2010

A Critical Analysis of Two Ideas in Modern Physics: The Special Theory of Relativity and the Double Slit-Experiment

Chris Akel

A Critical Analysis of Two Ideas in Modern Physics: The Special Theory of Relativity and the Double Slit-Experiment

A thesis submitted to the Faculty of Barry University
in partial fulfillment of the requirements
for the completion of the Honors Program

By

Chris Akel

September, 2009

Barry University
Honors Program

Honors Thesis Written by

Chris Akel

Approved by:

Dr. John Goehl

Chair, Thesis Supervisory Committee

Dr. John Boulos

Thesis Supervisory Committee Member

Dr. Tony Wallner

Honors Program Faculty Member

Dr. Lubomir Markov

External Member

Akel, Chris (B.S., Chemistry)
A Critical Analysis of Two Ideas in Modern Physics May/2009

Abstract of a senior honors thesis at Barry University.
Thesis supervised by Dr. John Goehl.

Number of pages in text 33

This study was conducted in an attempt to either further validate the ideas/findings portrayed in Special Relativity and the double-slit experiment, or to provide for a different explanation of the observed phenomenon/theoretical models. The most common accepted idea among physicists is that nothing can travel faster than the speed of light, and this study was meant to challenge that very belief. It also attempted to explain the diffraction patterns observed in the double-slit experiment through a different means other than the duality of light. In regards to Special Relativity, just as its founder Albert Einstein did, we used thought experiments to analyze how and why something either could, would, or should travel faster than the speed of light. MathCad was used to model different aspects of the double-slit experiment. The results thus far obtained from this study are inconclusive. The computer models so far indicate the possibility of obtaining two symmetrical peaks in the diffraction patterns of the double-slit experiment, but the remaining infinite number of smaller peaks has not yet and perhaps will not be accounted for from this study.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. John Goehl of Barry University for his continued support and guidance as these topics were pursued and for his expert advice pertaining to these studies, the thesis committee consisting of Drs. Tony Wallner, John Boulos, Pawena Sirimangkala, and Lubomir Markov for all of their assistance as this thesis was pursued, and the Department of Physical Sciences at Barry University for its support.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

One of the problems that we are attempting to address is whether or not an object can travel at speeds faster than the speed of light. In 1905, Albert Einstein developed the Special Theory of Relativity which states that objects cannot travel faster than the speed of light and since then, much controversy has surrounded the subject.[1] This problem is of great interest in modern physics as the theory must be taken into account as large particle accelerators are constructed such as the Large Hadron Collider currently being finished in France and Switzerland. Although much evidence exists to support Einstein's theory, if it is ever scientifically found to be incorrect, the entire physical world will need to re-think much of the research that has been done in the past several decades. Just as Einstein did, we will use thought experiments in an attempt to either further validate or invalidate his theory.

Another problem we are currently working on involves the double-slit experiment. To our understanding, the thickness of the wall is never taken into account when performing this experiment. For some reason which we have not yet been able to grasp, it is seemingly disregarded. One question we are attempting to answer is that if the slit is presumed to be infinitesimally small, then why is it even there. Perhaps altering this thickness will alter the observed diffraction patterns. If this occurs, more scientific inquiry will be required and this, in turn, could affect the way in which physicists view the duality of light as having both wave and particle properties.

THEORETICAL BASIS

As science progresses, older ideas and theories that have withstood the test of time are often incorporated into modern experimental processes and are normally accepted as fact. The question is whether or not the incorporation of such ideas, such as special relativity, has caused modern-day physicists to be unable to detect possible flaws with those very ideas in which they base their experiments. One aspect of the double-slit experiment that is not normally taken into account, for example, is the thickness of the wall. Perhaps altering this thickness will change the observed diffraction patterns. Throughout the literature search, no experiment or discussion that seemed to account for the thickness of the wall was found. This experiment may help to explain why that is the case or show that it should in fact be considered. It is that this study will lead to a better understanding of several concepts in modern-day physics and will allow them to possibly be viewed in a different and more comprehensive way.

LITERATURE REVIEW/DISCUSSION

The culture of the United States is quite scientific in that it is always attempting to define what is natural and what is rational. In our daily experiences, power is exercised through expertise in a specific field of science such as technology or medicine. Basically, science mediates our cultural experience. It seemingly defines what it is to be a person through such things as genetics and chemistry. Accordingly, it can be reasoned that scientific progress dictates culture and vice versa.

Culture represents a powerful human tool for survival but is a very fragile phenomenon. It is constantly changing and can easily become lost since it exists only in our minds. Our written languages, governments, buildings, and other man-made things are merely the products of culture; they are not culture in themselves. Archaeologists cannot dig up culture in their work-sites, they can only analyze the broken pots and other artifacts of ancient people in hopes that they can uncover secrets that may hint or reflect at certain cultural patterns, as they represent only things that were made and used through cultural knowledge and skills. Also, in this same way, they attempt to gather information about the culture's society which, contrary to popular belief, is not the same as culture itself.

As just stated, culture and society are not the same things. Cultures are complexes of learned behavior patterns and perceptions, while societies are groups of interacting organisms. Accordingly, it can be reasoned that people are not the only animals or species who possess societies. Scientifically, schools of fish, flocks of birds, and hives of bees all represent different societies. However, in the case of humans, societies are groups of people who directly or indirectly interact with each other. People in human societies generally perceive that their society is distinct from other societies in terms of shared traditions and expectations.

Although human societies and cultures are not exactly the same thing, they are closely connected because culture is created and transmitted to others through a society. Cultures are not and cannot be the product of lone individuals. They are the forever-evolving products of people interacting with each other. Patterns defined by culture such as language and politics make absolutely no sense except in terms of the interaction of people. If there were only one person on the planet, there would be no need for language or government.

Within the discipline of behavioral sciences, there is a difference of opinion about whether or not humans are the only animals that create and use culture. The answer to this argument, however, depends on how loosely the term culture is defined. If it is used broadly to refer to a complex of learned behavior patterns, then it is clear that we are not alone in creating and using culture. Many other animal species teach their young what they themselves learned in order to survive. A primary example of this is when chimpanzees and other somewhat intelligent apes teach their young about several hundred food and medicinal plants. These young apes also have to learn about the hierarchy and the social rules in place within their communities. As male apes become teenagers, they acquire hunting skills from the adults. Female apes must learn how to nurse and care for their babies. Knowledge of these things is not hardwired into their brains at birth. They are all learned patterns of behavior just as they are for humans. The primary difference here is that apes possess no sophisticated form of science so as to develop their culture in the way that humans can.

Science is the means of using deductive reasoning to make independently verifiable links between data or information. The process of science includes the breaking apart of something and the reassembling of it to help gain a full understanding of it and its parts. It has even been reasoned that this process is analogous to the process of reverse engineering. It is highly deducted and adheres to logical sense. In contrast, belief systems and culture supersede this aspect of working from the ground up in constructing realities and adhering to logic. Instead, they involve certainties that are sometimes based on nothing and sometimes on partial truths or facts. In this respect, the fundamental definitions of each concept, science and belief systems which are ubiquitous within a culture, create a dichotomy. A problem now arises in that there is seemingly no recognized separation between the two. What results is a large population of scientists who maintain a combination of the two concepts which in turn causes the negation of real science and scientific progress because it leads to clouded data or information within the associated processes involved.

As can be seen, science involves systematic, deductive skills while belief systems within cultures exist solely because so many people have been doing something for so long and it has been passed down through generations. Accordingly, we have a system constructed from independently verifiable explanations versus a system constructed by our ancestors as a way to interpret information with no independent verification other than that it is as it is because society says so.

Both scientists and non-scientists have a tendency to regard science and culture as different and parallel things, between which one must choose. However, in my opinion, science does not have to be viewed as an alternative to culture, but rather should act as a central component of it. A culture will become stronger when it embraces the powers of science and technology.

For many people, science is the cultural entity whose distinctive property is its claim to be able to uncover impersonal laws and, ultimately, the truth. Others may see it as being able to enhance human security and well-being. However, neither of these distinguishes science from other cultural entities, as many religious and political philosophies lay equal claim to providing that "truth" through a different path. Many nations, service professions, and other organizations regard the concepts of safety and well-being in regards to humans as their primary mission and again pursue it in much different ways than science would. Accordingly, these conflicting claims allow for arguments to take place between those who call themselves scientists and those who do not.

The scientific method is not about determining "truth." Being that a hypothesis is merely a proposition, or set of propositions, set forth as an explanation for the occurrence of some specified group of phenomena, it is nothing more than a useful way to summarize observations. It characterizes the observations in terms of some underlying pattern or principle that yields predictions about future observations. An experiment is nothing more than the making of a new observation to see whether it matches the predictions made by the previously existing summary. Because of this, some have argued that a hypothesis can never be proven true based on the idea that a new observation can show that a previous observation is no longer valid but cannot show that a given summary of the observation will continue to be valid forever.

Due to these ideas, it has been reasoned by many prominent philosophers that science should never be regarded as a candidate for the "truth." They basically argue that science generates stories from observations and if the term "true" is to be used at all, it should mean nothing more than consistent with all observations so far. Accordingly, they reason that there is no conclusion in science, but that it is a continual process of story-telling and testing. People who agree with these conclusions usually agree that science can best and most distinctively contribute to culture by providing "stories" that may increase, but never guarantee human well-being by exemplifying a commitment to skepticism and a resulting open-ended and continuing exploration of what might yet be.

On a different note, the scientific community of this country is forever being tasked with providing, through research, the wants of its culture. One example of this is the rise in plastic surgery throughout the last decade. In areas, such as Miami, Florida, that place huge amounts of pressure on people's appearance, the need for plastic surgery within the society, which as stated before is closely linked to culture, has risen dramatically over the years. This societal "need" has played a direct part on the scientific community, in that newer, safer, and better chemicals are needed so as to entice customers to get their "state-of-the-art" makeover to enhance their well-being. This idea of beauty is greatly fueled by the mass media, but that is another topic altogether. Being that the mass media is fueled by business, and that, according to a class discussion, business is culture, it can be reasoned that culture and science are not two completely separate ideas, but are closely linked ideas that depend upon each other for survival. As a result, chemistry, and science in general, are charged with providing the wants and needs of society and culture through technology and research. However, sometimes this research has in it a bias created by the society.

The society of the United States clings to an idea that if something works, use it, or if something feels good, do it, etc. Accordingly, as science progresses, older ideas and theories that have withstood the test of time are often incorporated into modern experimental processes and are normally accepted as fact. The question, however, now becomes whether or not the incorporation of such ideas, such as Albert Einstein's Special Theory of Relativity, has caused modern-day physicists to be unable to detect possible flaws with those very ideas on which they base their experiments.

On June 30th, 1905, Albert Einstein published "*On the Electrodynamics of Moving Bodies*," which was his third paper that year.[2] This paper was one of his four installments in which would later come to be known as the Annus Mirabilis papers. These papers contributed greatly to the foundation of modern physics and were instrumental in changing physicist's views of space, time, and matter.

In electromagnetism, Maxwell's equations represent a set of four partial differential equations which describe electric and magnetic field properties and relate them to their sources of charge density and current density. They are used to show that light is an electromagnetic wave.[3] That paper published by Einstein in 1905 reconciled Maxwell's equations for electricity and magnetism with the laws of mechanics by introducing major changes to mechanics close to the speed of light. In later years, this would become known as the Special Theory of Relativity.[4]

It had been known at the time that Maxwell's equations led to asymmetries when applied to moving bodies. Accordingly, it had not been possible to detect any motion of the Earth relative to the light medium.[3] To explain these observations, Einstein put forth two postulates. What was done first was to apply the principle that the laws of physics remain the same for any non- accelerating inertial reference frame to the laws of electrodynamics, optics, and mechanics. Secondly, which is of more interest to this study, was the proposal that regardless of the inertial frames of reference and independent of the state of motion of the emitting body, the speed of light has the same value.[2] According to Einstein, "...the unsuccessful attempts to discover any motion of the earth relatively to the 'light medium,' suggest that the phenomena of electrodynamics as well as of mechanics possess no properties corresponding to the idea of absolute rest."[5]

As can be deduced, based on Einstein's postulates, the speed of light is fixed and is not relative to the movement of the observer. If one were walking at five miles per hour and was to throw a baseball at five miles per hour in the same direction as he were walking, under classical Newtonian mechanics, an observer at rest would observe the baseball traveling at ten miles per hour. If the same observer were traveling in the same direction as the baseball at five miles per hour, he would only see the ball traveling at five miles per hour relative to himself. On the contrary, if one were traveling at half the speed of light, or approximately 93,000 miles per second, and were to turn on a flashlight which is projecting light at approximately 186,000 miles per second, a stationary observer, using classical mechanics, would observe the light travelling at 186,000 + 93,000, or 279,000 miles per second. However, based on Einstein's postulate, the observer, whether stationary or moving, would only be able to observe the light traveling at its given speed of 186,000 miles per second, which seemingly contradicts Newtonian mechanics.

This is resolved through the argument that Newtonian mechanics can only describe the properties of objects at very low speeds. As objects approach the speed of light, however, special relativity must be considered and Newtonian mechanics no longer holds true. The evidence supporting this conclusion is vast, but nevertheless, it remains inconclusive. In regards to this study, it seems unreasonable to argue that nothing can surpass the speed of light without ceasing to exist, as an application of Newtonian mechanics to objects traveling at very high speeds seemingly allows for it.

In another example, consider two observers, A and B, attempting to reach a plane that is travelling at five hundred miles per hour. Observer A is stationary relative to the plane while observer B is travelling in the same direction as the plane at a speed of two hundred fifty miles per hour. Logically, it would seem that the plane is traveling away from observer B at two hundred fifty miles per hour and away from observer A at five hundred miles per hour. However, that is not exactly the case. Although five hundred miles per hour is a very low speed when compared to the speed of light, on a microscopic scale, the plane would not be flying away from the observers at exactly those values, as according to special relativity, the speed of light must be considered:

1) $U = u - V$ (what one may think logically)

2) $$U = \frac{u - V}{1 - (uV/c^2)}$$ (what actually occurs relativistically)

Where U is the rate that the plane is flying away from the observer, u is the speed of the plane, V is the speed of the observer relative to the plane, and c is the speed of light. The first equation is often used at low speeds because at low speeds, the denominator of the second equation is extremely close to one.[5] However, according to modern physics, the second equation will always give a more exact answer which will seemingly always contradict Newtonian mechanics.

As objects approach the speed of light, other phenomena occur that again seem to somewhat contradict logic. Length contraction is the physical occurrence of a decrease in length detected by an observer in objects traveling at any non-zero velocity relative to that observer. This occurrence is only noticeable as objects closely approach the speed of light and the contraction is only in the direction parallel to the direction in which the observed body is traveling. As can be seen in the following formula, at low speeds, length contraction is negligible:

$$3) \qquad L' = L\sqrt{(1-v^2/c^2)}$$

Where L' is the length observed by an observer in relative motion with respect to the object, L is the length of the object at rest, v is the relative velocity between the observer and the moving object, and c is the speed of light. Accordingly, given the high value of c^2, length contraction only becomes important when an object approaches around one-tenth of the speed of light, or thirty thousand miles per second.[6] The fact that the speed of light is supposedly always measured to be the same in all directions for all observers partly acts as the basis for this idea.

In 1959, James Terrell and Roger Penrose published papers which stated that the length contraction just discussed cannot be observed. Instead, there would be a specific kind of rotation which basically amounts to a distortion that a passing object would appear to undergo if it were indeed traveling at a significant fraction of the speed of light. However, whether observable or not, the Large Hadron Collider which will soon be in operation will likely be able to experimentally test the basis of length contraction.[7]

Time dilation, another one of these phenomena, is where an observer finds that another's clock, which is mechanically identical to their own, is ticking at a slower rate when compared to their own clock. Basically, time will only pass at the same rate locally, such as from the perspective of an observer in the same frame of reference without reference to another frame of reference.[8] In a less confusing way, according to this idea, a clock on the space shuttle in orbit around Earth will tick slower than an identical clock at rest on Earth, as described by the following formula:

$$4)\qquad T' = \frac{T}{\sqrt{(1-v^2/c^2)}}$$

Where T is the time interval between two events happening at the same time for an observer in some inertial frame, T' is the time interval between those same events as measured by another observer moving with a certain velocity with respect to the former observer, v is the relative velocity between the observer and the moving clock, and c is the speed of light.

According to special relativity, "clocks that are moving with respect to an inertial system of observation are measured to be running slower."[9] This is described by the Lorentz transformation which converts two different observers' measurements of space and time. In special relativity, the effect of time dilation is reciprocal. By that, it is meant that when observed from the point of view of any two clocks which are in motion with respect to each other, it will always be the other group's clock that is time dilated assuming that the relative motion of both groups is uniform and they do not accelerate with respect to the other during the observation.[8]

In special relativity, the twin paradox is a thought experiment whereas a twin who ventures into space in a high-speed spaceship will return home to find that he has aged less than his identical twin that stayed on Earth. The fact that according to this idea one twin really and physically will age less than the other is quite contradicting because, according to special relativity, each twin will see the other as traveling, therefore each should see the other as aging more slowly. A specific example of the twin paradox is as follows: Consider one twin on a space ship traveling a distance (d) of 4.45 light years away at a speed (v) of 86.6 percent of the speed of light (c), or 0.866c. Assuming that the ship reaches its full speed immediately after departure, the round trip flight will take 2d/v, or 10.28 years in Earth time. In other words, everybody on Earth, including the twin's identical brother, will physically appear 10.28 years older when the ship returns. However, the amount of time as measured on the space ship's clocks will be reduced by the reciprocal of the Lorentz factor, $\sqrt{(1-v^2/c^2)}$. In this specific case, this value is 0.500. Accordingly, the twin aboard the space ship will have physically aged only 0.500 x 10.28, or 5.14 years upon the space ship's return to Earth. This idea, although relativistically possible, is quite counter-intuitive and again leads to the belief that objects are in fact able to travel faster than the speed of light and that the speed of light has no direct connection to the concept of time.

However, most modern physicists believe in the idea of time dilation. Throughout the past few decades, it has been tested a number of times. The work that has been and will continue to be carried out in particle accelerators such as the Large Hadron Collider at the Center for European Nuclear Research is seemingly a continuously running test of the time dilation of special relativity. It is one purpose of this paper to propose an alternate idea that could possibly account for the phenomena of time dilation by arguing that objects can surpass the speed of light, and this will now be done.

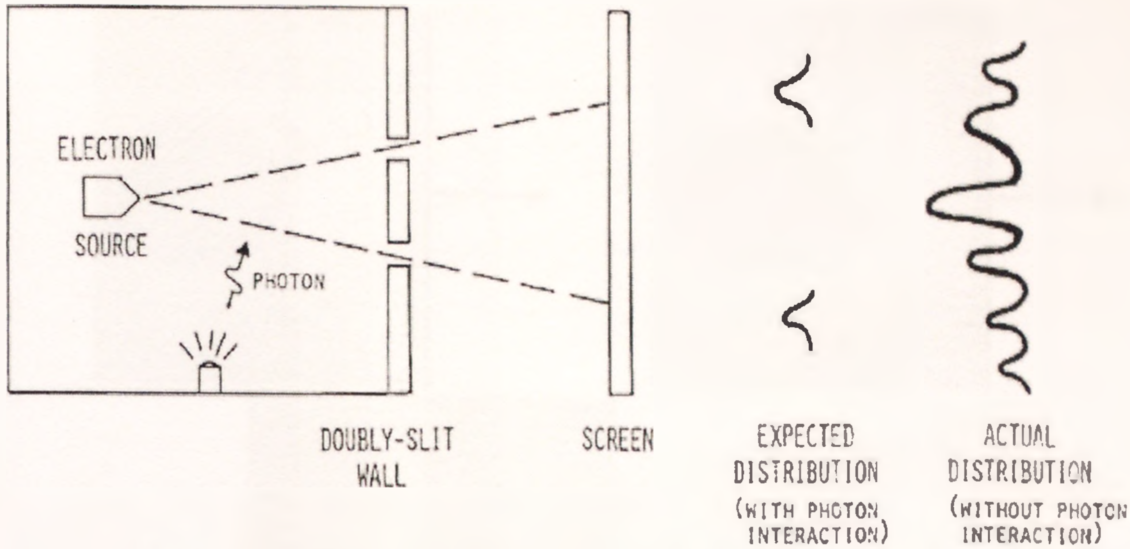
Theoretically, absolute zero is the lowest possible temperature that a substance can reach, as this denotes that the amount of energy/heat remaining in the substance is infinitesimally close to zero. Let us equate this to an object that is infinitesimally close to being at complete rest, that is, it possesses absolutely no energy to put it into motion. Now, as you add energy to the substance at absolute zero, its heat content begins to increase and since vast amounts of energy exist, the substance's heat content is basically infinite. Apply this same concept to the object sitting at rest and apparently the objects speed is also infinite, not finite as special relativity would lead you to believe.

Now let's assume an object were to travel faster than the speed of light. I would hypothesize that the object would become invisible once it surpassed that infamous speed, and because light can only travel at the speed of light, you would be seeing the object only after it has already passed you. This would account for objects seeming to last longer than normal when they are projected at speeds very close to the speed of light. Let's say the accepted "life-span" of a particular proton is one second. Now project that proton through an accelerator at half the speed of light and it will seemingly travel approximately (186,000) / (2) miles, or 93,000 miles (I am taking the speed of light to be 186,000 miles per second). Project the same proton at the speed of light, and it will travel approximately 186,000 miles. Now let's say that the exact same proton is projected at twice the speed of light. Realistically, the particle will only be traveling (186,000) (2) miles, or 372,000 miles. However, because the particle has surpassed the speed of light, it can only visibly be seen traveling at 186,000 miles per second, and thus it would appear that the proton doubled its "life-span" due to its speed, since it would take light two seconds to cover the distance that the proton traveled.

Basically, what is being proposed is that when it appears that an object has increased its "life-span" when supposedly traveling at or very close to the speed of light, realistically, it has not. It only seems this way because one can only see the object traveling at the speed of light when it is actually traveling faster than the speed of light. When the object's "life-span" has ended, it will still be visible for a certain period of time depending on how much faster than the speed of light the object was traveling at. Ultimately, the alleged increase in "life-span" is merely a result of seeing something that has already vanished. Consider a bullet traveling faster than the speed of light. Assume it strikes a piece of white paper. Would you first see a hole form in the paper and then after a certain period of time depending on how fast the bullet was traveling see the bullet pass through the hole? This idea could possibly account for why objects/particles appear to live longer as they are accelerated to speeds very near the speed of light. Perhaps it is that they are really traveling faster than the speed of light but can only be detected traveling at or very close to the speed of light. This seems to have a more logical and intuitive basis than to say that the particles projected through accelerators undergo an increase in their half-lives merely as a result of their speed. It seems more reasonable to say that time is constant while our perception of it, whether physical or not, is variable. The question of whether or not something can surpass the speed of light, as denoted by special relativity, has seemingly already been answered. However, it is important to note that special relativity, to this day, remains a theory.

The focus of this section will now shift to the double-slit experiment

First performed in 1801 by Thomas Young, the double-slit experiment demonstrates the duality of light as having wave and particle properties. Basically, a light source illuminates a *thin* plate with two parallel slits cut into it and the light passing through those slits hits a screen placed behind them. The wave properties of light cause the light waves passing through both of the slits to interfere with each other producing an interference pattern of bright and dark bands on the screen. At the screen, however, the light is always found to be absorbed as photons. Through a classical understanding of this, the number of particles that strike the screen should be equal to the sum of the particles that go through the left and right slits combined. The brightness at any point should be no more than the sum of the brightness when the left slit is blocked and the sum when the right slit is blocked. However, contrary to reason, it is found that when both slits are unblocked, specific points on the screen appear brighter and other points appear darker. Accordingly, it has been reasoned that the only explanation for this anomaly is the interference of the wave properties of light, as the additive nature of particles alone does not account for the observed diffraction patterns. The following figures show what was just discussed in a visual and more readily understandable form:



NOTE: IF THE ELECTRON IS HIT BY A PHOTON BEFORE IT REACHES THE TWO-SLIT REGION, IT DOES NOT EXHIBIT THE WAVE INTERFERENCE EFFECT, BUT INSTEAD ACTS AS A CLASSICAL OBJECT AND GOES THROUGH ONLY ONE SLIT, YIELDING THE "EXPECTED DISTRIBUTION" PATTERN.

Figure 1: the double-slit experiment[10]

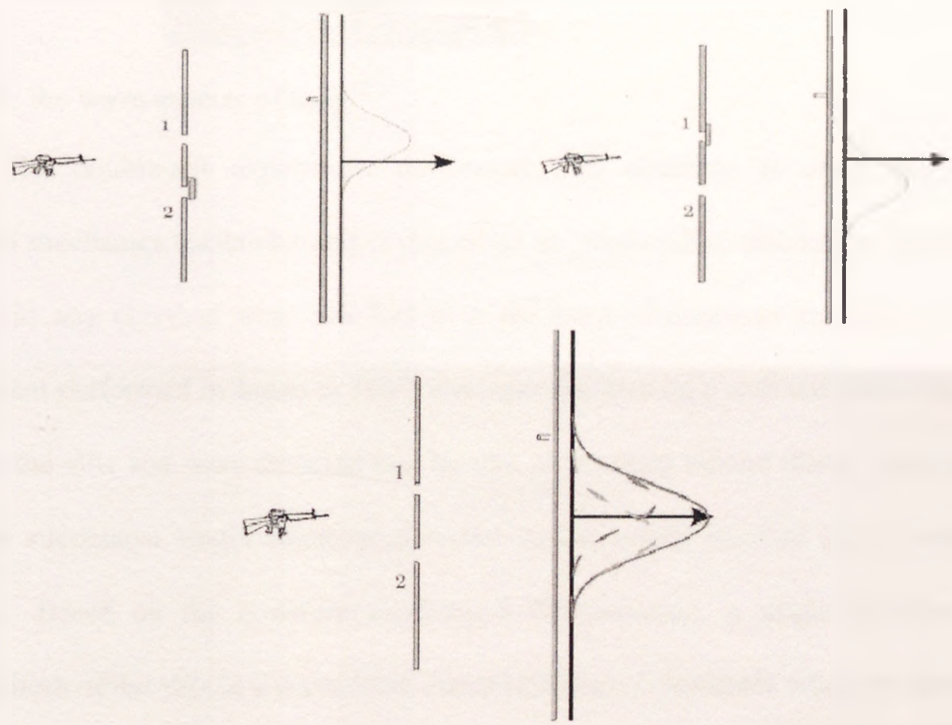


Figure 2: the particle aspects of light[11]

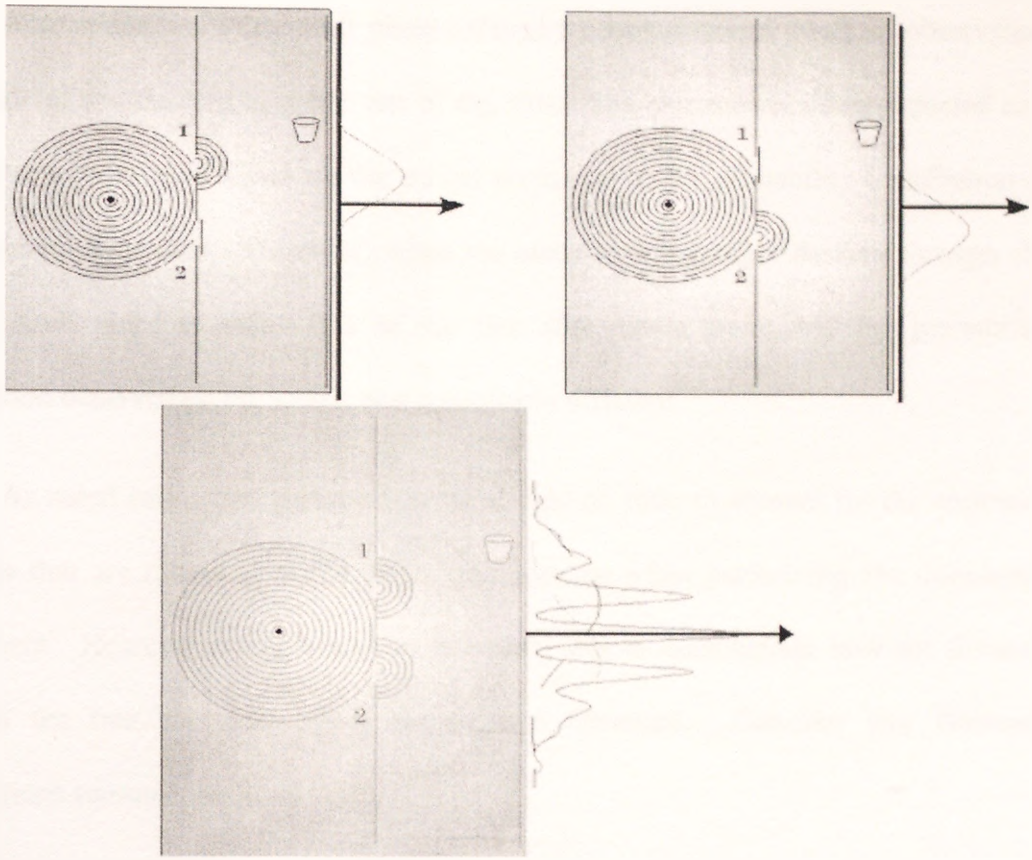


Figure 3: the wave aspects of light[12]

The double-slit experiment performed with electrons is often discussed in quantum mechanics textbooks and is described as "impossible, absolutely impossible to explain in any classical way, and has in it the heart of quantum mechanics."[13] In an experiment performed in Japan in 1987, electrons incident on a wall with two slits passed through the slits and were detected one by one on a screen behind them. Accumulation of those successive single electrons detected on the screen resulted in an interference pattern. Based on the quantum mechanical interpretation, a single electron passed through both of the slits in a wave form called probability amplitude when the uncertainty of the electron position in the wall plane covered the two slits and when no observation was made of the electron at either one of the slits. The electron was then detected as a particle at a point somewhere on the screen according to the probability distribution of the interference pattern. However, when the electron was caught passing through the slits, it took place at either one of the two slits, never both, and the probability distribution observed on the screen was completely different.[14]

As noted earlier, the particle aspects of light do little to account for the multitude of peaks that are observed in the diffraction patterns when performing the double-slit experiment. However, using MathCad, we were able to demonstrate how the distance between the two slits can affect the patterns observed. Consider two Gaussian distributions summed together:

$$5)\qquad f(x) := A \cdot e^{-B \cdot (x+\delta)^2} + A \cdot e^{-B \cdot (x-\delta)^2}$$

The first and second derivatives of this expression, respectively, are as follows:

$$6)\qquad d(w) := -2 \cdot A \cdot B \left[(w - \delta) \cdot e^{4 \cdot B \cdot \delta \cdot w} + w + \delta \right] \cdot e^{-B \cdot w^2 - 2 \cdot B \cdot \delta \cdot w - B \cdot \delta^2}$$

$$7)\qquad s(t) := 2 \cdot A \cdot B \left[\left(2 \cdot B \cdot t^2 - 4 \cdot B \cdot \delta \cdot t + 2 \cdot B \cdot \delta^2 - 1 \right) \cdot e^{4 \cdot B \cdot \delta \cdot t} + 2 \cdot B \cdot t^2 + 4 \cdot B \cdot \delta \cdot t + 2 \cdot B \cdot \delta^2 - 1 \right] \cdot e^{-B \cdot t^2 - 2 \cdot B \cdot \delta \cdot t - B \cdot \delta^2}$$

A, B, and ∂ are arbitrary values, however, for the purposes of the following graphs, A will be set equal to one, ∂ will be 0.5, and B will vary. As shown in this next graph, when B is made to depend on ∂, $B = 1/(2\cdot\partial^2)$, a flat spot will be observed when the two individual distributions, k(q) and y(z) are summed together to obtain f(x).

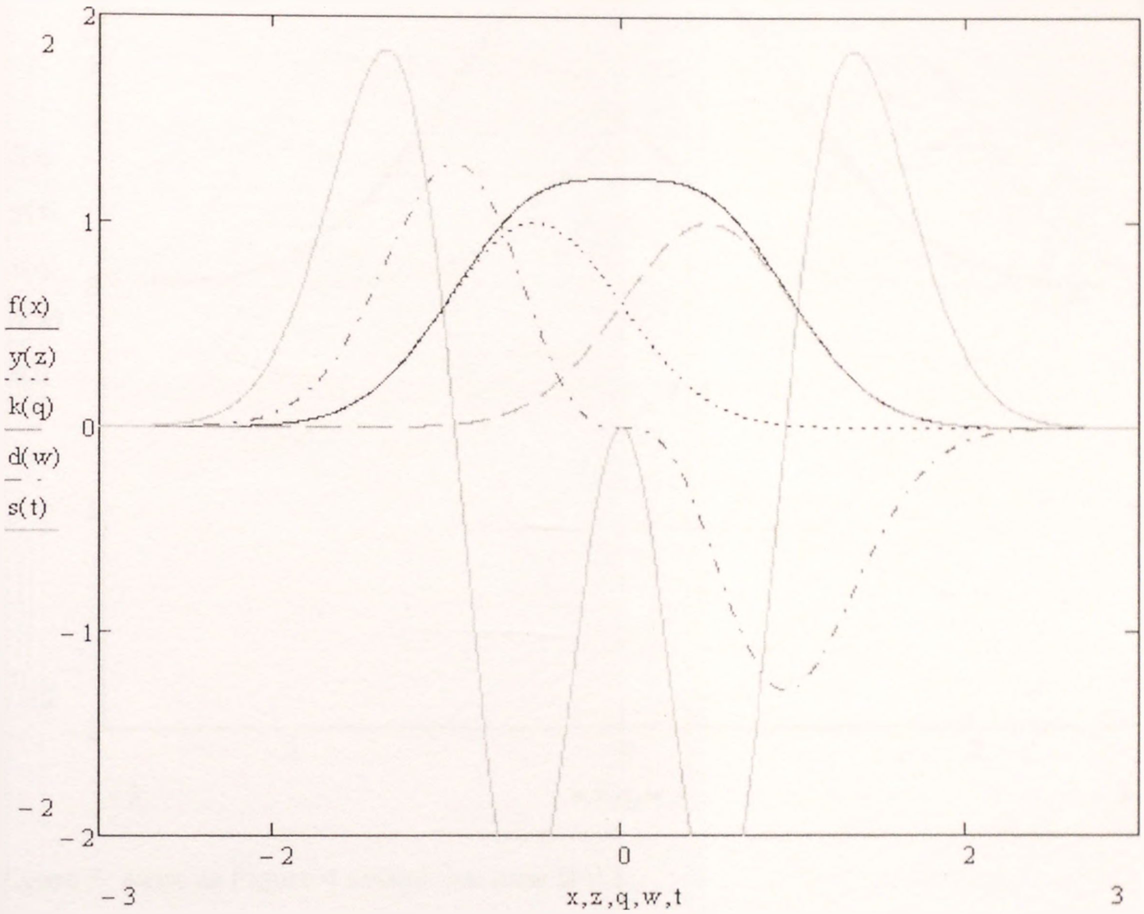


Figure 4: graph demonstrating the flat spot seen in f(x) when the condition of $B = 1/(2\cdot\partial^2)$ is met.

However, making B arbitrary and independent of ∂ will lead either to a single peak for the summation of the distributions or two peaks, depending on how large or small the value of B is. Figure 5 below has the same characteristics as above except that B is now set equal to one, and Figure 6 on page 23 also has the same characteristics except that B is set equal to four.

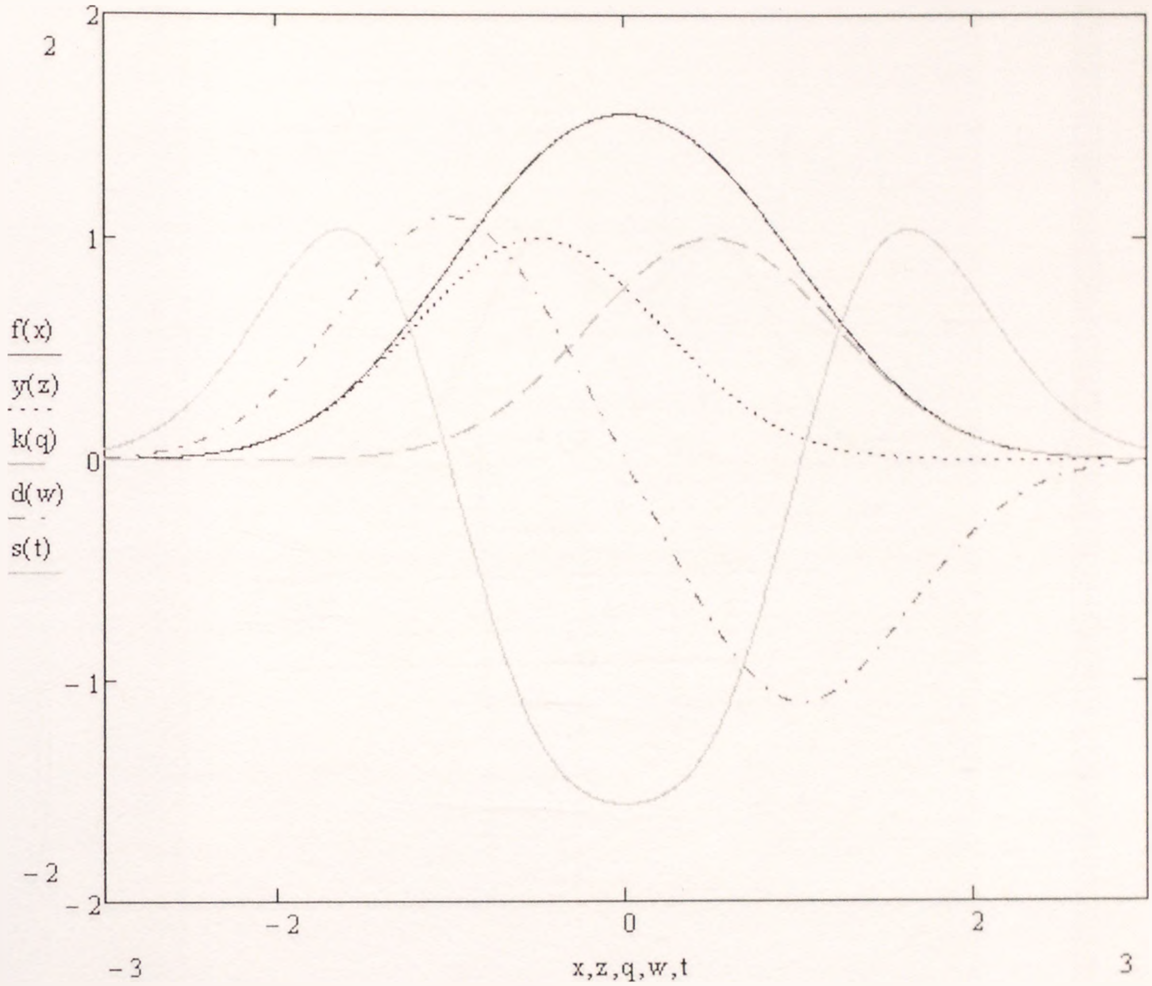


Figure 5: same as Figure 4 except that now B = 1.

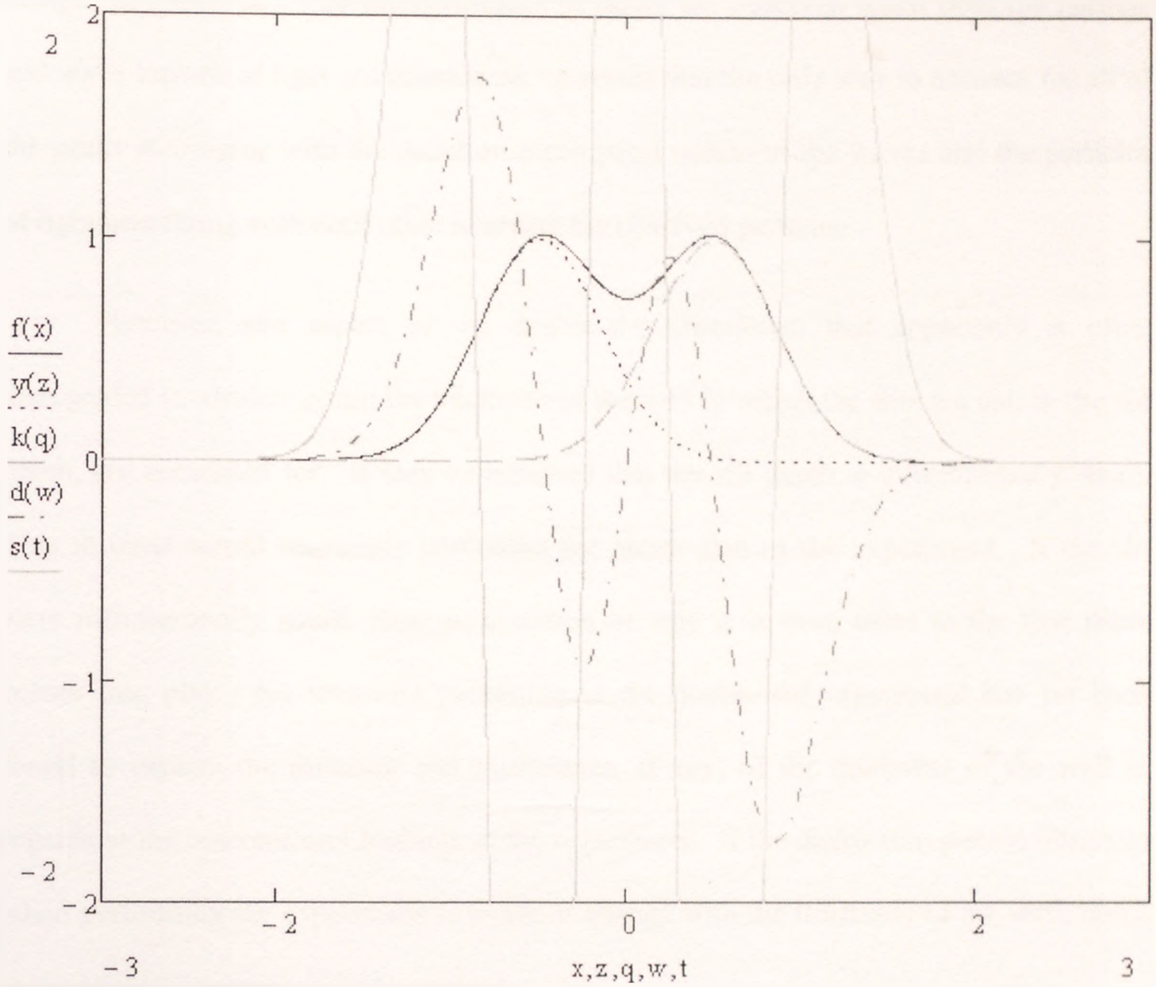


Figure 6: same as Figure 4 except that now B = 4.

As can be deduced, given that the particle properties of light allow for a normal distribution to be observed in regards to the double slit experiment, the altering of the distance between the two slits can affect the diffraction patterns observed. Using two slits, it is possible to observe two peaks in the distribution which was not noted in the above pictures depicting the particle properties of light. The number of slits is directly proportional to the maximum number of peaks that may be observed in the distribution when taking only the particle aspects of light into account. These graphs gave no further insight into how and why the multitudes of peaks are observed when both the particle and wave aspects of light are considered. It seems that the only way to account for all of the peaks is to agree with the quantum mechanical notion of the waves and the particles of light interfering with each other to create the observed patterns.

However, one aspect of the double-slit experiment that apparently is often disregarded is whether or not the thickness of the wall in which the slits are cut, or the slit depth, are accounted for. It may be assumed that the slit depth is infinitesimally small. This in itself would seemingly contradict the entire idea of the experiment. If the slit were infinitesimally small, then the question of why it is even there in the first place comes into play. No literature pertaining to the double-slit experiment has yet been found to explain the meaning and importance, if any, of the thickness of the wall in regards to the outcome and findings of the experiment. If the diffraction pattern observed when performing the experiment is found to change with the thickness of the wall, much more scientific inquiry will be required.

CONCLUSIONS

In regards to Albert Einstein's Special Theory of Relativity, the primary question that is attempting to be answered is whether or not an object can travel at speeds surpassing the speed of light. If so, what characteristics of the object would be observed? Would there be any physical changes to it? Could faster-than-light travel possible account for the observed phenomenon of time dilation? The questions, along with whether or not an object traveling faster than the speed of light would even be visible, are not easy to answer or test even given today's modern technologies. It may be that the Large Hadron Collider could possibly serve to answer some of these, but then again, the theory of special relativity was most likely taken into account during its construction. If special relativity is scientifically found to be false, then the entire physical world will be affected, as the reaches of relativity are vast.

In regards to the double-slit experiment, it was found that the number of slits is directly proportional to the number of peaks that can be observed when summing the two distributions obtained from particles of light passing through each of the slits. This, however, only accounted for a maximum of two peaks in the double-slit experiment when only taking into consideration the particle aspects of light. Accordingly, there must be something more happening which apparently is the wave aspects of light interfering with each other and thus causing the multitude of peaks to appear. On another note, one thing that is seemingly not taken into consideration when performing the experiment is whether or not the depth of the slit plays a part in the observed diffraction patterns. If this is found to be the case, more inquiry will be required, as the double-slit experiment is the basis for modern-day quantum mechanics.

Finally, in regards to science and culture, the two ideas are quite different. It is my opinion, however, that the two are wholly dependent upon each other in order to maintain a proper functioning society. In regards to scientific progression, sometimes it seems that the incorporation of ideas that have seemingly been verified over and over again into experimental processes may create a bias that prevents one from seeing something other than what has already been observed. Oddly enough, this is sometimes the case throughout culture where the society and people are blinded or shielded from something that they simply cannot or will not agree with, purely because it is contrary to their own collective thoughts and emotions.

REFERENCES

1. Dennis, Brian. Einstein: A Life. New York, John Wiley and Sons, **1996**.

2. Einstein, Albert. On The Electrodynamics of Moving Bodies. http://www.fourmilab.ch/etexts/einstein/specrel/www/. Accessed: 1-19-09.

3. Griffiths, David J. Introduction to Electrodynamics. Upper Saddle River, NJ, Prentice Hall, **1999**.

4. Stachel, John. Einstein's Miraculous Year. Princeton University Press, **1998**.

5. Einstein, Albert. Relativity: The Special and The General Theory. Tess Press, **1916**.

6. Redzic, D.V. Towards Disentangling the Meaning of Relativistic Length Contraction. *European Journal of Physics*. **2008**, 29 (2), 191-201

7. www.wikipedia.org. Length Contraction. http://en.wikipedia.org/wiki/Length_contraction. accessed: 3-2-09.

8. www.wikipedia.org. Time Dilation. http://en.wikipedia.org/wiki/Time_dilation. accessed: 2-24-09.

9. Ives, H.E.; Stilwell, G.R. An Experimental Study of the Rate of a Moving Clock. *Journal of the Optical Society of America*. **1938**, 28, 215-226

10. http://www.cheniere.org/books/excalibur/fig7.jpg. accessed: 1-19-09.

11. http://www.upscale.utoronto.ca/GeneralInterest/Harrison/DoubleSlit/gun3.gif. accessed: 1-19-09.

12. http://www.hmi.de/bereiche/SF/SF7/PANS/english/dualismus/images/Doppelspalt_eng.ggi. accessed: 1-19-09.

13. Feynman, R.P.; Leighton, R.B; Sands, M. The Feynman Lectures on Physics. **1964**, Vol. 3, 1-5.

14. Tonomura, A.; Endo, J.; Matsuda, T.; Kawasaki, T. Demonstration of Single-Electron Buildup of an Interference Pattern. *American Journal of Physics*. **1989**, 57 (2), 117-120.