and not particles.

Key words: wave.

When the white light passes through a prism of glass, it separates in its constituent colors, from the red to the blue. The speed of the light is $v = c/n$, where c is the velocity of the light in the vacuum (a constant speed) and $n = \sin \varphi_1 / \sin \varphi_2$ the index of refraction (respect of the vacuum, $n = 1$; Snell's law of refraction: $n_1 \sin \varphi_1 = n_2 \sin \varphi_2$, with $n_1 = 1$ and $n_2 = n$), φ_1 and φ_2 being the angles of incidence and refraction, respectively.

The energy of the light is $E = hf$, where h is the constant of Planck and f the frequency of the wave. The blue color has more energy than the red color, then the frequency of the blue is greater than the frequency of the red. As $c = \lambda f$, where λ is the wavelength, then the wavelength of the red is greater than the wavelength of the blue.

Therefore, the wave of the red color interacts less with the atoms of the prism of glass than the wave of the blue color. The red ray is deflected less than the blue ray, then the refraction angle of the red is greater than the one of the blue, and the index of refraction of the red is lesser than the one of the blue. Hence, the speed of the red is greater than the speed of the blue. As all the colors are in the same wave front, at a given time the red cover a greater distance inside of the prism than the blue, which explains the separation of the colors (in the form of a fan) in the figure of dispersion (or spectrum of colors).

This physical phenomenon cannot be explained suitably if we consider that the light is formed by particles (photons). Naturally, when the wavelength of the light is very short (very high frequency; that is, very high energy), the light looks like particles (photons), which is the case of the gamma rays (or gamma photons).

In summary, the dispersion of the white light by a prism of glass in its constituent colors proves that the light is a wave and not particles.