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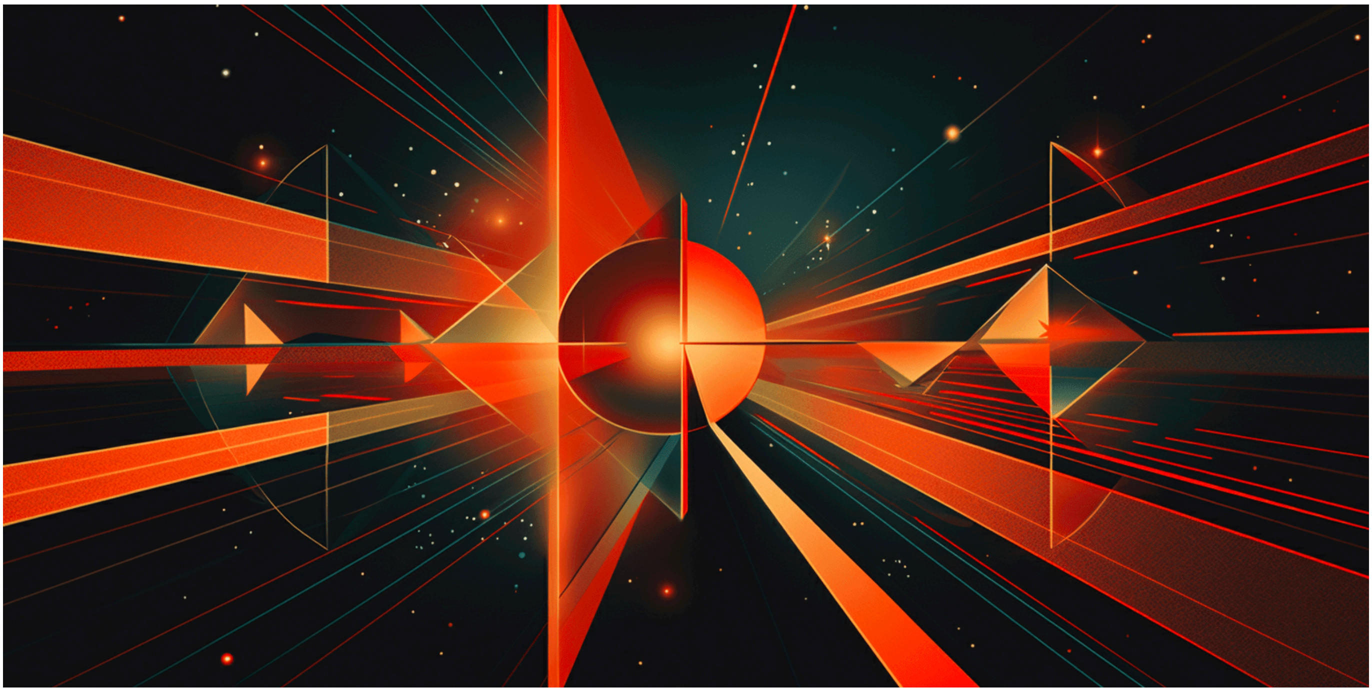

Preprint v1

Aug 27, 2023

https://doi.org/10.32388/SGXNTT

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Relativistic effects and photon-mirror interaction – energy absorption and time delay

This research paper explores the intricate interplay between photons and mirrors, shedding light on the processes that occur during photon-mirror interactions. We delve into the absorption of photons by electrons on a mirror's surface, which leads to energy gain and movement of electrons to higher energy levels. This interaction, akin to photoelectric absorption, is fundamental to understanding the behavior of light and mirrors. The paper investigates the principles of mirror reflectivity, highlighting the optimization of reflectivity by minimizing energy absorption ΔE to maintain high reflectivity. We also examine the angles of incidence and reflection, emphasizing their equal values and the related sum of angles.

Through careful analysis, we establish that the energy difference between incident and reflecting photons, denoted as ΔE, corresponds to a time delay Δt between the photons. This unique relationship between energy and time delay introduces the concept of infinitesimal time delay during reflection, contributing to a time distortion in the behavior of light. The research culminates in the assertion that the constancy of motion of a photon of light is disrupted when it is reflected by a mirror due to the introduced time delay.

Keywords: Relativity, Photoelectric Absorption

1. Introduction

The interaction between photons and mirrors is a fundamental phenomenon with profound implications for our understanding of light and its behavior. In this research, we delve into the intricate details of photon-mirror interactions, energy absorption, and the subsequent time delay introduced by the interaction.

1.1. Photon-Mirror Interaction and Energy Absorption. When a photon collides with an atom on a mirror's surface, it has the potential to be absorbed by an electron within the atom. This absorption results in the electron gaining energy hf and transitioning to a higher energy level. This process, analogous to photoelectric absorption, is central to the interaction between photons and mirrors. The mirror's reflectivity is optimized by minimizing energy absorption ΔE, ensuring that high reflectivity is maintained. The energy of the reflected photon, denoted as $hf - \Delta E$, represents the energy loss within the mirror [1-4].

1.2. Angle of Incidence and Reflection. The angles of incidence and reflection play a pivotal role in photon-mirror interactions. The relationship between these angles is such that the angle of incidence θi is equal to the angle of reflection θr. This relationship is also expressed in terms of angles in degrees (θi and θr), where $\theta i + \theta r = 180°$. This symmetry in angles contributes to the predictable behavior of reflected photons[2,3,5].

1.3. Photon Energy Absorption and Time Delay. The difference in energy between the incident photon γi and the reflecting photon γr is represented as ΔE, which signifies the energy absorbed by the mirror. Remarkably, this energy difference also corresponds to a time delay Δt between the incident and reflecting photons. This intriguing relationship between energy and time introduces the concept of infinitesimal time delay during reflection, leading to a time distortion in the behavior of light[1-6].

2. Equations and scientific foundations. When a photon hf interacts with an atom on a mirror's surface, it can indeed be absorbed by an electron in the atom. This interaction results in the electron gaining energy hf from the absorbed photon. This increase in energy can cause the electron to move to a higher energy level within the atom, farther away from the nucleus. Photoelectric absorption takes place. Mirrors are made to minimize absorption ΔE to

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The author declares no conflict of interests.

maintain high reflectivity. Optimize reflectivity $hf - \Delta E$ and minimize light absorption ΔE. The reflected photon will have energy $hf - \Delta E$. The reflected photon will have energy of $hf - \Delta E$.

The angle of incidence θi is equal to the angle of reflection θr. Since the angle of incidence θi is equal to the angle of reflection $\theta r, \theta i = \theta r$; and the sum of the angles of incidence θi and reflection θr always equals $180°, \theta i + \theta r = 180$. Therefore, if the angle of incidence $\theta i = 180°$, the angle of reflection $\theta r = 180°$.

The reflected photon having energy $hf - \Delta E$ travels in the opposite direction of the interacting photon with energy hf; the angle of incidence is equal to the angle of reflection. This means that the direction of the reflected photon is related to the direction of the incident photon but is not necessarily opposite to it[5,6,8].

Briefly, incident photon energy $\gamma i = hf$; reflecting photon energy $\gamma r = hf - \Delta E$; photon energy absorption $\gamma i - \gamma r = \Delta E$.

So, when a photon of light at the speed of light strikes or collides with a mirror wall, initially, the photon is absorbed by electrons in the mirror's surface atoms. In effect, the collision causes another photon to detach from an electron in an atom on the mirror surface, and the detached photon travels at the speed of light but in the opposite direction to the colliding photon. As a result, some of the energy of the colliding photons is lost in the collision with the mirror surface.

The reflected photon having energy $hf - \Delta E$ travels in the opposite direction of the interacting photon with energy hf, at a $180°$ angle, when the angle of incidence was $180°$.

Briefly, when a photon collides with a mirror surface, it is initially absorbed by electrons in the mirror's surface atoms. The collision causes another photon to detach from an electron in an atom on the mirror surface. The detached photon travels at the speed of light but in the opposite direction to the colliding photon. Some energy of the colliding photons is lost in the collision with the mirror surface[6,7,8-10].

The energy of the incident photon is hf, where h is Planck's constant, and f is the frequency of the photon. The energy of the reflecting photon is $hf - \Delta E$, where ΔE represents energy loss due to interactions within the mirror. The difference in energy between the incident and reflecting photons is ΔE. This difference represents the energy absorbed by the mirror and not reflected[3,6,8].

The photon energy absorption = $\gamma i - \gamma r$, the difference in energy between the incident and reflecting photons $= \Delta E$.

Assuming, the incident photon frequency = $f1$; when, the incident photon energy = γi ; and the reflecting photon frequency $= f2$; when, the reflecting photon energy $= \gamma r$; the change in energy between incident photon and reflecting photon $= \Delta E$.

The change in energy ΔE is equal to the time delay Δt between the incident photon and the reflecting photon. This suggests a relationship between the energy difference of the incident and reflecting photons and the difference in frequencies $f1$ and $f2$ of those photons., presented by the equation.

2.1. Given Equations. Infinitesimal loss in wave energy is given by[2,5,10],

$$\Delta E = \gamma i - \gamma r$$

Incident photon frequency is given by,

$$f1$$

Reflecting photon frequency is given by,

$$f2$$

Now,

$$\left\{ \begin{array}{c} T^{\circ} = \frac{T}{360} = \frac{\frac{1}{f}}{360} = \Delta t \\ f = \frac{E}{h} = \frac{1}{360} \times T^{\circ} \end{array} \right|$$

$$\Longrightarrow T^{\circ} = 1/f \times 360 = \Delta t$$

So, the relationships are,

$$\Delta E = \gamma i - \gamma r$$
$$\Delta t = f1 - f2$$

Hence,

$$\Delta E = \Delta t.$$

Therefore when, there is an infinitesimal time delay Δt between the colliding photon γi and the diffusing photon γr to change direction of travel. Therefore, the constancy of motion of a photon of light is broken when it is reflected by a mirror[2,5,10].

3. Conclusions

This research paper explores the intricate interactions between photons and mirrors, revealing the processes of energy absorption and time delay. We have shown that the energy absorbed by a mirror during photon-mirror interaction is intricately tied to the time delay between incident and reflecting photons. This relationship challenges our conventional understanding of the constancy of motion of light, as the introduced time delay disrupts this constancy during reflection. By investigating these phenomena, we gain deeper insights into the behavior of light and its interactions with mirrors, contributing to our broader understanding of the fundamental principles of physics.

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