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Relativity from the Eagles Point of View

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Introduction

In the following paper I will explain how I can derive Relativity and Newton's laws from just one equation:

$$\left\langle \vec{\lambda} \cdot \vec{\lambda} \right\rangle \left\langle f \cdot f \right\rangle = c^2$$

This equation can explain also, why Relativity is the perfect theory of universe while Newtonian Mechanics lake the ability to describe nature correctly. Unfortunately, because of our life experience, our mind was adapted to mechanical physics. Einstein's theory of Relativity enable us to translate Newtonian Mechanics to Relativistic Mechanic by using expression like the expression below and more expression

$$m = \frac{m_0}{\sqrt{1 - \frac{V^2}{c^2}}} = \gamma \cdot m_0 \qquad \left(mc^2\right)^2 = \left(Pc\right)^2 + \left(m_0 c^2\right)^2$$

And then solve the problem, and than translate the solution back to the familiar mechanical world.

It is also shown in that paper that our universe is entirely wavy. It is shown that space is bend by the electric field and bend much less by gravitational field. Therefore particle movement in straight line is rare. The curved space due to electrostatic force and the fine structure constant are responsible to quantum behavior of the atom.

I also found that wave of matter are circular. While light can move in straight lines.

Abbreviations

c	speed of light
h	Plank constant
m_0	rest mass
m	moving mass
$\vec{V}$	velocity
$\vec{P}=m\cdot\vec{V}$	momentum

$\vec{\beta}=\vec{V}/c=\sin(\theta)=\tanh(\psi)$

$\gamma=1\Big/\sqrt{1\text{-}\beta^2}=\dfrac{1}{\cos(\theta)}=\cosh(\psi)$

f	frequency
t	time
$\vec{x}$	distance from origin
$T=\dfrac{1}{f}$	time period
$\vec{\lambda}$	wavelength
$\vec{k}=\dfrac{2\cdot\pi}{\vec{\lambda}}$	wave number
$\lambda_c=\dfrac{h}{m_0c}$	Compton wavelength
$\overrightarrow{\lambda_e}=\dfrac{h}{m\cdot\vec{V}}=\dfrac{h}{\vec{P}}$	De Borglie wavelength of electron with velocity V

$f_c\cdot\overrightarrow{\lambda_c}=c \qquad f\cdot\vec{\lambda}=c \qquad f^*\cdot\vec{\lambda}^*=c \qquad f_e\cdot\vec{\lambda}_e=c$

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Chapter 1

INTRODUCTION

According to De Borglie Hypothesis all matter has a wave-like nature. Hence each particle can be described, at least, mathematically as a wave. Those waves really exist as was proven in various experiments.

A wave is usually described by differential equation;

1] $$\nabla^2\Phi(\vec{x},t)=\frac{1}{\frac{\omega\cdot\omega}{\left\langle\vec{k}\cdot\vec{k}\right\rangle}}\frac{\partial^2 f(\vec{x},t)}{\partial t^2}$$

f is the frequency, λ the wavelength and k the wave number

2]
$$\omega=2\cdot\pi\cdot f$$
$$\vec{k}=\frac{2\pi}{\vec{\lambda}}$$

And V is the velocity of the wave

3] $$\frac{\omega}{\left\|\vec{k}\right\|}=\left\|\vec{\lambda}\right\|\cdot f=\left\|\vec{V}\right\|$$

The solution of the wave equation is

4] $$\Phi(\vec{x},t)=A\cdot\cos\left[\vec{k}\cdot(\vec{x}\pm\frac{\omega}{\vec{k}}\cdot t)+\zeta\right]=A\cdot\cos\left[\vec{k}\cdot(\vec{x}\pm\vec{V}\cdot t)+\zeta\right]$$

The extension of Einstein's second postulate and modification of De Borglie Hypothesis

The second postulate of Einstein (1905) was :

"The speed of light is the same for all inertial observers"

This postulate was a result of Michelson Morley interferometer experiment.
At the end of the 19th century it was believed that space is filled with ether. And the ether is a transport medium for electromagnetic waves.
Michelson and Morley tried to measure the speed of the Earth and the speed of light with respect to the ether. The outcome of the experiment was that no motion through the "Ether" was detect in any direction. So, Einstein's assumption was that the "Ether"

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does not exist, the velocity of light is constant in any direction and in any frame of reference.

Einstein found also that the photons has a momentum P

4]
$$\lambda \cdot f = c$$
$$\lambda_{photon} = \frac{h}{P_{photon}}$$

Although the rest mass of the photon is zero;

5]
$$m_{0\,photon} = 0$$

In 1924, Louis-Victor de Broglie formulated the De Broglie hypothesis, claiming that all matter, not just light, has a wave-like nature
De Broglie made a bold assertion. Considering Einstein's relationship of wavelength λ to momentum P, De Broglie proposed that Eq 4 would determine the wavelength of any matter:

6]
$$\vec{\lambda}_{matter} = \frac{h}{\vec{P}_{matter}} = \frac{h}{m_{matter} \cdot \vec{V}_{matter}}$$
$$\vec{\lambda}_{matter} \cdot f_{matter} = \vec{V}_{matter}$$

The only different is about rest mass, the rest mass of electrons is not zero and the photon mass is always;

7]
$$m_{0matter} \neq 0$$

In this article I suggest to make a minor modification to De Broglie Hypothesis and write Eq 6 in a different way.

8]
$$\vec{\lambda}_{matter} \cdot f_{\text{modified}} = c$$
$$f_{\text{modified}} = \frac{f_{matter}}{\beta}$$
$$\beta = \frac{V_{matter}}{c}$$

Now due to this modification all the waves (photons and matter-waves) obey one simple law:

10]
$$\left\|\vec{\lambda}\right\| \cdot f = c$$

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From now on we shell use f_{modified} instead of f_{matter}, And the electron modified frequency will be f_e $\quad (f_e = f_{modified})$, And the wavelength of the moving electron will be λ_e $\quad (\lambda_e = \lambda_{matter})$

The mechanical velocity V of the electron can be found from;

11]

$$
\begin{aligned}
& f_e = f_{\text{modified}} = \frac{f_{matter}}{\beta} \\
& \left\| \vec{\lambda}_e \right\| \cdot f_{\text{e}} = c \\
& \beta = \frac{V}{c} \\
& \left\| \vec{\lambda}_e \right\| \cdot \left(\beta \cdot f_{\text{e}} \right) = \beta \cdot c = V
\end{aligned}
$$

Why physics is so complicate

Why physics is so complicate, The answer of this question can be very simple. **The simplest solution of a physical problem is obtained if we choose the most appropriate coordinate system to that problem.**
Unfortunately, in photon electron collision, **the best coordinates of each particle are in the direction of its λ,** and each particle has a different direction of motion (λ).
When two particles collide, before collision we need two coordinate system, and after collision we need a new pair of coordinate system. A simple solution need four coordinate systems.
We try to solve the problem with one coordinate system instead of four coordinates system. And the result is complicate, sometimes wrong. And sometimes, the mathematical expression masks the physical behavior. This happens very often with Schrödinger equation.

Chapter 2

Lorenz Transformations

Maxwell equation (Eq 1) is wave differential equations that successfully describe electromagnetic wave propagation in empty space.

1]
$$\frac{\partial^2 \Phi}{\partial x^2} + \frac{\partial^2 \Phi}{\partial y^2} + \frac{\partial^2 \Phi}{\partial z^2} - \frac{1}{c^2} \frac{\partial^2 \Phi}{\partial x^2} = 0$$

The velocity of the wave is the speed of light c that appear in Eq 1

As previously mentioned Michelson Morley experiment proved that the speed of light is constant in any direction . In order that the speed of light will be also invariant in any frame of reference, which means that this equation will look the same in another coordinate system x' ,
we demand that:

2] $$\frac{\partial^2\Phi}{\partial x'^2}+\frac{\partial^2\Phi}{\partial y'^2}+\frac{\partial^2\Phi}{\partial z'^2}-\frac{1}{c^2}\frac{\partial^2\Phi}{\partial t'^2}=\frac{\partial^2\Phi}{\partial x^2}+\frac{\partial^2\Phi}{\partial y^2}+\frac{\partial^2\Phi}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2\Phi}{\partial t^2}=0$$

in both coordinate the speed of light have to be the same

According to Lorenz transformation or Minkowsky transformation that will be considered later
What is common to both coordinate is ;

3] $$c^2t'^2-(x'^2+y'^2+z'^2)=c^2t^2-(x^2+y^2+z^2)$$

Lorenz transformation that obey Eq 3 is ;

4] $$\begin{bmatrix} ct'\sqrt{1-\frac{V^2}{c^2}} \\ x'\sqrt{1-\frac{V^2}{c^2}} \\ y' \\ z' \end{bmatrix}=\begin{bmatrix} 1 & -\frac{V}{c} & 0 & 0 \\ -\frac{V}{c} & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}\cdot\begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}$$

the foolowing definitions are widly used

5] $$\beta=\frac{V}{c}$$
$$\gamma=\frac{1}{\sqrt{1-\frac{V^2}{c^2}}}$$

according to those definitions the matrix is:

6] $$\begin{bmatrix} \frac{ct'}{\gamma} \\ \frac{x'}{\gamma} \\ y' \\ z' \end{bmatrix}=\begin{bmatrix} 1 & -\beta & 0 & 0 \\ -\beta & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}\cdot\begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}$$

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as will be justified later, Lorenz suggested the following trigonometric relations ;

7]
$$\beta = \frac{V}{c} = \sin(\theta) \le 1$$
$$\gamma = \frac{1}{\sqrt{1-\frac{V^2}{c^2}}} = \frac{1}{\cos(\theta)}$$

In that case Lorenz transformation in matrix form is

8]
$$\begin{bmatrix} ct'\cos(\theta) \\ x'\cos(\theta) \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} 1 & -\sin(\theta) & 0 & 0 \\ -\sin(\theta) & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}$$

Minkowsky (~1905) suggested, another kind of coordinates rotation: Hyperbolic rotation. His definition was a bit different from Lorenz definition . According to Minkowsky transformation ;

9]
$$\frac{V}{c} = \beta = tanh(\psi) \le 1$$
$$\gamma = \cosh(\psi)$$
$$\gamma \cdot \beta = \sinh(\psi)$$

in matrix form ;

10]
$$\begin{bmatrix} ct' \\ x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} \cosh(\psi) & -\sinh(\psi) & 0 & 0 \\ -\sinh(\psi) & \cosh(\psi) & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}$$

In order to translate angles between Minkovsky and Lorenz transformation we can use

11]
$$\beta = \tanh(\psi) = \sin(\theta)$$

Both transformations are numerically identical, but differ physically, **And we must to find which transformation is the physical one.**

To answer this question we have to pay attentions to the results of "Compton Effect"

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"Compton Effect" is an important experiment that had been done in 1923. The experiment and its result will be carefully judged later in this paper.

Einstein's theory of Relativity

Einstein's equation establish the relation between mass, energy, momentum and velocity
Einstein revealed that mass depend on velocity according to

12] $$m = \frac{m_0}{\sqrt{1 - \frac{V^2}{c^2}}} = \gamma \cdot m_0$$

Einstein also found the relation between momentum and energy

13] $$\left(mc^2\right)^2 = \left(Pc\right)^2 + \left(m_0c^2\right)^2$$

The last equation reminds us Pythagoras law. Later I will show that Pythagoras law is crucial to Relativity.

De Borglie Hypothesis

De Borglie Hypothesis was that the electron's wavelength λ is inversely proportional to the momentum *P* of that electron, but, momentum is proportional to the wave number *k*

14] $$\vec{P} \sim \frac{1}{\vec{\lambda}_e}$$

Because

15] $$\vec{k} = \frac{2\pi}{\vec{\lambda}}$$

Therefore

16] $$\vec{P} \sim \vec{k}$$

Conclusion

In Relativity, Conservation of wave numbers is the same as Conservation of momentum In Newton's mechanics

17] $$\sum \vec{P}_n = \sum \vec{k}_n = \sum \frac{1}{\vec{\lambda}_n} = 0$$

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As said before, De Borglie Hypothesis was that the electron's wavelength is inversely proportional to the momentum of that electron,

18]

$$\lambda_e = \frac{h}{\vec{P}} = \frac{h}{m\cdot\vec{V}} = \frac{h}{\dfrac{m_0}{\sqrt{1-\dfrac{V^2}{c^2}}}\cdot\dfrac{c\cdot\vec{V}}{c}} = \frac{h}{m_0\cdot c}\cdot\frac{\sqrt{1-\beta^2}}{\beta} = \frac{\lambda c}{\gamma\cdot\beta}$$

where

h is Plank Constant

$\vec{P} = m\cdot\vec{V}$ is the momentum

and

$\lambda c = \dfrac{h}{m_0\cdot c}$ is Compton's wavelength

The frequency f_e according to De Borglie Hypothesis was proportional to the total energy hf_e of the moving electron. So,

19] $$f_e = \frac{c}{\lambda_e} = \frac{c\cdot\gamma\cdot\beta}{\lambda c} = f_C\cdot\gamma\cdot\beta$$

it can be easily checked that

20] $$f_e\cdot\lambda_e = f_C\cdot\lambda c = c$$

And also the actual electron velocity V can be found

21] $$(\beta\cdot f_e)\cdot\lambda_e = (\beta\cdot f_C)\cdot\lambda c = \beta\cdot c = V$$

The most miserable conclusion is that from the nineteen century the scientists try to describe physical phenomena in term of Newtonian's physic like conservation of momentum and conservation of energy, instead of defining new conservation laws. Like the law of Conservation of wave numbers (Conservation of momentum)

Compton Effect will help us to revise some of Newton's laws

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Chapter 3

The Bohr's Atom and the Fine-Structure Constant

Bending the Space

Abbreviations

$c=3{\cdot}10^{8}$	speed of light
$h=6.626{\cdot}10^{-34}$	Plank Constant
$m_0=9.11{\cdot}10^{-31}$	electron rest mass
$\kappa_0= c^2{\cdot}10^{-7}$	Culomb constant
$\varepsilon_0=8.85{\cdot}10^{-12}$	vacuum permittivity
$\mu_0=4{\cdot}\pi{\cdot}10^{-7}$	permeability constant
$e=1.6{\cdot}10^{-19}$	electron charge
$\lambda c=\frac{h}{m_0{\cdot}c}=0.0243{\cdot}10^{-10}$	Compton wavelength
$\alpha=\frac{1}{137.035999}$	fine-structure constant
R	Bohr Radius of atom
n=1,2,3,,,,,,	orbital number (integer)
Z	Atomic number (integer)

Introduction

In 1913, Niels Bohr developed a simple theory that succeeded to explain the Rydberg formula. Rydberg formula predicted empirically the wavelengths of the hydrogen atom spectrum. Bohr assumed the atom to be a planetary system and derived equation that could explain what happens in the hydrogen atom.

Arnold Sommerfeld introduced the fine-structure constant in 1916, in conjugate to Bohr's atom model. The **fine-structure constant** (usually denoted α, but in this paper it will be also denoted β) is given by;

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1] $$\alpha_1 = \beta_1 = \frac{V_1}{c} = \frac{2\cdot\pi\cdot\kappa_0\cdot e^2}{h\cdot c} = \frac{c\cdot\mu_0\cdot e^2}{2h} = \frac{1}{137.03599}$$

This constant is dimensionless quantity (velocity divided by velocity) and it has a constant numerical value in all system of units.

The fine structure constant appears in Bohr's model of the hydrogen atom. In hydrogen like atom, Bohr assumed that, the centrifugal force is balanced by the electrostatic force between the negative charged electron and the heavy proton in the nucleus of the atom.

2]

$$\frac{m\cdot V^2}{R} = \frac{k_e\cdot e^2}{R^2}$$

e is the electron charge , and k_e is the Coulombs Constant. And R the orbit radius of the electron spinning around the nucleus

Performing some legal algebraic manipulations on Eq 2
The Newtonian expression is translated approximately to a relativistic expression

3]

$$\frac{m\cdot V^2}{c^2\cdot R} = \frac{k_e\cdot e^2}{c^2\cdot R^2}$$

$$\frac{m_0\cdot\beta^2}{\sqrt{1-\beta^2}} = \frac{k_e\cdot e^2}{c^2\cdot R}$$

$$\frac{\beta^2}{\sqrt{1-\beta^2}} = \frac{k_e\cdot e^2}{m_0\cdot c^2\cdot R}\cdot\frac{2\cdot\pi}{2\cdot\pi}\cdot\frac{h\cdot c}{h\cdot c} = \frac{h\cdot}{m_0\cdot c}\cdot\frac{c}{c}\cdot\frac{2\cdot\pi\cdot k_e\cdot e^2}{h\cdot c}\cdot\frac{1}{2\cdot\pi\cdot R}$$

$$\beta = \alpha = \frac{2\cdot\pi\cdot k_e\cdot e^2}{h\cdot c} \approx \frac{1}{137.035999}$$

$$\lambda c = \frac{h}{m_0\cdot c}$$

$$\frac{\beta^2}{\sqrt{1-\beta^2}} = \lambda c\cdot\beta\cdot\frac{1}{2\cdot\pi\cdot R}$$

$$2\cdot\pi\cdot R = \lambda c\cdot\frac{\sqrt{1-\beta^2}}{\beta} = \frac{\lambda c}{\gamma\cdot\beta} = \lambda e$$

In the last line of Eq 3, We can see that due to Relativity **the circumference of the circle become as long as the electron wavelength λe**

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This representation is more usefull

4] $$\frac{1}{\gamma\cdot\beta\cdot 2\cdot\pi}=\frac{R}{\lambda_c}=21.8093745$$

Or

5] $$\frac{1}{\gamma\cdot\beta}=\frac{2\cdot\pi\cdot R}{\lambda_c}=2\cdot\pi\cdot 21.8093745=137.032341$$

This is a very curious result. The electron is not moving around the nucleus. Instead, the electron has a wavelength ***λe***. but the wave is circular and the end of ***λe*** is connected to its start point. Why the wave is bent to make a circle. May be the answer is , due to the electric field between the electron and the nucleus that bend space. And the result is a standing wave

From Eq 4

6] $$2\cdot\pi=\frac{\lambda c}{\gamma\cdot\beta\cdot R}=\frac{\lambda e}{R}=\frac{h}{m_0 c}\cdot\frac{1}{\gamma\cdot\beta\cdot R}=\frac{h}{m\cdot V}\cdot\frac{1}{R}$$
$$m\cdot V\cdot R=\frac{h}{2\cdot\pi}$$

Conclusion

This means that the mechanical angular momentum of the electron surrounding the nucleus is constant. Conservation of angular momentum is due to Relativity. The electrostatic force between the electron and the proton bend space and the wave has the shape of a circle, Linear conservation of momentum become angular conservation of momentum. <u>the circumference of the circle become as long as the electron wavelength *λe*</u>

The radius of the first orbit in Bohr's Atom is found to be approximately

7] $$\lambda_c=\frac{2\cdot\pi\cdot R\cdot\beta}{\sqrt{1-\beta^2}}\approx\frac{2\cdot\pi\cdot R}{137.035999}$$
$$R=\frac{\lambda_c}{2\cdot\pi}\cdot\frac{\sqrt{1-\beta^2}}{\beta}=5.29967799799740\cdot 10^{-11}$$

If the orbital number is higher, the electron speed V_n changes to;

8] $$\beta_n=n\cdot\beta_1$$

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and for other orbits

9]

$$\alpha_1 = \beta_1 = \frac{V_1}{c} = \frac{1}{137.03599}$$

$$\alpha_n = \beta_n = \frac{V_n}{c} = \frac{Z \cdot V_1}{n \cdot c}$$

$$R_n = \frac{n^2}{Z} \cdot R_1$$

$$E_n = \frac{Z^2}{n^2} \cdot E_1$$

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Chapter 4

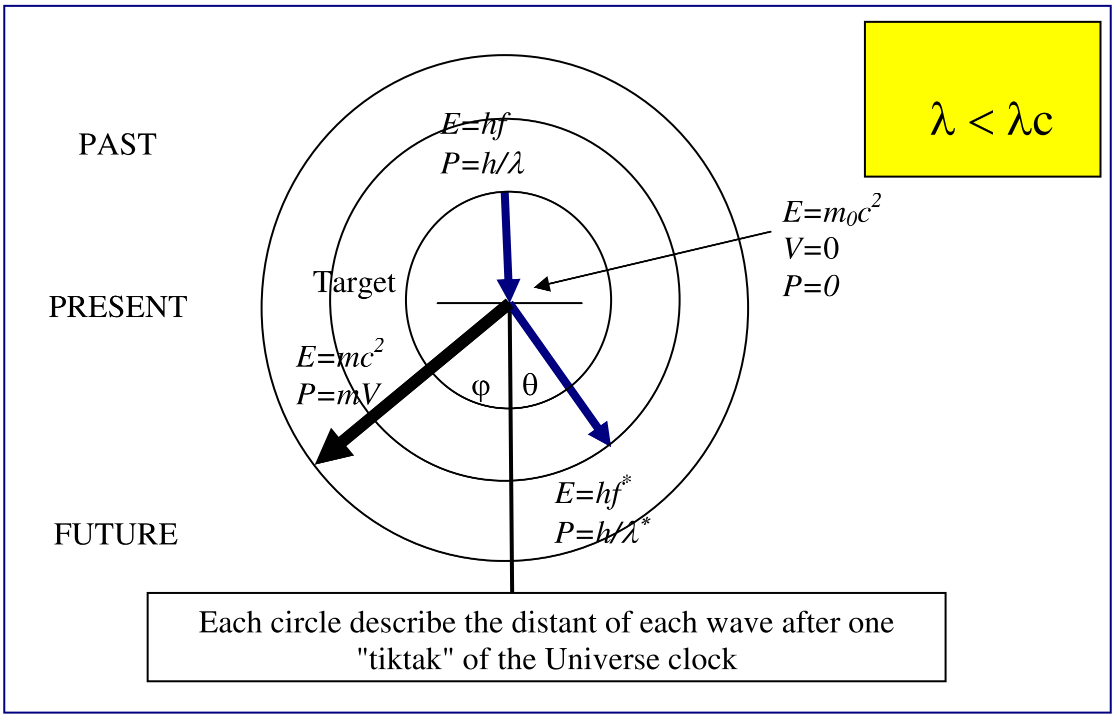
Introduction

Electrons may collide with photons (Compton effect) or may be attracted by an electrostatic field like in the case of the Bohr atom. Or can create Neutrons with protons. And we have to find what are the common laws for those different interactions

Compton's Experiment (1923) and the new conservation laws

Compton's experiment layout is described below.

In Compton Experiment, photon with wavelength λ collides with an electron at rest. The scattered photon has a longer wavelength λ^* and therefore have lower energy. The photon is deflected, and continues to move with a new angel θ. The electron that was at rest, after collision, is deflected from its course in the opposite direction at an angle φ



Derivation of Compton Equation

	Before collision	After collision
The energy of incident photon	$h \cdot f$	$h \cdot f^*$
The energy of electron	$m_o \cdot c^2$	$m \cdot c^2$
The wavelength of the photon	λ	λ^*
The momentum of electron	0	$m \cdot \vec{V}$

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The energy of the system before collision,

$$E_{PAST} = hf + m_o c^2$$

The energy of the system after collision,

$$E_{FUTURE} = hf^* + mc^2$$

From the principle of conservation of energy

1] $$hf - hf^* + m_o c^2 = mc^2$$

Remembering that for the photon

$$P = \frac{hf}{c} = \frac{h}{\lambda}$$

From the principle of conservation of linear momentum along x and y axis, we have in y axis

2] $$hf - hf^* \cos(\theta) = mcV \cos(\phi)$$

in x axis

3] $$hf^* \sin(\theta) = mcV \sin(\phi)$$

Squaring (2) and (3) and then adding,

4] $$m^2V^2c^2 = (hf)^2 + (hf^*)^2 - 2(hf)(hf^*)\cos(\theta)$$

Squaring equation (1);

5] $$m^2c^4 = m_o{}^2c^4 + (hf)^2 + (hf^*)^2 - 2(hf)(hf^*) + 2m_o c^2\left[hf - hf^*\right]$$

Subtracting (4) from (5);

6] $$m^2c^4 - m^2V^2c^2 = m_o{}^2c^4 + 2(hf)(hf^*)\left[\cos(\theta) - 1\right] + 2m_o c^2\left[hf - hf^*\right]$$

Relativistic mass depend on velocity according to

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7] $$m = \frac{m_o}{\sqrt{1 - \frac{V^2}{c^2}}}$$

Or

8] $$m^2c^2 - m^2V^2 = m_o{}^2c^2$$

Multiplying both sides by c^2;

9] $$m^2c^4 - m^2V^2c^2 = m_o{}^2c^4$$

Using equation (9) equation (6) becomes

10] $$\begin{aligned} &0 = 2(hf)(hf^*)[\cos(\theta) - 1] + 2m_oc^2[hf - hf^*] \\ &\frac{h}{m_oc^2}[1 - \cos(\theta)] = \frac{f - f^*}{f \cdot f^*} = \frac{1}{f^*} - \frac{1}{f} \\ &\frac{c}{f^*} - \frac{c}{f} = \lambda^* - \lambda = \frac{h}{m_oc}[1 - \cos(\theta)] \end{aligned}$$

The last line in Eq 10 is Compton equation

11] $$\begin{aligned} &\lambda^* - \lambda = \lambda_c \cdot (1 - \cos(\theta)) \\ &\lambda_c = \frac{h}{m_oc} \end{aligned}$$

Where λc is called the Compton wavelength of the electron.

Compton's conclusion where:

1. The wavelength of the scattered photon λ^* is greater than the wavelength of incident photon λ.
2. $\lambda - \lambda^*$ is independent of the incident wavelength.

Compton did not understood what is the physical meaning of cos(θ)

Since

12] $$-1 \le \cos(\theta) \le 1$$

Compton conclusion was that

13] $$\lambda^* - \lambda \le 2 \cdot \lambda_c$$

Compton also did not explained why the electron and the photon change their direction (see θ and φ in Compton's experiment layout in the picture above). May be he could not measure the electron deviation φ. Compton measured photons frequencies only. Compton did not notice that: The most important conclusion of Compton Effect concern cos(θ): In order to change velocity the electron must collide with a photons. And the collision changes the electron direction of movement and the electron move in straight lines if its energy is constant.

For example : Our body is composed of many electrons, if we walk we change direction and speed, so photons are involved in this process.

Compton missed many other conclusion And I claim that **there is another set of conclusions to Compton Effect, and the question is what are the correct conclusions, the conclusion represented above or the new set that will be represented now**

Chapter 5

Compton Effect alternative set of conclusions

Compton's conclusion from his experiment was,

1] $$\lambda^* - \lambda = \lambda c \cdot (1 - \cos(\theta))$$

The Correct "Equation"

What I did is not trivial to mathematicians.
Compton equation was separate into two parts one part describes the wavelengths before impact **(past)** and the second after impact **(future)**

2] $$\lambda = \lambda_C \cdot \cos(\theta) \qquad \lambda^* = \lambda_C$$

Now I declare a new physical law The New Law is

Law of photon electron interaction

- After photon-electron elastic interaction, the photons wavelength λ^* and Compton's wavelength λc, have the same wavelengths,

$$\lambda^* = \lambda_C$$

- In order to equalize their wavelengths (λ^* = λc) The photon change its direction with an angel θ , such that :

$$\lambda = \lambda_C \cdot \cos(\theta)$$

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And what about φ ????????

Compton did not check the electron shift angle φ. The angle does not appear in his Equation. The equation that relate θ to φ can be found somewhere online and is given by Eq 3.

3]

$$ctg(\varphi) = \left(1 - \frac{h \cdot f}{m_0 \cdot c^2}\right) \cdot ctg\left(\frac{\theta}{2}\right)$$

And from Eq 2 and Eq 3

4]

$$ctg(\varphi) = \left(1 - \frac{h \cdot f}{m_0 \cdot c^2}\right) \cdot ctg\left(\frac{\theta}{2}\right) = \left(1 - \frac{h}{m_0 \cdot c} \cdot \frac{f}{c}\right) \cdot ctg\left(\frac{\theta}{2}\right) = \left(1 - \lambda c \cdot \frac{f}{c}\right) \cdot ctg\left(\frac{\theta}{2}\right)$$

$$ctg(\varphi) = \left(1 - \frac{\lambda c}{\lambda}\right) \cdot ctg\left(\frac{\theta}{2}\right)$$

$$ctg(\varphi) = \left(1 - \frac{1}{\cos(\theta)}\right) \cdot ctg\left(\frac{\theta}{2}\right)$$

And the end result of identity solution is

5]

$$\varphi + \theta = \pi/2$$

This result is amazing

The angle between the photon and the electron after scattering is always π/2

This result is just because $(mc^2)^2 = (Pc)^2 + (m_0c^2)^2$ obey Pythagoras law in a right angle triangle.

Relativity and Compton Equation

As claimed before, In Compton's experiment, the photon electron collision is elastic and is conserving energy and momentum
The momentum vector scheme is,

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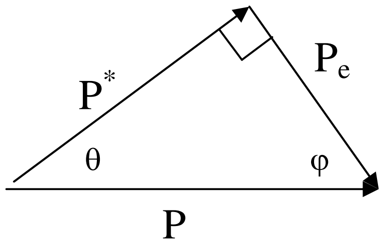


Using Quantum and Relativity, One can find the exact meaning of scattering angles θ and φ using triangular law of cosines

6] $$\vec{P}_e = \vec{P} = m \cdot \vec{V} = \frac{m_0}{\sqrt{1-\beta^2}} \cdot \frac{c \cdot \vec{V}}{c} = \frac{m_0 \cdot c}{h} \cdot \frac{h \cdot \vec{\beta}}{\sqrt{1-\beta^2}} = \frac{h}{\lambda_c} \cdot \frac{\vec{\beta}}{\sqrt{1-\beta^2}}$$

$$P^2 = \vec{P} \cdot \vec{P} = P^2 + P^{*2} - 2 \cdot \vec{P} \cdot \vec{P}^* = \frac{h^2}{\lambda_c^2} \cdot \frac{\beta^2}{1-\beta^2} = \frac{h^2}{\lambda^2 \cdot \lambda^{*2}} \cdot \left(\lambda^{*2} + \lambda^2 - 2 \cdot \lambda \cdot \lambda^* \cos(\theta)\right)$$

$$\frac{\beta^2}{1-\beta^2} = \frac{\lambda_c^2}{\lambda^2 \cdot \lambda^{*2}} \cdot \left(\lambda^{*2} + \lambda^2 - 2 \cdot \lambda \cdot \lambda^* \cos(\theta)\right) = \frac{\lambda_c^2}{\lambda^2 \cdot \lambda^{*2}} \cdot \left(\lambda^{*2} + \lambda^2 - 2 \cdot \lambda \cdot \lambda^* \left[\frac{\lambda}{\lambda_c}\right]\right)$$

$$\frac{\beta^2}{1-\beta^2} = \frac{\lambda_c^2}{\lambda^2} + \frac{\lambda_c^2}{\lambda^{*2}} - \frac{2 \cdot \lambda_c^2}{\lambda_c \cdot \lambda^*} = \frac{1}{\cos^2(\theta)} + 1 - 2 = \frac{1}{\cos^2(\theta)} - 1 = \frac{1-\cos^2(\theta)}{\cos^2(\theta)} = \frac{\sin^2(\theta)}{\cos^2(\theta)}$$

$$\vec{\beta} = \sin(\theta) \qquad \frac{\vec{\beta}}{\sqrt{1-\beta^2}} = \frac{\sin(\theta)}{\cos(\theta)} = \tan(\theta) \qquad \sqrt{1-\beta^2} = \cos(\theta)$$

The three equations in the last line are very important items in the dictionary that enable us to find the electron speed and direction using only the photon deflecting angle θ, known as the Relativity Factors

7]

$$\vec{\beta} = \sin(\theta) \qquad \frac{\vec{\beta}}{\sqrt{1-\beta^2}} = \frac{\sin(\theta)}{\cos(\theta)} = \tan(\theta) \qquad \sqrt{1-\beta^2} = \cos(\theta)$$

[$\beta = \frac{V}{c} = \sin(\theta)$ **was suggested also by Lorenz]**

Computing the electron momentum and finding all the links between Quantum Mechanics and Relativity

Considered now the momentum of the electron after Compton's scattering of course we have to use relativistic mass and relativistic speed, the electron Relativistic velocity is V, and the relativistic mass is m

8]

$$\overrightarrow{P_e} = m \cdot \vec{V} = \frac{m_0 c \cdot \vec{V}/c}{\sqrt{1-\frac{\vec{V}\cdot\vec{V}}{c^2}}} = \frac{m_0 c \cdot \vec{\beta}}{\sqrt{1-\beta^2}}$$

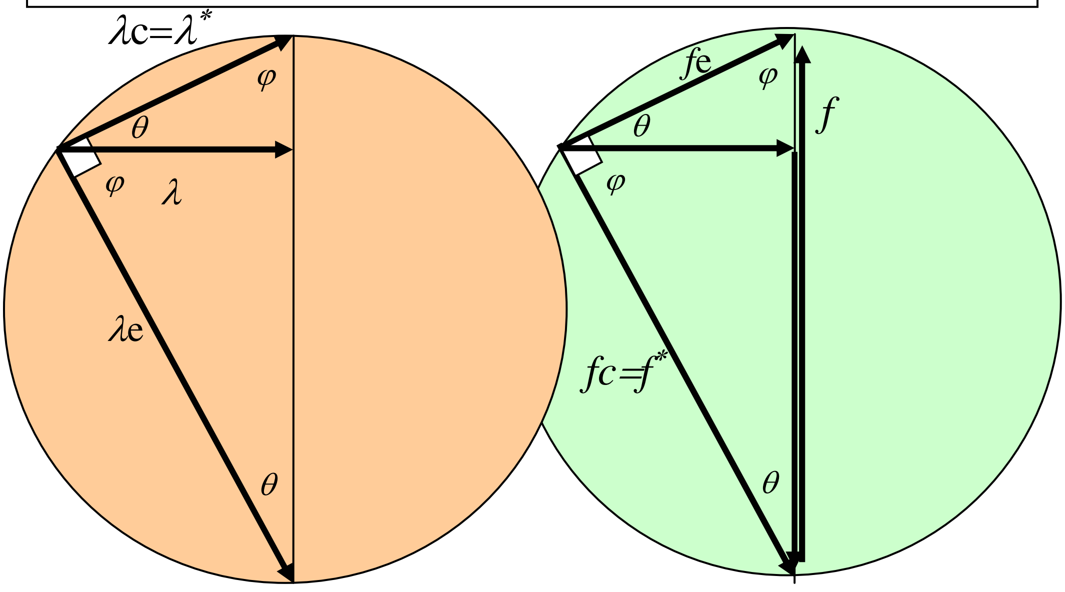
$$\lambda_e = \frac{h}{m \cdot \vec{V}} = \frac{h}{m_0 c} \cdot \frac{\sqrt{1-\beta^2}}{\vec{\beta}} = \lambda_c \cdot \frac{\sqrt{1-\beta^2}}{\vec{\beta}} = \lambda_c \cdot \frac{\cos(\theta)}{\sin(\theta)} = \lambda_c \cdot ctg(\theta)$$

$$f_e = \frac{c}{\lambda_e} = \frac{c}{\lambda_c} \cdot \frac{\vec{\beta}}{\sqrt{1-\beta^2}} = f_c \cdot \frac{\vec{\beta}}{\sqrt{1-\beta^2}} = f_c \cdot \frac{\sin(\theta)}{\cos(\theta)} = f_c \cdot \tan(\theta)$$

What we find is a wavelength and frequency associated with the moving electron that obey relativity, and.

9] $$\lambda_e \cdot f_e = \lambda_c \cdot f_c = c$$

All the relations among angels, frequencies and wavelengths



Now we have 4 wavelength and 4 frequencies two for the electron and two for the photon that describe photon electron wavelengths and frequencies before and after collision.

10] $$\lambda_c,\ \lambda_e,\ \lambda^*,\ \lambda,\ \text{and}\quad f_c,\ f_e,\ f^*\ f$$

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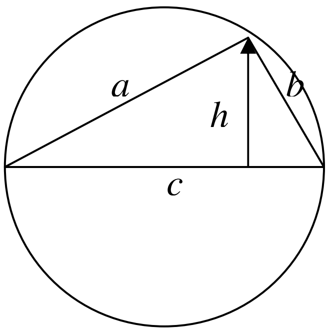
We know from Relativity, that length and mass depend on relativistic velocity β
The circles above help to translate length and mass measured in one frame of reference, and find its length and mass in another frame of reference.
Every change in speed (acceleration) cause to a change in direction, since

11] $$\frac{V}{c} = \beta = \sin(\theta)$$

Compton did not pay attention to the physical meaning of cos(θ) in Compton's Equation
Cos(θ) in Compton's Equation means that in order to change electron velocity (change electron energy) we must hit the electron with a photon, Electron photon collision change energy and velocity but change also the direction of both particles. So it is difficult to photon and electron to move in straight lines. Instead those particles move at least in circles
Don't forget that our body is made from electrons. If we move we change the position of the electrons in our body. While moving we hit billion of photons that change our direction

Pythagoras theorem and Relativity

In Pythagoras theorem we can find two important equations



Pythagoras' theorem

1] $a^2 + b^2 = c^2$

2] $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{h^2}$

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From **Pythagoras' theorem** and the picture above that contains two big circles it can easily be shown, that,

12]

from left circle

$$\frac{1}{\lambda_c^2}+\frac{1}{\lambda_e^2}=\frac{1}{\lambda^2}$$

multiply by c^2

$$\frac{c^2}{\lambda_c^2}+\frac{c^2}{\lambda_e^2}=\frac{c^2}{\lambda^2}$$

but

$$\frac{\mathrm{c}}{\lambda_c}=f_c \qquad \frac{\mathrm{c}}{\lambda_{\mathrm{e}}}=f_e \qquad \frac{\mathrm{c}}{\lambda}=f$$

just what you get from the right circle

$$f_c^2+f_e^2=f^2$$

So Einstein's constant : the speed of light : c make the link between wavelengths and frequencies, using Pythagoras theorem
such that

13] $$c=\lambda_c\cdot f_c=\lambda_e\cdot f_e=\lambda^*\cdot f^*=\lambda\cdot f=c$$

Conclusions

From Compton effect we found that

14] $$\frac{V}{c}=\beta=\sin(\theta)$$
$$|\sin(\theta)|\le 1$$

So, Compton Expriment prove also that we can't pass speed of light

Since

15] $$\frac{V}{c}=\beta=\sin(\theta)$$

And

16] $$\sqrt{1-\beta^2}=\cos(\theta)$$

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Einstein mass becomes

17] $$m = \frac{m_o}{\sqrt{1-\frac{V^2}{c^2}}} = \frac{m_o}{\sqrt{1-\beta^2}} = \frac{m_o}{\cos(\theta)}$$

And Lorenz transformation is

18]
$$x' = \frac{x - \frac{V}{c}\cdot c\cdot t}{\sqrt{1-\frac{V^2}{c^2}}} = \frac{x-\beta\cdot c\cdot t}{\sqrt{1-\beta^2}} = \gamma\left(x-\beta\cdot c\cdot t\right) = \frac{x - c\cdot t\cdot \sin(\theta)}{\cos(\theta)}$$
$$c\cdot t' = \frac{c\cdot t - \frac{V}{c}\cdot x}{\sqrt{1-\frac{V^2}{c^2}}} = \frac{c\cdot t-\beta\cdot x}{\sqrt{1-\beta^2}} = \gamma\left(c\cdot t-\beta\cdot x\right) = \frac{c\cdot t - x\cdot \sin(\theta)}{\cos(\theta)}$$
$$y' = y$$
$$z' = z$$

the Lorenz rotation in matrix form is

19] $$\begin{bmatrix} ct'\cos(\theta) \\ x'\cos(\theta) \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} 1 & -\sin(\theta) & 0 & 0 \\ -\sin(\theta) & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}$$

And one can easily check that

20] $$(ct')^2 - x'^2 = (ct)^2 - x^2$$

Lorenz transformation is composed of Time Dilation and length contraction as Einstein suggested

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Chapter 4

Longitudinal contraction of a body in motion

One consequence of the well known theory of Relativity is that a body in motion is shorter than a body at rest

1] $$L^* = \frac{L}{\sqrt{1-\beta^2}}$$

The best way to measure the length of the body is by finding how many λ are contained in L (Michelson–Morley experiment used this approach)

2] $$L = X \cdot \lambda$$

but, from Compton Experiment and my assumption,

3] $$\lambda = \lambda_c \cdot \cos(\theta) \qquad \lambda^* = \lambda_c$$

Multiplying both side of the equations by X. And the well known equation is easily found.

4] $$L = X \cdot \lambda = X \cdot \lambda_c \cdot \cos(\theta) \qquad L^* = X \cdot \lambda^* = X \cdot \lambda_c$$
$$L = L^* \cdot \cos(\theta) = L^* \cdot \sqrt{1-\beta^2}$$
$$L^* = \frac{L}{\sqrt{1-\beta^2}} = \frac{L}{\cos(\theta)}$$

Time Dilation

Using a similar process for time dilation

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5]

$$\lambda = \lambda_c \cdot \cos(\theta) \qquad \lambda^* = \lambda_c$$

$$\frac{c}{f} = \frac{c}{f_c} \cdot \cos(\theta) \qquad \frac{c}{f^*} = \frac{c}{f_c}$$

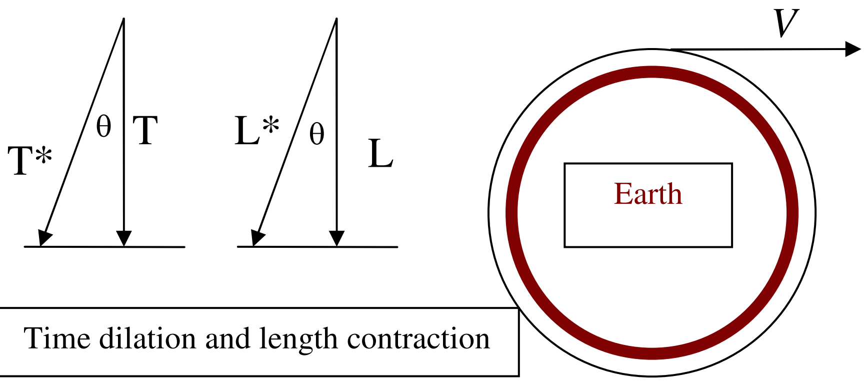
$$T = \frac{1}{f}$$

$$c \cdot T = c \cdot T_c \cdot \cos(\theta) \qquad c \cdot T^* = c \cdot T_c$$

$$c \cdot T = c \cdot T^* \cdot \cos(\theta)$$

$$T^* = \frac{T}{\cos(\theta)} = \frac{T}{\sqrt{1-\beta^2}} \qquad \beta = \frac{V}{c}$$

From the results above ,Time dilation depend on scattering angle and Relativity Factor



Time dilation and length contraction

Summary

It was shown that Relativity is a consequence of the main law of UNIVERSE

$$\left\|\vec{\lambda}\right\| \cdot f = c$$

It was believed that Newton's laws apply when the speed is low compare to the speed of light. The "Fine structure Constant" example was used to show that while mechanics deals with particles. Relativity deals with waves. And Relativity is not negligible in any speed. The numerical results at low speed are the same as in Newtonian Mechanics, the physical explanation is different. From this example we can learn that electric fields are strong and bend space to a very little radius, the atom radius. Gravitational fields are weak and they bend space with radius as big as the distance between planets and the sun.

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The end of the wave is connected to the start of the wave. This can explain why angular momentum is conserved. Compton Equation teaches us that to change electron energy and direction, the electron must to interact with photons. But the electron can change direction without changing energy in an electric or gravitational field. Only because those field bend space.

I hope that it is understood that Newton's laws are approximation to Relativity, and the source of Relativity is

$$\left\|\bar{\lambda}\right\| \cdot f = c$$

Thank you for reading the article
If you find any mistake please send a mail

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Appendix

Calculating the trigonometric identity

$$ctg(\varphi)=\left(1-\frac{1}{\cos(\theta)}\right)\cdot ctg\left(\frac{\theta}{2}\right)=\frac{\cos(\theta)-1}{\cos(\theta)}\cdot ctg\left(\frac{\theta}{2}\right)$$

$$ctg(\varphi)=\frac{-2\cdot\sin^2\left(\theta/2\right)}{\cos(\theta)}\cdot\frac{\cos\left(\theta/2\right)}{\sin\left(\theta/2\right)}=-1\cdot\frac{\sin(\theta)+\sin\left(0^\circ\right)}{\cos(\theta)}=-1\cdot\frac{\sin(\theta)}{\cos(\theta)}$$

$$ctg(\varphi)=\frac{\cos(\varphi)}{\sin(\varphi)}=-1\cdot\frac{\sin(\theta)}{\cos(\theta)}$$

$$\cos(\varphi)\cdot\cos(\theta)+\sin(\varphi)\sin(\theta)=0$$

$$\frac{\cos(\varphi)\cdot\cos(\theta)+\sin(\varphi)\cdot\sin(\theta)}{\sin(\varphi)\cdot\cos(\theta)}=0$$

$$\frac{\cos(\varphi+\theta)}{\sin(\varphi)\cdot\cos(\theta)}=0$$

$$\varphi+\theta=\pi/2$$

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