SRYAHWA PUBLICATIONS

Open Access Journal of Physics
ISSN: 2637-5826 | Volume 8, Issue 2, 2026
https://doi.org/10.22259/2637-5826.0802007

RESEARCH ARTICLE

Light Waves – A Further Proof they are Particles

Donald C. Aucamp, ScD

Professor Emeritus, Southern Illinois University at Edwardsville, USA.

Received: 08 April 2026 Accepted: 23 April 2026 Published: 28 April 2026

Corresponding Author: Donald C. Aucamp, ScD, Professor Emeritus, Southern Illinois University at Edwardsville, USA.

Abstract

Photons have been shown in prior papers by this author to be wafer thin atomic sized particles which are single electric field corpuscles in the shape of washers. They therefore are not waves, though diffraction grating experiments seem to conclude otherwise in certain situations. Also, it has been shown in these papers that the experimental wavelengths determined in diffraction grating experiments are not the nonexistent wavelengths of the arriving photons, but rather are the lengths of the photons as they exit from the grating. These exiting lengths are significantly larger than the arrival values. Moreover, it has been proved that the independence assumption in the standard wavelength calculations is in error. In this current work it is shown that the photon arrivals in diffraction grating experiments are much too small to have the wavelengths which are determined from them, so that it is once again concluded that photons are particles.

1. Introduction

Photons have been shown in Aucamp[1-7] to be atomic sized, spinning, single electric field particles in the shape of wafer thin washers which move at the velocity of light orthogonal to their orbital plane. In contradiction to this theory, light has for a very long time been assumed to be a wave, except when certain diffraction grating experiments indicate it is a particle. This contradiction has given rise to what is known as the wave-particle paradox, a problem which has been unresolved for a very long time until this author's recent works.

In contrast to the standard wave theory of light, the particle theory analyzed in [1-7] is very hard to accept because it contradicts long-held views and the apparent results of spectroscopy. However, strong support for it is that it leads to irrefutable formulas for Planck's constant, the photoelectric effect, and the structure of the periodic table. In addition, it is explained in these works why spectroscopy experiments correctly indicate the identities of the sources. It is also shown that experimental wavelengths are in fact the photon lengths after they exit from the grating, values which are significantly greater that the arrival lengths.

The objective of this work is to further confirm that photons cannot be waves because they have lengths which are significantly smaller than the lengths which are indicated by the results of diffraction grating experiments.

2. Background Theory

The background theory employed in this work is developed in [1-7]. In the following summary analysis of certain aspects of these works it will be assumed that an electron in a given atomic orbit of an element with radius r=A is knocked out of orbit and that an electron from an outer orbit of the same element with radius r=B moves to replace it. Though it is shown that electrons actually exist in pairs in all stable atoms, it is proved in [1-7] that the assumption of single emissions yields the same results, if properly interpreted.

The following three equations are due to Bohr[8], where V, K, and U are the velocity, kinetic energy, and potential energy respectively, of an electron in orbit:

$$V = [k_0 / (mr)]^{1/2} \quad (2.1)$$

Citation: Donald C. Aucamp, ScD. Light Waves – A Further Proof they are Particles. Open Access Journal of Physics. 2026; 8(2): 102-105.

$$K = m V^2 / 2 = k_0 / (2r) \quad (2.2)$$

$$U = \int_{\infty}^{r} f\,dr = \int_{\infty}^{r} (k_0 / r^2)\,dr = -k_0 / r \quad (2.3)$$

The constant, k_0 is given by $k_0=e^2/(4\pi\varepsilon_0)\approx 89.8755$. In addition to this theory a law of atomic radii is derived in [1-7] as follows:

$$r = n^2 r_0 \quad (2.4)$$

In this law n is a positive integer and $r_0 \approx .0529$ nm , which is the Bohr radius of the smallest atomic element. Thus, $A=n_A^2 r_0$ and $B=n_B^2 r_0$. In the photon emission process the radiated energy, E, in an electron move from r=B to r=A is given from Bohr as follows:

$$E = (k_0/2)\,(1/A - 1/B) \quad (2.5)$$

Since A<B, it is seen that E>0. Also, from (2.1):

$$V_B / V_A = (A / B)^{1/2} \quad (2.6)$$

Since B>A it is clear from (2.6) that $V_B<V_A$, which might seem strange because the emission radiates energy. The reason for this is due to the potential energy gained in the move. Since E>0 in (2.5), energy is radiated outward. The reader is directed toward [1-7] for more detail.

In addition to the above equations a photo-electric law which amends Einstein's [9] theory is derived in [1-7] as follows:

$$ET = h\,(n_B-n_A) \quad (2.7)$$

Even though photons have no frequency, if a variable, f, is defined as f=1/T, then (2.7) is equivalent to $E=hf(n_B-n_A)$. It is therefore noted that (2.7) differs from Einstein's photoelectric formula, which is E=hf. It is argued that the Einstein result is not totally valid when $n_B-n_A>1$ because in this case more energy is radiated and the process takes more time, so E>hf. While it may generally be the case that $n_B-n_A=1$, it is argued this may not always be true. Also, in [1-7] a valid formula for h is derived as follows:

$$h = 2\,\pi\,(m r_0 k_0)^{1/2} \quad (2.8)$$

Moreover, if L is the thickness of the washer, the emission time T can be ascertained by assuming the photon moves at velocity v. Thus:

$$T\,v = L \quad (2.9)$$

Thus, if the photon moves at the velocity of light, then:

$$T = L / c \quad (2.10)$$

It is interesting that the formula for h as given by (2.8) was determined by Bohr in another form in his correspondence principle theory, in which he combined his planetary model with quantum mechanics in the special case when $A=n^2r_0$, $B=(n+1)^2r_0$, and $n\to\infty$. However, Bohr in his analysis postulated the validity of the photoelectric effect, which was not done in deriving (2.8). In addition, he also placed severe requirements on A and B.

Very important, this theory contradicts Einstein's conclusion that his formula covers all radiation. It clearly does not apply to radiation caused by externally accelerating charges, such as is the case with radio waves.

3. Wavelengths, Assuming They Exist

It is reiterated that photons are, from [1-7], particles and not waves. However, in contradiction to this contention, it will be assumed in the analysis given below that photons are waves. Then, with this assumption, the equation for the photon wavelength λ must satisfy the following, where v is its velocity and T is its period:

$$\lambda = v\,T \quad (3.1)$$

It will also be assumed in this analysis that the photon emission stems from a given element, in which an electron is emitted from row n_A and is replaced by an electron from row n_B , where $n_B>n_A$. If the atomic numbers of these two electrons are A and B, then from (2.4):

$$A = n_A^2\, r_0 \quad (3.2)$$

$$B = n_B^2\, r_0 \quad (3.3)$$

Since from (2.7) $ET = h\,(n_B-n_A)$, then $T = h(n_B-n_A) / E$. Thus, from (2.5):

$$T = h\,(n_B-n_A) / [\,(k_0/2)\,(1/A - 1/B)\,] \quad (3.4)$$

Then, from (3.2) and (3.3), $T = h\,r_0\,(n_B-n_A) / [\,(k_0/2)\,[1/n_A^2 - 1/n_B^2]$. Thus, from the above results and a little algebra, the wavelength, λ , is given as follows:

$$\lambda = v\,T = (2vhr_0/k_0) / [(1/n_A^2 - 1/n_B^2)] \quad (3.5)$$

This equation will now be used to prove that photons are much too small to result in the kind of waves which are calculated in diffraction grating experiments. Thus, they are the particles given in [1-7]

4. Proof That Light is Not a Wave

In this analysis several assumptions concerning the variable parameters in the wavelength equation for λ in (3.5) will be made, and it will be seen that the resulting value of λ is far too small to be a feasible result of any diffraction grating experiment. It will also be seen that any reasonable variation of these assumed parameter values will likewise result in the same conclusion, so that the proof that photons are not waves will be complete.

Specifically, it will be assumed that an electron is ejected from an element from row n_A and an electron from row n_B moves to fill its place, and it is further assumed that $n_B=n_A+1$. Thus, the variable term in (3.5) is evaluated as follows:

$$1/n_A^2 - 1/(n_B^2) = 1/n_A^2 - 1/(n_A+1)^2 \quad (4.1)$$

If it is also assumed $n_A=1$, then

$$1/n_A^2 - 1/(n_B^2) = 3/4. \quad (4.2)$$

If it will be further assumed that v=c, then from (3.5)

$$\lambda = (2chr_0/k_0) / (3/4) = 8chr_0 / (3k_0) \quad (4.3)$$

The above result for the value of λ is evaluated by setting $c=3x10^8$, $h=6.826x10^{-34}$, $r_0=5.29x10^{-11}$, and $k_0=e^2/(4\pi\varepsilon_0)=89.8755$. On inserting these values into (4.3) the result is:

$$\lambda = (2chr_0/k_0) / (3/4) = 3.214 \times 10^{-37} \quad (4.4)$$

From this result it will be argued that photons, in general, are not waves.

First, it is noted that λ in (4.4) is miniscule compared to the results of diffraction grating experiments, which are approximately in the neighborhood of from 100 to 1000 nm. Second, it is argued that any reasonable variation in the assumed parameter values of n_A, n_B, and v in (3.5) would still result in a value of λ that is miniscule compared to the value actually obtained in any experiment. This result is primarily due to fact that hr_0 in this equation is calculated as $hr_0 \approx 3.6x10^{-45}$, which is an extremely small number. Thus, from this argument, the value of λ as given in (3.5) will generally be significantly smaller than the experimental wavelength, and it is therefore concluded that photons are not waves.

5. Conclusions

This work is primarily concerned with extending the theory in Aucamp[1-7] to further prove that photons are particles and not waves. Briefly, electrons in atomic orbit are shown in these papers to be strings which exist in pairs in such a way that the fields created by them when they orbit a nucleus are constant in space. Thus, there is no radiation. From this central idea many results accrue, such as the derivations of the photoelectric effect, Planck's constant, and the structure of the periodic table. Also, it is explained in these papers how atoms radiate and what is the shape of the resulting photons. In these works it is assumed that an emission occurs when an electron pair is knocked out of orbit, and a pair from an outside orbit moves to replace it. It is also shown that single electron emissions yield identical results, if properly interpreted.

It is further shown in these works that photon emissions are essentially in the shape of very thin washers which move at the velocity of light normal to the atomic orbital plane. These washers are single electric field corpuscles with very small thicknesses. They have a radius equal to the radius of the emitting atomic orbit (called A in this work), and have a thickness of L=cT, where T is the period of time actually spent radiating. As it is shown that L/A is an extremely small number, the shape of a photon is essentially that of a very thin washer. Since photons have no frequency and therefore no wavelength, it is not surprising that experiments never actually measure frequencies.

In this present work it is proved that photons cannot be waves because, if they were, they would have wavelengths which are much too small to agree with the results of diffraction grating experiments. So it is therefore concluded that photons are particles and not waves.

Finally, as it is argued that quantum mechanics was developed, at least in part, because of the need to explain the lack of orbital radiation in Bohr's atom, from the results of [1-7] the wave function is no longer needed.

6. References

1. Aucamp, D.C. (2023),"A Non-Radiating Atomic Electron Model with an Application to Molecular Structure and the Periodic Table", Open Access Journal of Physics(OAJP), V5(1), pp. 01-08.
2. Aucamp, D.C. (2023),"An Alternative to Quantum Theory, Photon Radiation, Entanglement, Photon Structure, the Wave-Particle Paradox, and Einstein's Photoelectric Effect", OAJP, V5(1), pp. 10-14.
3. Aucamp, D.C. (2023), "Proofs of the Law of Atomic Radii and the Atomic Numbers of the Noble Elements", OAJP, V5(1), pp. 15-17.
4. Aucamp, D.C. (2023), " A Disproof of Einstein's Photoelectric Contention That Maxwell Emissions are Photons, with an Application to the Resolution of the Wave-Particle Paradox", OAJP, V5(2), pp. 1-3.
5. Aucamp, D.C. (2025), "The Details of the Photon Emission Process and a Derivation of the Formulas for Planck's Constant and the Photoelectric Effect", OAJP, V8(1), pp. 1-5.

6. Aucamp, D.C. (2026), “A Proof that Diffraction Grating Experimental Wavelength Conclusions are in Error”, OAJ P, V8(2), pp. 1-3.

7. Aucamp, D.C. (2026), “A Resolution of the Wave-Particle Paradox”, OAJP, V8(2), pp. 41-45.

8. Bohr, Niels, (1913), “On the Constitution of Atoms and Molecules (3 papers): Part I, Part II, Part III”, Philosophical Magazine 28.

9. Einstein, A. (1905), ”Zur Elektrodynamik bewegter Korper”, Annalen der Physik, 17, 891 (translation in The Principal of Relativity, Dover).