# Lightwaves, Not Photons

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In the latter part of the 19th century, it was believed that light was a wave-type phenomenon, and that an invisible light-conducting medium was required through which the waves could propagate, since, *by definition*, waves are cyclic deformations that propagate through light-conducting mediums, thus mandating the existence of such a medium. In 1905 Einstein published a paper entitled "On a Heuristic Point of View Concerning the Transformation of Light". In this paper he introduced the concept that rather than being a wave-type phenomenon, light actually consisted of particles, commonly referred to as "photons;" however, he did not give up the concept of wavelengths being associated with the photons. This hybrid definition of light, i.e., that it consists of particles with various wavelengths, has resulted in a confused understanding of light, permitting relativists to believe that a light-conducting aether was not required since light actually consisted of particles and hence waves were not required for their transmission. The purpose of this paper is to point out that light is a wave-type phenomenon in every respect, and that an aether is still a scientific requirement for its transmission.

## 1. Introduction

In the latter part of the nineteenth century, it was widely believed that light consisted of waves that traveled through an as-yet undetected universal medium referred to as the "luminiferous aether" or, simply the "aether" for short. The fact that light consisted of waves was not contested by anyone: its numerous wave-type properties, which include such characteristics as "dispersion" (i.e., the splitting of a lightbeam into its separate colors when passed through a prism), "diffraction" (i.e., the bending of light around an obstacle), and "interference" (i.e., the phenomenon of "standing waves""), confirmed, without question, that light was a wave-type phenomenon.

During this same period of time, a phenomenon known as the photoelectric effect was being investigated. The photoelectric effect consists of the emission of electrons from certain "photoemissive" metals when light is incident on the metals. During these investigations it was found that, in some respects, the photoelectric effect seemed to exhibit certain properties that could not be satisfactorily explained by a wave-type explanation of light.

At the time this phenomenon was being investigated, metallic conductors were believed to consist of a lattice of positive ions, permeated by a swarm of free electrons in random motion. It was further believed that a free electron within the metal could not normally pass through the surface of the metal because of a potential barrier—or potential difference—between the interior of the metal and the surrounding space. However, when light of sufficiently short wavelength was incident on the surface of the metal, some of the free electrons would instantaneously acquire sufficient energy from the light to penetrate the barrier and escape.

## 2. The Wave Concept of Light

Although the wave concept of light was capable of explaining this effect in a general way, it did not seem to provide satisfactory explanations for two specific properties of the effect. For example, it was assumed that the incident light provided the kinetic energy possessed by the escaping electrons. However, the maximum velocity of escaping electrons was of such great magnitude that it would have required the electrons to somehow collect the kinetic energy of the incident light wavefront on an area several million times greater than the cross section of an atom; or, similarly, estimates were that a time of about 100 seconds would be required for lightwaves to provide enough kinetic energy to eject electrons at their observed velocities, yet this had to happen almost instantaneously (i.e., within one cycle of a lightwave), a seemingly impossible requirement. And secondly, it was observed that lightwaves of shorter wavelengths ejected electrons at greater velocities than lightwaves of longer wavelengths: a seemingly improbable condition.

In an effort to resolve these problems, Einstein, in 1905, published a paper in the German scientific journal *Annalen Der Physic*, entitled "On a Heuristic Point of View Concerning the Production and Transformation of Light" [1]. This is generally referred to as Einstein's seminal paper on the photoelectric effect. In this paper, since he did not believe in the existence of a light-conducting medium and therefore did not understand the true nature of lightwaves, he attempted to describe light in an unusual way. Rather that assuming lightwaves contained only kinetic energy that was distributed over a wavefront, he theorized that light still consisted of waves, but that the waves consisted of energy in the form of "energy quanta," a nebulous term that was never clearly defined. In the intervening years, persons unknown have referred to those "energy quanta" as "packets," or "bundles" of energy, which have, in turn, metomorphosised the general understanding of light from consisting of waves, to consisting of "particles," commonly referred to as "photons."

All the difficulties encountered in explaining the various properties of the photoelectric effect with the wave concept of light were theoretically overcome with this new—what we shall call the "photon" concept—as follows:

1. It was assumed that the shorter the wavelength (or the higher the frequency) of the incident light, the greater the energy of the photons comprising it was assumed to be; thus higher frequency waves naturally imparted greater velocities to ejected electrons than lower frequency waves.

2. It was assumed that when a photon struck an electron, it imparted all its energy to the electron, and the photon then ceased to exist.
3. It was not necessary to wait for energy to accumulate when a lightbeam struck a photoemissive surface because a single photon, colliding with an electron, would immediately provide the necessary energy for the electron to escape.

Although the above listed explanations seemingly provided an explanation for the photoelectric effect and eventually became accepted, they did not—in fact—explain anything that was not already known. It was known that the energy required to eject an electron was delivered by the incident light, and that the energy was delivered within one cycle of the lightwave; therefore it was obvious that one cycle of the lightwave had to contain the necessary energy to eject the electron. Furthermore, since it was observed that shorter wavelength lightwaves ejected electrons at greater velocities than longer wavelength lightwaves, that characteristic was also well known. Therefore, all Einstein did was restate that which was already known by substituting the term "energy quanta" for the term "lightwave." However, the question that needed to be answered was—What is the form of the so-called "energy quanta" contained within a lightwave that will explain why shorter wavelengths eject electrons at higher velocities than longer wavelengths? By using the undefined term "energy quanta," Einstein, as well as all others that followed, apparently assumed that it was the simple kinetic energy of a single particle comprising a wave that provided the energy required to eject electrons. Therefore, when the "energy quanta" concept eventually became accepted as the "photon" concept, an impossible dual concept of light came into being: it is presently assumed that light still behaves as a wave insofar as its propagation is concerned, but that it behaves as a particle insofar as its interaction with physical matter is concerned.

Unfortunately, because Einstein did not grasp the concept of a physical aether within which lightwaves propagated, he was unable to see that the properties of the "energy quanta," or "photons," were readily explained in a rational manner as natural properties of lightwaves. In the discussion that follows, the hypothesized light-conducting medium previously referred to as the "aether" is referred to as the "Universal Energy Field" (UEF), as defined in Chapter 18 of the book, **Einstein and The-Emperor's-New-Clothes Syndrome** [2]. The manner in which lightwaves traveling through the UEF explain the photoelectric effect is as follows.

In order to rationally explain these properties, we must first consider the nature of the forces that act on charged subatomic particles—such as the electron—within photo-emissive materials. These are continuous, or so-called "dc" electrostatic forces, and it is these forces within photoemissive materials that must be overcome in order for electrons to be ejected.

In addition, it should be noted that lightwaves consist of cyclic, or so-called "ac" modulations in the form of alternate compactions and rarefactions of UEF field particles that are superimposed on the otherwise uniform distribution of energy within the UEF: a modulation that also superimposes on dc electrostatic fields, which are themselves composed of particular configurations of the UEF. Now, it should be noted that this ac modulation constitutes an internal energy within each lightwave, which is in addition to the rather minute kinetic energy possessed by the lightwave wavefront. Therefore, it is this ac modulation that must provide the energy required for the ejection of electrons from photoemissive materials. Although Einstein had no idea that this energy was an integral part of the UEF, it is, nevertheless, the energy he referred to as "energy quanta," which he assumed existed as separate and discrete "energy quanta" within an otherwise empty space. And finally, we must note that the only property of waves that increases with frequency is the rate-of-change of their waveform; therefore this is the property that must account for the correlation between increasing lightwave frequency and increasing electron-ejection velocity.

With these understandings, then, the rational explanation for the properties of the photoelectric effect, utilizing the intrinsic properties of lightwaves to account for those properties, is as follows:

The lightwave ac modulation of the UEF that impinges on the surface of photoemissive materials is superimposed on the dc electrostatic fields within the photoemissive materials, thereby causing cyclic forces to be exerted on the electrons within those dc fields which cause the electrons to vibrate in a cyclic manner. Now, an electron that is so affected will change its position in accordance with the lightwave waveform, and the instantaneous, cyclic velocity of the electron will be determined by the rate-of-change of that waveform (recall that velocity is defined as rate-of-change of position). In addition—since the kinetic energy of an electron is a function of its velocity—the kinetic energy of the electron will also vary as a function of the rate-of-change of the waveform, resulting in cyclic energy of the electron that increases directly with lightwave frequency.

Now, within a photoemissive material, there will exist a threshold frequency at which the cyclic energy imparted to free electrons by one cycle of incident lightwave modulation will be just sufficient on the rarefaction, or "ejection-half" of the light cycle, to overcome the potential barrier of the material and eject the electrons. Furthermore, as the frequency is increased above this value, the ejection velocities of electrons will likewise increase due to the increasing electron energy produced by the increasing rate-of-change of the lightwave waveform.

These properties of lightwaves, then, rationally explain why electrons are ejected within one cycle of a lightwave, and why shorter wavelengths of light eject electrons at higher velocities than longer wavelengths. Furthermore, since the energy imparted to the electrons comes from the modulation energy of a wave, there is no need for anything physical to cease to exist upon imparting its energy to an electron, as it is assumed must happen to the photon.

As previously stated, it is only because of the influence of relativity—which contends that a universal medium does not exist—that it has not been possible to envision how the properties of lightwaves can more rationally account for the properties of the photoelectric effect than do the properties of vague, undefined "energy quanta," or "photons."

For the foregoing reasons, it is concluded that the particle, or "photon" concept of light is specious, and that light is purely a form of wave motion. It is simply a matter of common sense to seek rational explanations for physical phenomena that clarify, rather than confuse the understanding of the physical world.

## 3. Conclusion

Although the above discourse reveals that Einstein's concept that light consisted of particles, called "photons," was—in essence—meaningless, one is confronted with the fact that Einstein was awarded a Nobel Prize in 1921 for his ostensible discovery of the law of the photoelectric effect. However, the reason why this discovery was awarded the Nobel Prize is as follows.

In 1919, Einstein became world-famous, primarily because of the ostensible corroboration of his relativistic prediction that lightbeams would be deflected by gravitational fields; a prediction assumed to have been confirmed by the classic, so-called light-bending experiment performed in that year by the astronomer Sir Arthur Eddington. For this reason, in 1921, the Nobel Committee for Physics felt compelled to award him a Nobel Prize for his ostensible great achievements. Now, both Einstein's first relativity paper and his photoelectric paper were published in the year 1905, and it was felt that the theories expressed in one of those papers should be awarded the prize. However, although the theory of relativity was by far the most well-known of the two, the members of the Nobel committee did not award it the prize since they were reluctant to reward a theory that was based on mere, unverifiable "speculations," as explained in Chapter 9 of the aforementioned book [2]. For this reason, then, the prize was awarded for the ostensible explanation of the photoelectric effect, not because Einstein's interpretation of the effect had been verified as fact, but simply as a sop to Einstein in honor of his ostensible great achievements.

It can be seen, then, in spite of the fact that neither of Einstein's two theories of relativity have ever been confirmed as fact (nor have they as-yet been accepted as being impossible), and although his explanation of the photoelectric effect, rather than clarifying the nature of light, resulted in a confused understanding of the phenomenon that has inhibited the rational progress of science for the last 100 years, the unwarranted awarding of the Nobel prize to Einstein contributed immensely to the unwarranted belief that Einstein must be a genius, causing essentially the entire scientific community to fall victim to the Emperor's-New-Clothes syndrome and revere him as both the greatest scientist of all time and the man of the 20th century, when, in fact, he was the greatest charlatan ever to masquerade as a mathematician or scientist.

In addition, it is realized that those staunch relativists who were present during the presentation of this paper today did not make any attempt to evaluate the rational, common sense explanations presented in the paper, and therefore their attendance today has been a complete waste of their time.

## References

[ 1 ] Albert Einstein, "Über einen die Erzeugung und Verwandlung des Lichtes betreffenden heuristischen Gesichtspunkt" (On a Heuristic Point of View Concerning the Production and Transformation of Light), *Annalen Der Physic* **17** (6): 132–148 (1905).

[ 2 ] Robert Henderson, **Einstein and The-Emperor's-New-Clothes Syndrome** (BookSurge Publishing, 2007).