Light Transmission, Reflection, Refraction and Interference as Scientific Evidence of God

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Abstract

The microscopic mechanism underlying transmission of light in transparent media is still unknown. The Ewald-Oseen extinction theorem is an attempt to explain it mathematically but not very convincing. In this paper, we present a new explanation to the phenomena of light transmission in transparent media, light reflection and refraction. The mystery of 'where the energy goes' during destructive interference of light will be revealed.

Introduction

The behavior of light has perplexed scientists for centuries, despite the apparent advance in theoretical physics. For example, the constancy of the speed of light in vacuum is still a subject of debate and is confusing researchers and laymen alike, more than a century after it was proposed by Albert Einstein. If the nature and behavior of light in vacuum is still not fully understood, how can one hope to completely understand the behavior of light interacting with matter ?

Transmission of light in transparent media

One of the less understood light phenomena is the transmission of light through transparent media such as glass and water. We know that light travels in glass with a speed less than its vacuum speed, by a factor of the refractive index (n) of glass. However, when one tries to understand this phenomenon microscopically, one finds no way to figure out an explanation. As the Wikipedia article [1] describes it, the wave inside the glass is a superposition of the incident wave and the wave emitted from electron oscillations (due to their interaction with the incident wave). Both waves individually propagate at the vacuum speed of light (c), but the only wave known to be propagating through the glass is one with a reduced speed (c/n). There is no logical way of understanding why two waves with velocity c interfere to create a resultant wave with velocity c/n.

The Ewald-Oseen extinction theorem attempts to explain this mathematically, but not convincing. A number of authors have expressed this. A paper[2] describes the dissatisfaction of the author with this theorem.

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" . . . The Ewald-Oseen theorem resolves this paradox by showing how the oscillating electrons conspire to produce a field that exactly cancels out the original beam everywhere inside the medium. The net field is indeed the sum of the incident beam and the radiated field of the oscillating electrons, but the latter field completely masks the former.

Although the proof of the Ewald-Oseen theorem is fairly straightforward, it involves complicated integrations over dipolar fields in three-dimensional space, making it a brute-force drill in calculus and devoid of physical insight. "

One can also see that the Ewald-Oseen proof is based on classical Maxwell's equations, which are basically based on the ether. The proof threats light as a classical phenomenon (ether), but we know that light is a quantum phenomenon, according to which a photon is only absorbed by a single electron.

Also light passing through transparent media is transmitted almost completely unchanged (in wavelength). Some authors have described this as a "miracle".

Another article [3] describes the problem as follows:

" . . . If windows are made of zillions of randomly arranged excitable molecules, then windows cannot be transparent. That's what I would predict.

The first optical miracle is that windows are transparent. "

Other articles[4][5] express similar ideas, respectively:

" . . . the "miracle" by which the radiation from many induced molecular dipoles conspires to produce a single wave propagating at the reduced speed . . . "

" . . . The convoluted combination of reflection and transmission explains why light moves more slowly through solids than through the air or through a vacuum. "

The Wikipedia article [1] expresses similar ideas:

" . . . When light traveling in vacuum enters a transparent medium like glass, the light slows down, as described by the index of refraction. Although this fact is famous and familiar, it is actually quite strange and surprising when you think about it microscopically. "

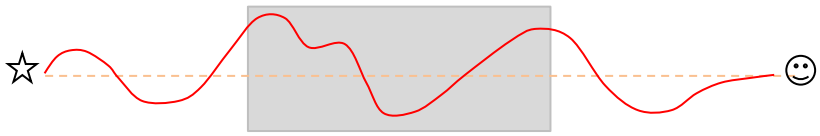
" . . . Yet when the waves are added up, they surprisingly create *only* a wave that travels at the slower speed. "

Transmission and refraction of light in transparent media as scientific evidence of God

This author has proposed a novel theory [6][7] underlying quantum phenomena such as the photon/electron interference patterns in double-slit experiments, the "Which-Way" experiments, "wave function collapse" and quantum entanglement. The new theory proposes a new *internal dynamics* of quantum particles such as electrons and photons.

According to the new theory, each photon in a double-slit experiment is aimed at a particular point on the detecting screen, at the instant of light emission. The *initial conditions* of each photon is *fine-tuned* at the instant of emission, so the path of the photon is predetermined at the instant of emission.

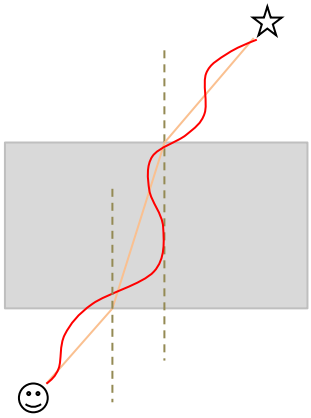
This same theory can be applied to explain the phenomenon of transmission of light through transparent media, such as glass, and the refractive index. The initial condition of each photon is fine-tuned at the instant of emission, so the photon follows a curved path while passing through the glass. The path length of the photon is such that it is exactly as if the speed of light in the glass has reduced by a factor of the refractive index of glass.



The new theory predicts that light generally travels in curved paths and hence the measured speed of light is only the average value, whether in vacuum or in transparent media. Light travels in straight line only on average. The instantaneous velocity of light can be subluminal or superluminal. This unconventional behavior of light is *fundamentally inaccessible* to experiments.

This raises the question : what/who fine tunes each photon at the instant of emission?
God fine tunes the *initial conditions* of each and every photon emitted in the universe so that light behaves in the way we know it to behave in the different light speed and quantum experiments.

The same theory applies to refraction of light, as shown below. Note that the orange line shows the conventional path of light and the curved line path shows the actual path of light.



Reflection of light

Basically, a similar argument as above applies to the phenomenon of light reflection from a mirror. It is well known from classical optics that the angle of incidence is equal to the angle of reflection. Again, the standard explanation for this is classical, basically based on ether theory, which is implicit in Maxwell's equations. But we know that photons and electrons are quantum particles, and a photon incident on a reflective surface is absorbed and re-emitted by a single electron. With this view, it is not clear why the angle of incidence and reflection should be equal.

In this paper, a new explanation for light transmission in transparent media and light reflection is proposed.

Interference of light

The phenomenon of the interference of light is even more intriguing. For example, where does the energy go during destructive interference of light? Do photons emitted from the source travel to the screen where they are 'destroyed' due to destructive interference, which would imply non-conservation of energy? The mystery is that photons are not emitted from the source during complete destructive interference. That is, if there is going to be a complete destructive interference at a certain point on the screen, no photons are emitted towards that point. See the APPENDIX for the detail discussion.

Glory be to God and to His Mother, Our Lady Saint Virgin Mary

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APPENDIX

Destructive Interference of Light - Where Does the Energy Go?

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Abstract

We already know the unconventional and inexplicable behavior of light/photons (and other quantum particles such as electrons) in the Which-Way quantum experiment and entanglement phenomena. In this paper we propose another quantum experiment using a Michelson interferometer. We start with an 'elementary' thought experiment. Suppose that a Michelson interferometer is set up so that the two light beams undergo complete constructive interference, with a single bright spot. Then the distance of one of the mirrors is slightly adjusted for a complete destructive interference: the bright spot disappears. The puzzle is: where does the light go? We suspect that, just like nature does not allow us to know which slit a photon has passed through in the double-slit experiment, nature may not allow us to know 'where the light goes' in the case of (complete) destructive interference. Although nature may not allow a direct measurement, we can understand by reasoning 'where the light goes' during complete destructive interference. This paper reveals the mystery. A simple quantum experiment based on the Michelson interferometer is proposed.

Introduction

The behavior of quantum particles such as photons and electrons has puzzled physicists for decades. Some of these are the Which-Way quantum experiment, quantum entanglement and wave function collapse.

One of the elementary phenomena that have no explanation to date, despite the claimed advance/success of theoretical physics, is related to interference of light: where does the energy go during complete destructive interference? Is the law of conservation of energy violated? This is even more puzzling when we think of a hypothetical experiment of complete destructive interference of the electron wave. (Such an experiment can be actually difficult to design and perform). Would this violate the law of conservation of matter?

This is a fairly well- known puzzle which is rarely discussed in mainstream physics today, not because physicists are not puzzled by it but because mainstream does not want to publicly admit that such an 'elementary' problem has no explanation in current physics, which would contradict all the promotions being made about modern physics.

However, there are still some genuine scientists in the mainstream[1] who are open minded enough to discuss the reality, and this has been one of the motivations to write this paper.

This puzzle occasionally came to my mind in the past until I found the mystery behind quantum phenomena[2]. Once I found the quantum mystery, the puzzle of 'where the energy goes' during complete destructive interference of light was automatically solved.

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Complete destructive interference of light in a Michelson interferometer

Consider a Michelson interferometer shown below. At first suppose that there is a complete constructive interference, with a single bright spot. Then suppose that one of the arms is adjusted by a half- wavelength (or integral multiples of it). We know that this will cause complete destructive interference: the bright spot disappears. The puzzle is: where does the energy (the light) go?

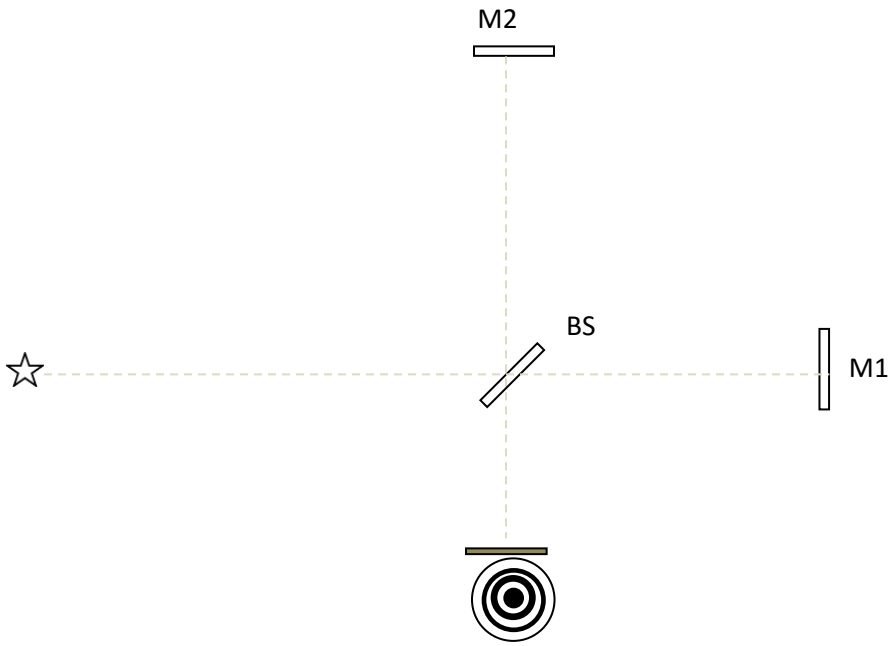

Fig.1

In the YouTube video[1] , the author proposed that the light (energy) that disappears from the initially bright spot appears somewhere else: reflected back into the source. For this, he added a beam-splitter as shown below to form a second interference pattern. What he demonstrated was that when the bright spot disappears from the first point, it appears at the second point and vice versa.

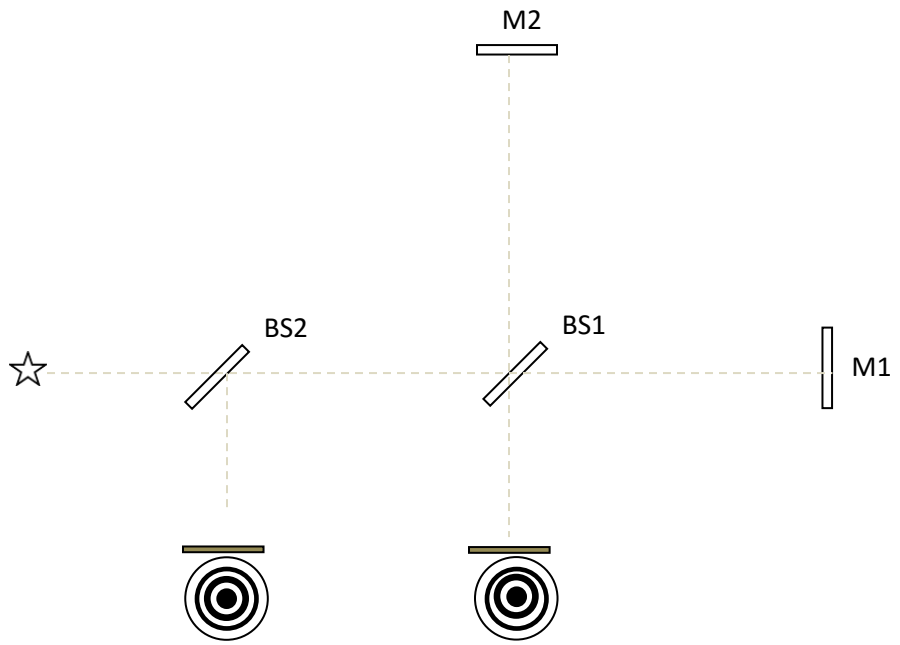

Fig.2

At first it seems this would finally solve the puzzle. But the he came up with another puzzle: since the phase difference between the two light beams is always the same along the path, how can there be complete destructive interference at one place and constructive interference at another place? He left the viewers with this puzzle in a YouTube video posted ten years ago. So the idea that the energy that disappears from the initially bright spot will appear somewhere else has not basically solved the problem: it only led to another problem which needs a solution itself.

There is also another argument against the idea that the light reflects back into the laser. If the light reflected back into the laser, then this would raise another question. According to the energy conservation law, the energy of the light reflected back into the laser must somehow be dissipated or build up the total energy in the system. The total energy in the system (light, heat) would continuously increase. The temperature of the laser source would continuously increase, etc. But this is unlikely.

Solving the mystery

The solution to the mystery is this:

Light is not emitted from the source in the first place during complete destructive interference. The mystery that has eluded physicists so far is that, if there is going to be complete destructive interference, light will not be emitted from the source in the first place. Light is emitted from the source only during constructive interference. Generally, photons are emitted from the source only towards points of constructive interference (with varying degrees of interference). Unconventionally, photons are not emitted at all towards points of complete destructive

interference. The current (wrong) understanding is implicitly based on classical thinking that the two light waves independently travel to the detecting screen, where they interfere destructively (or constructively).

But this leads to the question: how does the source 'know' that there will be a complete destructive interference, so as to 'decide' not to emit light? Does the source have a 'foreknowledge' that destructive interference will occur? The profound implication of this puzzle is this: the direct intervention of God in the universe, hence a scientific proof of God.

A Michelson interferometer quantum experiment

One might think of testing the above hypothesis: that light is not emitted from the source during complete destructive interference. The way to test this would be to put a detector between the light source and the beam-splitter of the interferometer, as shown below. This would enable measuring the intensity of light entering the interferometer during complete destructive interference. The detector should read zero, according to the above hypothesis.

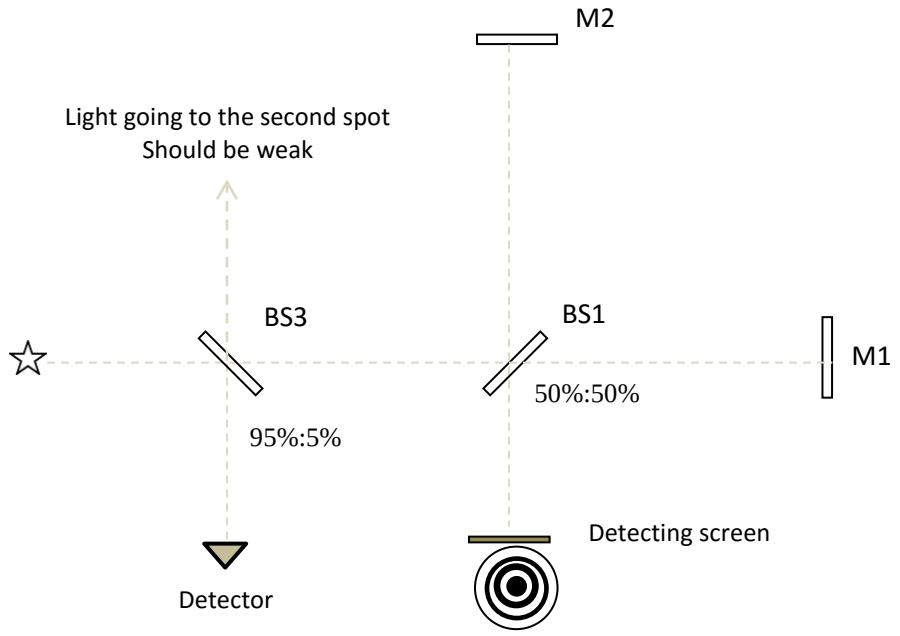

Fig.3

The detector consists of a beam-splitter (BS3) and a light detector. A beam-splitter with a splitting ratio of (95%:5%) is placed in front of the beam-splitter of the interferometer, with 5% of the light going to a light detector. It is important that the ratio of transmitted to reflected light be as high as possible. This is because the beam-splitter will also cause a second interference pattern (bright spot) and we want the intensity of this to be as small as possible. From the intensity of light detected by the detector, the intensity of light going to the interferometer can be inferred.

But this will 'work' only until it is tested. From our past experience of quantum phenomena, I suspect that the moment the detector is placed between the source and the interferometer, the interference fringe will disappear, just like in the Which-Way experiment. All we see with the detector in place will be a bright spot (not due to interference). The two light beams stop interfering, and just form a bright spot independently. But what is the basis for this claim?

This idea occurred to me after I saw the YouTube video [1] I mentioned earlier. The fact that the bright spot appears at the second point when it disappears from the first point made me suspect that some kind of strange quantum phenomena we know in the Which-Way and other quantum experiments may be at play in this experiment also.

But why does this happen? Perhaps God does not want us to make a direct measurement to know 'where the light energy is going', or to directly test that light is not emitted during complete destructive interference. He may want us to just believe it? Although we cannot make a direct measurement, we can understand what is going on by reasoning.

Now returning to the experiment [1], consider the light reflected back into the laser. Consider a laser source emitting the light beam towards a mirror which reflects the light directly towards the laser, i.e. the plane of the mirror is perpendicular to the light beam. The current universal understanding is that, conventionally, the source emits the light (energy), which is reflected back from the mirror into the laser. This is wrong. The new theory proposed in this paper is that no light is actually emitted towards the mirror in this case because there is nothing that absorbs the light energy on its path. The mirror would ideally reflect back all the incident light and will absorb zero energy. Therefore, there is no light emitted from the source in the first place.

Several arguments could be made against this hypothesis. One may argue that a standing wave will be formed which can be detected and that this is evidence that there is a forward propagating light wave (energy) and a backward propagating wave.

Nature is so elusive. Light will be emitted only when the SWR detector is placed in the path. One might think that the full intensity of light is emitted when the detector is there. No. Only a small amount of energy that can be absorbed in the detector is emitted. The amount of light actually emitted is only a tiny fraction of the nominal light intensity of the laser. However, this is inaccessible to direct experimental proof.

Therefore, the explanation that the energy that disappears from the initially bright spot goes back into the laser is wrong. One may ask: then where does the energy in the second bright spot come from? The explanation is this: that energy is available only when we detect it (as was done by using a beam splitter and a screen).

And why does the bright spot appear in one place when it disappears from the other place? The phase difference of the two light beams is supposed to be the same everywhere along the path, because the light beams are the 'same' (in the words of the author) ?
The solution to this puzzle lies in the word 'the same'. This is the prevailing fallacy in physics, which is still trapped in classical thinking despite being 'modern'. There is a hidden 'ether

thinking' in this view. The mystery that has eluded physicists is that the light is not 'the same'. Every photon is aimed to be detected at a specific point in space.

The path length of the light beams is of the order of one million times the wavelength of light. Therefore, the phase difference between the two light beams at any point is determined by probability, and not by classical laws. This is to say that the fact that the two light beams are in phase at one point and out of phase at another point should not be much of a puzzle in light of the quantum nature of light we discussed so far. This is because quantum principles, and not classical principles, govern all optical and quantum phenomena.

However, I also propose an alternative outcome. With the detector put in place (Fig.3), the interference pattern will not disappear and there is no change of the detector output. This would imply an *apparent* non-conservation of energy. There will be no energy going from the source to the detecting screen during complete destructive interference, but there will be a small energy going to the detector *as if* light was going to the detecting screen. This would be inaccessible to experimental verification.

Light interference pattern

So far we have considered the case of complete constructive or destructive interference. In most cases, however, we have interference patterns, which occur when there is neither complete constructive interference nor complete destructive interference. What I have observed is that an experimental setup for complete constructive or destructive interference necessarily results in the light beam being reflected back (conventionally thinking) into the source, and this allows for a conventional argument that the light reflects back into the source during complete destructive interference, as discussed above. Although I have presented arguments against this conventional view, a more decisive disproof of this conventional view is needed. This requires an experimental setup in which the light does not reflect back into the source. Such experimental setups always create interference patterns, as shown below.

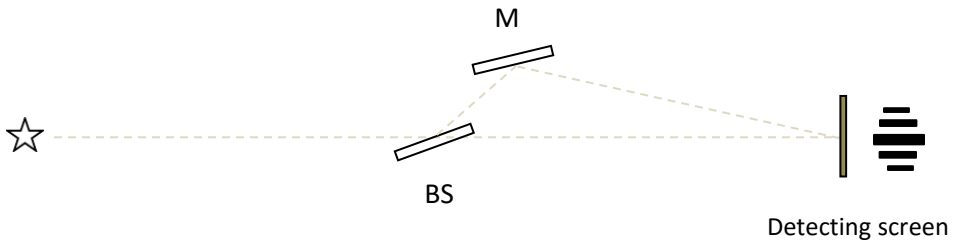

Fig.4

The argument is as follows. Suppose that initially there is some interference pattern, with alternating bright and dark fringes. For this, the difference in the path lengths of the two beams should be less than the coherence length of the source. Also the angle between the two light beams at the detector screen should be very small for the fringes to be visible. Then the position

of one of the mirrors is adjusted slightly. This will cause a change in the interference pattern. In general, the *total* light energy in the first interference pattern will be different (greater or smaller) from the *total* light energy in the second pattern. Suppose that the energy in the second pattern (E2) is less than the energy in the first pattern (E1) . The question is: where does the net energy (E1-E2) go? Thus, unlike the case of complete destructive interference, this experimental setup eliminates any conventional explanation because there is no light reflected back into the source.

A proposed experiment to test apparent non-conservation of energy

Suppose that in the above experiment a sensor is put in place of the detecting screen. The sensor could be a small photovoltaic panel with a resistor load attached to its output. As the interference fringes change due to adjustment of the mirror, the current and voltage output of the photovoltaic panel could be monitored. The sensor could also be a small water container with black outer surface to absorb the light energy. The temperature of the water is monitored as the interference fringes change. Any fluctuation of the sensor output will show an *apparent* non-conservation of energy. What actually happens is that the number of photons that are emitted from the source varies with change of interference pattern, hence no violation of energy conservation law.

However, there is a more feasible experiment, as shown below.

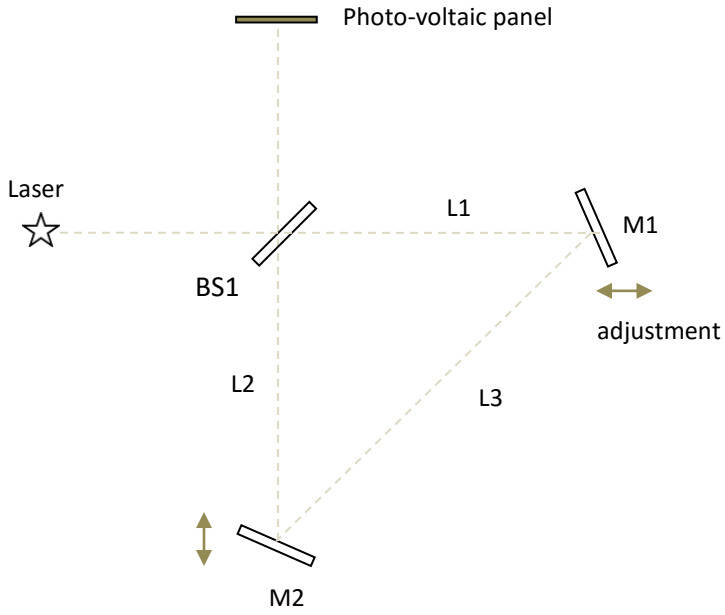

Fig.5

An interference pattern is formed by careful adjustments of the positions and angles of the mirrors. A small photo-voltaic panel is used as the detecting screen. The difference between the

path lengths of the two light beams should be less than the coherence length of the laser beam used.

To avoid more than two images of the source creating the interference pattern:

$$L1 + L2 + L3 \quad < \quad coherence\ length \quad < \quad 2(\ L1 + L2 + L3\ )$$

It should be noted that the interference pattern is formed on the background of light due to multiple reflections between the beam-splitter and the mirrors.

Once the interference pattern is formed, the positions of the mirrors can be adjusted slightly, causing change of the interference pattern, while the current output of the photo-voltaic panel is being monitored. Any significant change in the current (more precisely, the power) output will show an apparent non-conservation of energy.

A more convenient experiment is shown below.

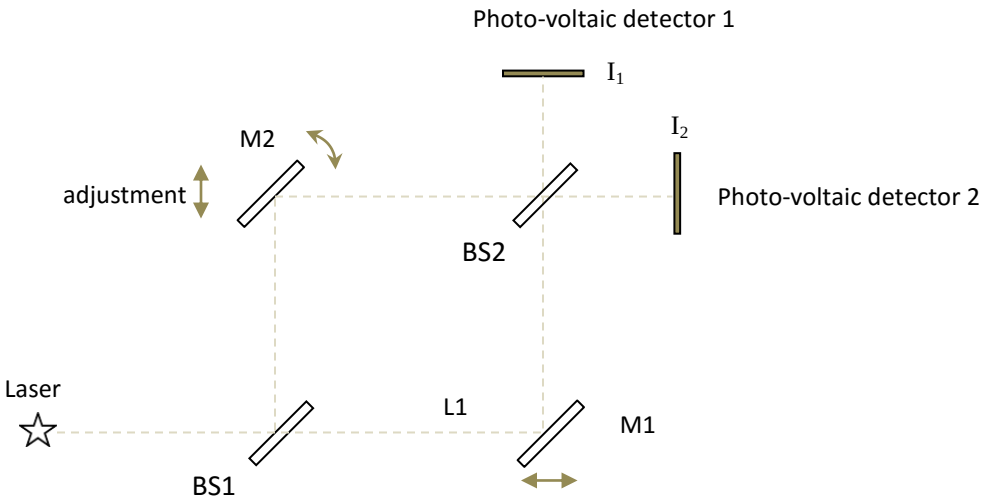

Fig.6

First an interference pattern is created by adjusting the positions and angles of the mirrors and/or beam splitters. The light intensity (current) at the first detector is I_1 and that at the second detector is I_2 . Then the sum of the light intensities ($I_1 + I_2$) at the two photo-voltaic detectors is noted. Then the positions or angles of the mirrors are adjusted to change the interference pattern, and the sum of the new light intensities ($I_1' + I_2'$) at the two detectors noted.
If ($I_1 + I_2$) ≠ ($I_1' + I_2'$), then this proves an (apparent) non conservation of energy.

The real mystery - scientific evidence of God

Instead of interpreting this as a violation of the principle of energy conservation, I propose a new explanation as follows.

The new explanation is that photons are not emitted from the source towards points of complete destructive interference in the first place. It is not that light energy is emitted from the source and then destroyed due to destructive interference. The photons are emitted only towards points of constructive interference in the first place.

The question follows: how does the source 'know' where to aim the photons? The only possible explanation is that God can see the experimental setup and aim each and every photon to the points on the detecting screen, in order to form an interference pattern.

The theories discussed so far applies not only to light and quantum particles, but also fundamentally to all electromagnetic waves.

Conclusion

In this paper, two related theories have been proposed:

1. Light is not emitted from the source during complete destructive interference.

2. But this is inaccessible to direct experimental test. (This one may be a reasonable speculation)

We have seen that the phenomenon of (destructive) interference of light is a direct scientific evidence of God.

Thanks to Almighty God Jesus Christ and His Mother Our Lady Saint Virgin Mary

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