English CPH E-Book

Theory of CPH

Section 12

Speed of Light and CPH Theory

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Introduction

CPH Theory propounded in 1987 that reclaimed the speed of light depends to external force that applied on light. So, in CPH Theory, as relativity shows the speed of light is equal c in all inertial frames.

But it is changeable by external conditions. Presently experiments and ideas show light travels faster that c. There is not any theory or analysis why the speed of light does change in theoretical physics. CPH Theory based on structure of photon and it is able gives an analysis about the speed of light.

Following are two articles about the speed of light that show it's changeable. After of them you can see analysis of photon structure and its speed according CPH Theory.

Light that travels… faster than light!

A team of researchers from the Ecole Polytechnique Fédérale de Lausanne (EPFL) has successfully demonstrated, for the first time, that it is possible to control the speed of light – both slowing it down and speeding it up – in an optical fiber, using off-the-shelf instrumentation in normal environmental conditions. Their results, to be published in the August 22 issue of Applied

Physics Letters, could have implications that range from optical computing to the fiber-optic telecommunications industry.

On the screen, a small pulse shifts back and forth – just a little bit. But this seemingly unremarkable phenomenon could have profound technological consequences. It represents the success of Luc Thévenaz and his fellow researchers in the Nanophotonics and Metrology laboratory at EPFL in controlling the speed of light in a simple optical fiber. They were able not only to slow light down by a factor of three from its well – established speed *c* of 300 million meters per second in a vacuum, but they've also accomplished the considerable feat of speeding it up – making light go faster than the speed of light.

This is not the first time that scientists have tweaked the speed of a light signal. Even light passing through a window or water is slowed down a fraction as it travels through the medium. In fact, in the right conditions, scientists have been able to slow light down to the speed of a bicycle, or even stop it altogether. In 2003, a group from the University of Rochester made an important advance by slowing down a light signal in a room-temperature solid.

But all these methods depend on special media such as cold gases or crystalline solids, and they only work at certain well-defined wavelengths. With the publication of their new method, the EPFL team, made up of Luc Thévenaz, Miguel Gonzaléz Herraez and Kwang-Yong Song, has raised the bar higher still. Their all-optical technique to slow light works in off-the-shelf optical fibers, without requiring costly experimental set-ups or special media. They can easily tune the speed of the light signal, thus achieving a wide range of delays.

“This has the enormous advantage of being a simple, inexpensive procedure that works at any wavelength, notably at wavelengths used in telecommunications," explains Thévenaz.

The telecommunications industry transmits vast quantities of data via fiber optics. Light signals race down the information superhighway at about 186,000 miles per second. But information cannot be processed at this speed, because with current technology light signals cannot be stored, routed or processed without first being transformed into electrical signals, which work much more slowly. If the light signal could be controlled by light, it would be possible to route and process optical data without the costly electrical conversion, opening up the possibility of processing information at the speed of light.

This is exactly what the EPFL team has demonstrated. Using their Stimulated Brillouin Scattering (SBS) method, the group was able to slow a light signal down by a factor of 3.6, creating a sort of temporary"optical memory." They were also able to create extreme conditions in which the light signal travelled faster than 300 million meters a second. And even though this seems to violate all sorts of cherished physical assumptions, Einstein needn't move over – relativity isn't called into question, because only a portion of the signal is affected.

Slowing down light is considered to be a critical step in our ability to process information optically. The US Defense Advanced Research Projects Agency (DARPA) considers it so important that it has been funnelling millions of dollars into projects such as"Applications of Slow Light in Optical Fibers" and research on all-optical routers. To succeed commercially, a device that slows down light must be able to work across a range of wavelengths, be capable of working at high bit-rates and be reasonably compact and inexpensive.

The EPFL team has brought applications of slow light an important step closer to this reality. And Thévenaz points out that this technology could take us far beyond just improving on current telecom applications. He suggests that their method could be used to generate high-performance microwave signals that could be used in next-generation wireless communication networks, or

used to improve transmissions between satellites. We may just be seeing the tip of the optical iceberg.

http://actualites.epfl.ch/index.php?module=Presseinfo&func=view_com&id=288

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Light's Most Exotic Trick Yet: So Fast it Goes. Backwards?

In the past few years, scientists have found ways to make light go both faster and slower than its usual speed limit, but now researchers at the University of Rochester have published a paper today in Science on how they've gone one step further: pushing light into reverse. As if to defy common sense, the backward-moving pulse of light travels faster than light.

Confused? You're not alone.

"I've had some of the world's experts scratching their heads over this one," says Robert Boyd, the M. Parker Givens Professor of Optics at the University of Rochester. "Theory predicted that we could send light backwards, but nobody knew if the theory would hold up or even if it could be observed in laboratory conditions."

Boyd recently showed how he can slow down a pulse of light to slower than an airplane, or speed it up faster than its breakneck pace, using exotic techniques and materials. But he's now taken what was once just a mathematical oddity—negative speed—and shown it working in the real world.

"It's weird stuff," says Boyd. "We sent a pulse through an optical fiber, and before its peak even entered the fiber, it was exiting the other end. Through experiments we were able to see that the pulse inside the fiber was actually moving backward, linking the input and output pulses."

So, wouldn't Einstein shake a finger at all these strange goings-on? After all, this seems to violate Einstein's sacred tenet that nothing can travel faster than the speed of light.

"Einstein said information can't travel faster than light, and in this case, as with all fast-light experiments, no information is truly moving faster than light," says Boyd. "The pulse of light is shaped like a hump with a peak and long leading and trailing edges. The leading edge carries with it all the information about the pulse and enters the fiber first. By the time the peak enters the fiber, the leading edge is already well ahead, exiting. From the information in that leading edge, the fiber essentially 'reconstructs' the pulse at the far end, sending one version out the fiber, and another backward toward the beginning of the fiber."

Boyd is already working on ways to see what will happen if he can design a pulse without a leading edge. Einstein says the entire faster-than-light and reverse-light phenomena will disappear. Boyd is eager to put Einstein to the test.

So How Does Light Go Backwards?

Boyd, along with Rochester graduate students George M. Gehring and Aaron Schweinsberg, and undergraduates Christopher Barsi of Manhattan College and Natalie Kostinski of the University of Michigan, sent a burst of laser light through an optical fiber that had been laced with the element erbium. As the pulse exited the laser, it was split into two. One pulse went into the erbium fiber

and the second traveled along undisturbed as a reference. The peak of the pulse emerged from the other end of the fiber before the peak entered the front of the fiber, and well ahead of the peak of the reference pulse.

But to find out if the pulse was truly traveling backward within the fiber, Boyd and his students had to cut back the fiber every few inches and re-measure the pulse peaks when they exited each pared-back section of the fiber. By arranging that data and playing it back in a time sequence, Boyd was able to depict, for the first time, that the pulse of light was moving backward within the fiber.

To understand how light's speed can be manipulated, think of a funhouse mirror that makes you look fatter. As you first walk by the mirror, you look normal, but as you pass the curved portion in the center, your reflection stretches, with the far edge seeming to leap ahead of you (the reference walker) for a moment. In the same way, a pulse of light fired through special materials moves at normal speed until it hits the substance, where it is stretched out to reach and exit the material's other side [See "fast light" animation].

Conversely, if the funhouse mirror were the kind that made you look skinny, your reflection would appear to suddenly squish together, with the leading edge of your reflection slowing as you passed the curved section. Similarly, a light pulse can be made to contract and slow inside a material, exiting the other side much later than it naturally would [See "slow light" animation].

To visualize Boyd's reverse-traveling light pulse, replace the mirror with a big-screen TV and video camera. As you may have noticed when passing such a display in an electronics store window, as you walk past the camera, your on-screen image appears on the far side of the TV. It walks toward you, passes you in the middle, and continues moving in the opposite direction until it exits the other side of the screen.

A negative-speed pulse of light acts much the same way. As the pulse enters the material, a second pulse appears on the far end of the fiber and flows backward. The reversed pulse not only propagates backward, but it releases a forward pulse out the far end of the fiber. In this way, the pulse that enters the front of the fiber appears out the end almost instantly, apparently traveling faster than the regular speed of light. To use the TV analogy again—it's as if you walked by the shop window, saw your image stepping toward you from the opposite edge of the TV screen, and that TV image of you created a clone at that far edge, walking in the same direction as you, several paces ahead [See "backward light" animation].

"I know this all sounds weird, but this is the way the world works," says Boyd.

About the University of Rochester

The University of Rochester (www.rochester.edu) is one of the nation's leading private universities. Located in Rochester, N.Y., the University's environment gives students exceptional opportunities for interdisciplinary study and close collaboration with faculty. Its College of Arts, Sciences, and Engineering is complemented by the Eastman School of Music, Simon School of Business, Warner School of Education, Laboratory for Laser Energetics, and Schools of Medicine and Nursing.

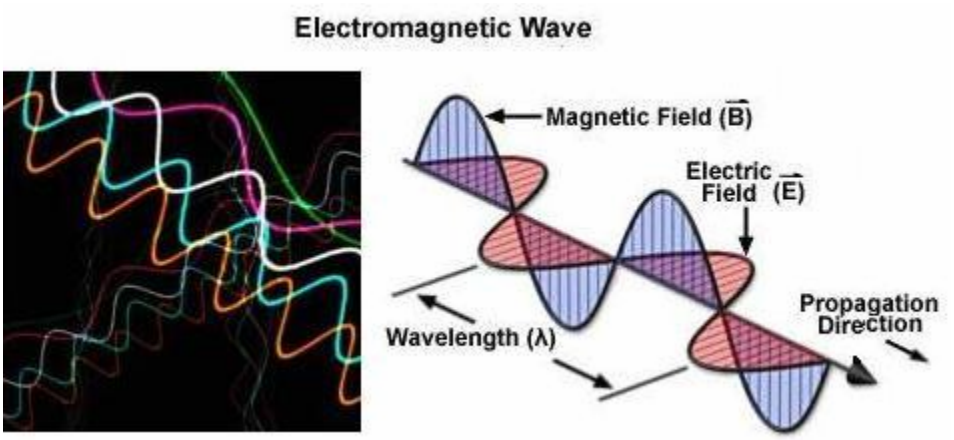
From University of Rochester

http://www.rochester.edu/news/show.php?id=2544

A new look at electromagnetic waves

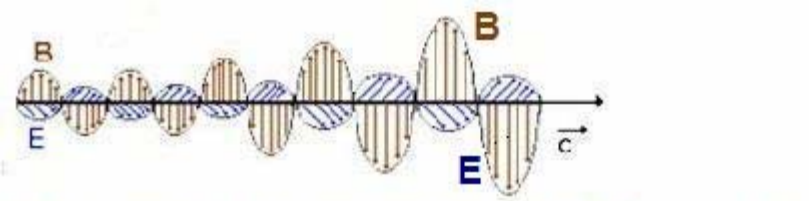
A photon becomes energy-laden by revolving. We know this because the electromagnetic fields around a "ray of light" are electromagnetic waves not static fields. Relativistic ally, the electromagnetic field generated by a photon is much stronger than the associated gravitational field. Further it is not clear at the present time whether the gravitational field of an energy-laden photon is static or oscillatory. It is not understood how the photon generates two sets of fields (electromagnetic and gravitational) of so different intensities. This is an enigma.

Let's take a new look at behavior of electromagnetic wave in a gravitational field; it can help for resolving this enigma. As we know an electromagnetic wave has form of two vertical electricity field and magnetic field (figure)



As General Relativity predicted and experiments show, the frequency of photons changes in a gravitational field. Remember Mossbuaer Effect. According Higgs boson what happens in this case?
By reconsider to these thee ideas, we are able take a different and new result.

1- **Energy of photon increases and according relativity mass-energy, its mass increases.**
2- **According Mossbuaer Effect and $W=\Delta mc^2$, when gravity force acts on photon, mass (energy) of photon increases.**
3- **Remember Higgs boson that How Particles Acquire Mass?**
4- **A part of gravity work converts to electricity energy and other part of gravity work converts to magnetic energy.**



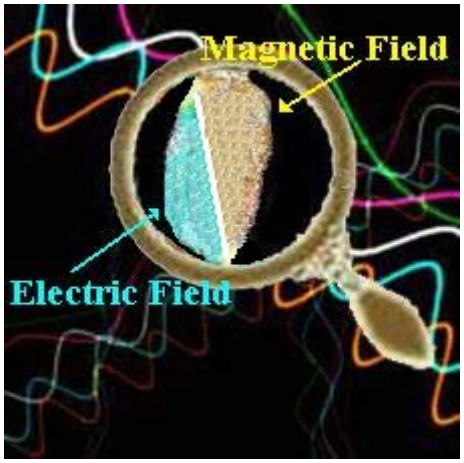
When a photon falls in a gravitational field, the strongly of magnetic field and electricity field increase.

According relations;

$$\nu' = \nu\left(1 \pm \frac{GM}{rc^2}\right) \text{ and } E=h\nu$$

Increasing and decreasing of photon's energy were doing part by part. And photon's energy comes of its electricity energy and magnetic energy, so in red-shift and blue-shift electricity and magnetic energy of photon do change. So, intensity of electricity field and magnetic field change by gravity effect.

Zoom on an electromagnetic wave. There are two electric field and magnetic field. These fields move with linear speed of c. But they have other motion that the paths of these motions are changeable.



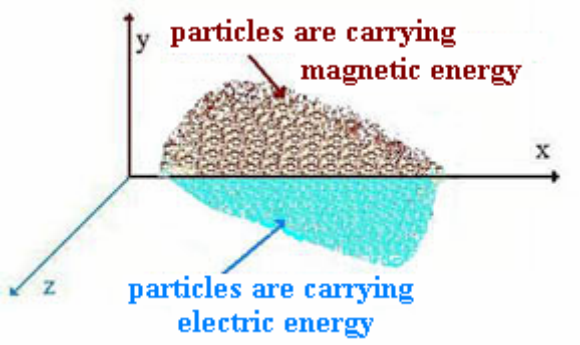
Do consider to top and down of wave.

Amount of seep is not stable.

Above picture shows the amount of wave speed on top is greater than down. Let's explain it more by combining relativity, quantum mechanics and Higgs ideas.

Is the speed of electric field and magnetic fields same as c?

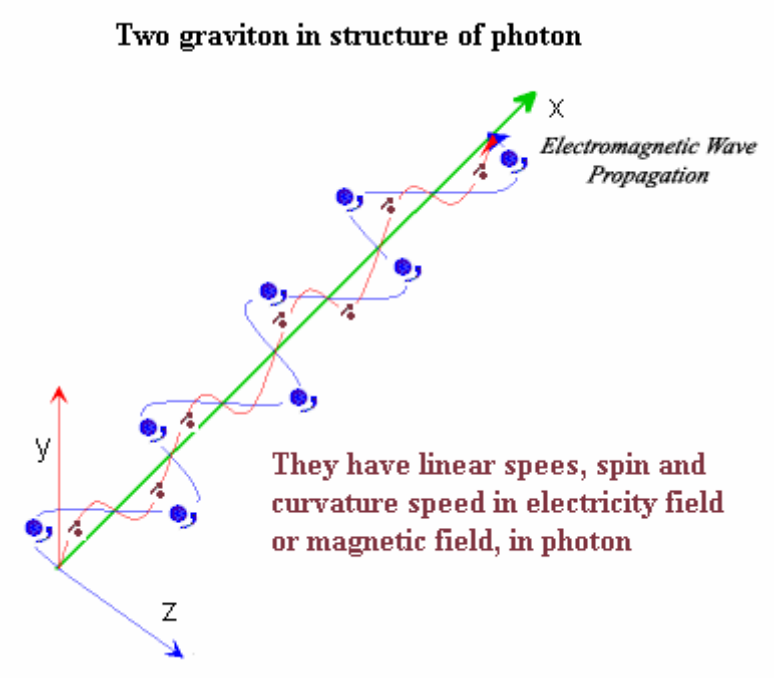
Again zoom on this part of electromagnetic wave on axis. But in this case take a new look by consider to Higgs ideas (following picture).



Suppose every field has formed of particles that they are moving. So, magnetic field contains many particles that they are carrying magnetic energy. And electric field has formed of articles that they are carrying electric energy, too. This looking is able give us very interesting conceptions about electromagnetic energy and how gravity affects on it.

New definition of graviton

According above explain take a look at photon that is falling in gravitation field. Gravity acts on it and the energy of photon (also, it's mass) increases. How we can explain this increasing of photon's energy by graviton theory? As we know gravity is a force and force is energy per distance, **F=-du/dx**. According Higgs conception, we can accept that graviton enters to structure of photon and during this action, a graviton disappears and the energy of photon increases. But graviton has spin and it cannot attaches to other particle that they have spin too. So, graviton keeps its spin and moves in structure of photon with the linear as speed of light (Following picture).



So, the amount of passing path per time is not equal c and it is greater than c.

But there appear a great problem in above explaining. Because lots gravitons enter to photon and the energy of photon increases, how we can explain the intensity of electricity and magnetic field of photon increases too?

It is a fact that the energy of photon increases in gravitational field and other fact is photon generates two sets of fields (electromagnetic and gravitational) of so different intensities. How we can explain theses facts about photon in gravitational field?

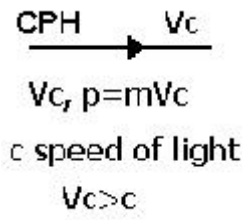
Our explain must be able to resolving two problems;

1- **When photon's energy increases in gravitational field, why and how the intensity of electricity and magnetic fields increase too?**
2- **Why the amount speed of electricity and magnetic fields that appear around photon on other axis are not constant?**

Now we are on a place that guesses some provable conceptions about photon and new definition of graviton. I will continue with definition of CPH and Principe of CPH and then return to above subject.

Definition of CPH

Suppose there is a particle with mass of m that is moving with speed **Vc** in an inertial reference frame. And **Vc>c** (c is the speed of light). So, CPH linear momentum gives with **p=mVc** (See Figure). It is Called CPH (Creation Particle Higgs). When CPH has spin, it calls **graviton**.



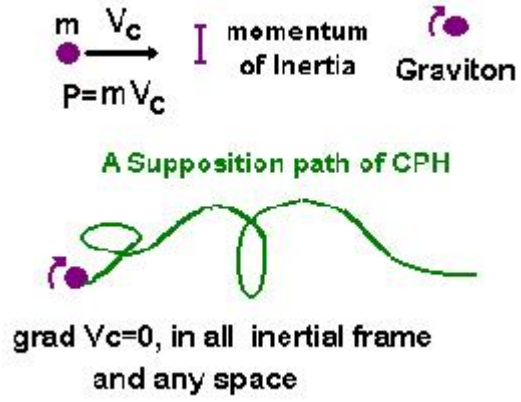
Principle of CPH

CPH is a particle with constant mass m and moves with constant amount of speed equal Vc. CPH has the momentum of Inertia **I**. In any interaction between CPH and other particles/masses/forces, the amount of Vc does not change, so;

gradVc=0 in all inertial* reference *frames and any space

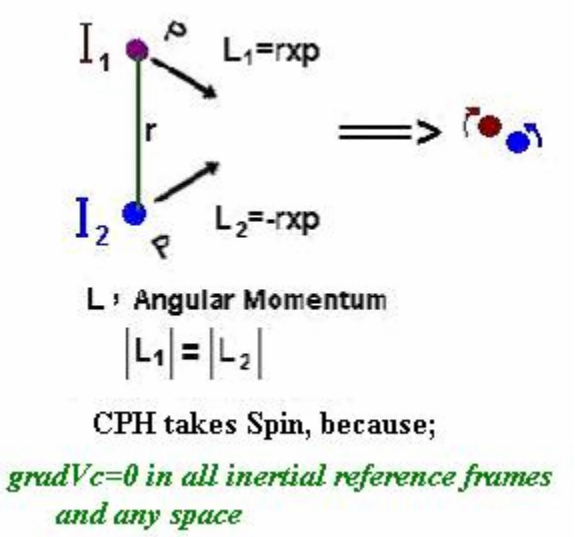
Explain

CPH carries linear momentum of P=mVc. So, CPH has inertia and also has Momentum Inertia I. When an external force is applied on a CPH, then a part of its linear momentum (P=mVc) converts to angular momentum and CPH takes Spin, so that the amount speed of CPH does not change in any case. When CPH has Spin, it is called GRAVITON (Following figure).



When gravity works on an object/particle, graviton does disappear and converts to energy. Because it is not acceptable that force acts and produces energy; and force does not have any effect on itself while producing energy.

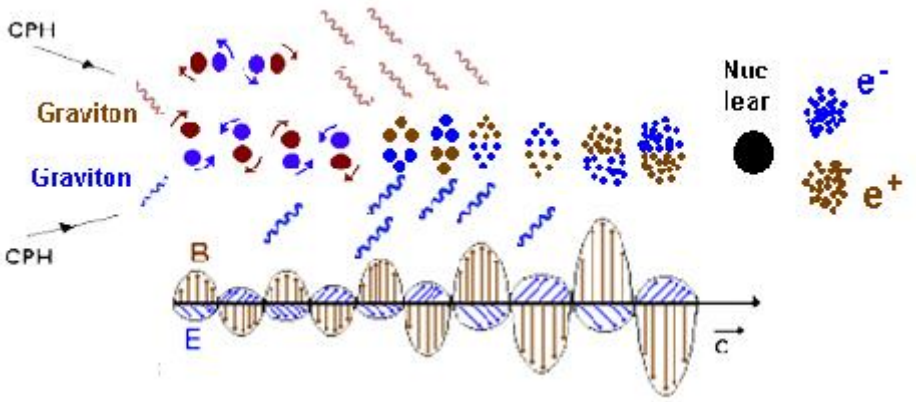
All efforts for finding a unified field theory had no success, because physicists do not consider the conversion of force and energy. Also, a graviton combines with another gravitons and produces energy (See Figure).



The picture above shows two CPH with the mass of m, speed of Vc and linear momentum of P=mVc, in distance of r feel each other (see color-charge and magnet-color item). They absorb each other and “r” decreases. But CPH must move with the amount speed of Vc, so they lose a part of their linear speed and takes Spin and graviton appears.

A Photon is formed by lots of CPH that they have spin and photon has spin too. So, when a photon is traveling with speed of c, CPH has linear speed of c and it has itself spin and a speed equal to the speed of the photon (according to the structure of photon).

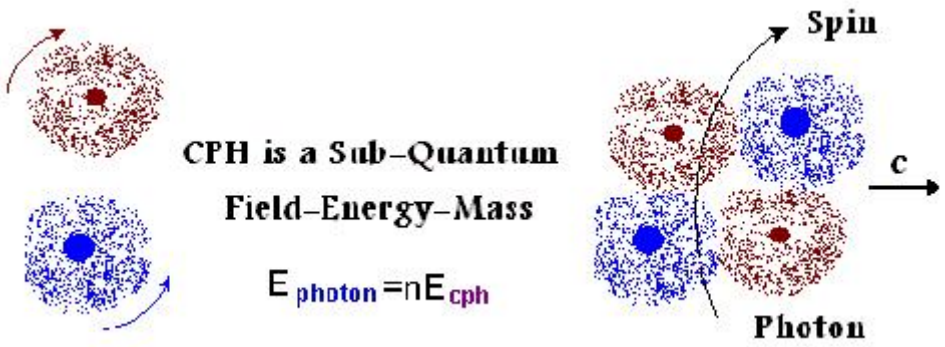
In a gravitational field, when a photon shifts to blue, gravitons convert to energy. And when the photon shifts to red, energy converts to graviton. And when energy decays, it produces Matter and Anti-Matter. See Figure. In fact every thing formed of CPH.



Color charge and magnet color

A photon becomes energy-laden by revolving. We know this because the electromagnetic fields around a "ray of electromagnetic" are electromagnetic waves not static fields.

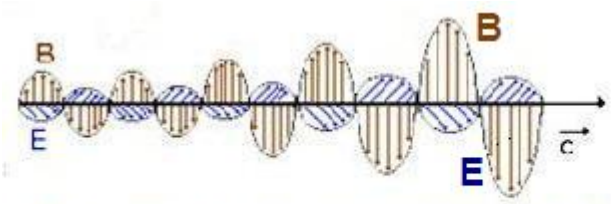
Let's return to at behavior of electromagnetic wave in a gravitational field again; it can help for resolving this enigma. As we know an electromagnetic wave has form of 2 vertical electricity field and magnetic field.



Suppose a photon is falling in a gravitational field, its frequency increases.
What happens in this case?
When gravity acts on a photon, according relation:

$$W=\Delta E=\Delta mc^2$$

a part of gravity work converts to electricity energy and other part of gravity work converts to magnetic energy (see figure).

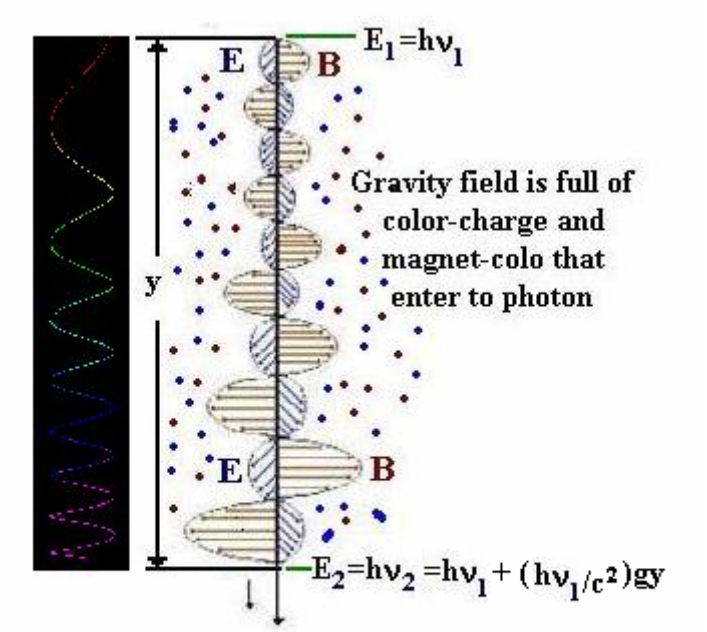


When a photon falls in a gravitational field, the strongly of magnetic field and electricity field increase.

There is no any explain about this phenomenon in theoretical physics. But CPH Theory explains it very simply.

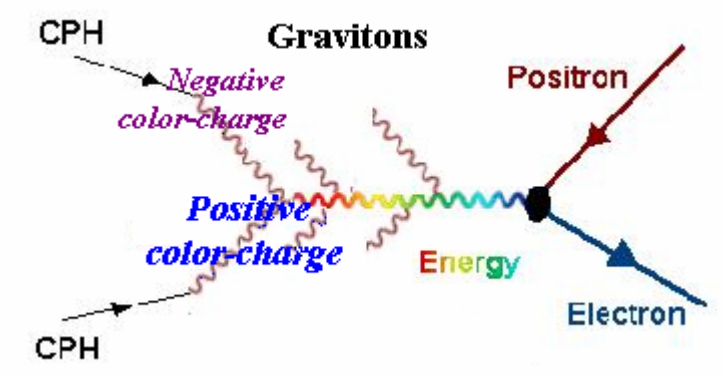
Color charge and color magnet

When a CPH feels other CPH, they take Spin and are called graviton. A graviton behaves like positive electricity charge and other one behaves like negative electricity charge (they annihilate each other), but they are moving and a CPH behaves like magnetic force, and two vertical electricity field and magnetic field do appear. It's acceptable because when photon is falling in gravitational field, the electricity field and magnetic field around it increase. Gravitational field has formed of gravitons. Gravitons enter into photon, the electricity and magnetic field increase, but photon has no electricity effect. So, there are two groups of particles that behave like charge and a group annihilates the effect of other group. But it depends to intensity gravity, for low intensity, gravity is not able to provide color-charge and magnetic-color for this projection (see picture).



When photon falls in gravitational field it's intensity of electric and magnetic fields increas.

According graviton has spin, so gravitons are color charge or color magnet.
A Photon is formed of lots CPH that they have spin and photon has spin too. So, when a photon is traveling with speed of c, CPH has linear speed of c and it keeps itself spin, and a speed on other axis (in electricity field on magnetic field, consider to properties of photon).
In a gravitational field, when a photon shifts to blue, gravitons convert to energy. In fact color-charge and magnetic-color enter into electricity and magnetic fields of photon. And when photon shifts to red, energy converts to graviton. Color-charge and magnetic-color of electricity and magnetic-color leave photon's structure. And when energy decays, it produces Matter and Anti-Matter. See Figure4. In fact every thing formed of CPH.



In fact a CPH is a sub-quantum of existence in nature. CPH has mass that is a manifest of matter; its movement is a manifest of energy. CPH has sub-quantum bounding Color charge or Color magnet field around itself.
A CPH feels another CPH, when they contact or they are very near (a distance like Plank Length that is equal $1.6x10^{-35}$ m). In this case their color charge/color magnet are able act on each other and do combine.

Photons (and all subatomic particles) are formed of many CPH that they have spin. So, CPH has many kinds movement. For example do consider to electron that moves on its orbit in an Iron atom in car. CPH has these movements, itself Spin, spin of electron, on orbit of electron, speed of car and so on. So that;

gradVc=0 in all inertial* reference *frames and any space

Any changing of CPH's movement is changing of its transfer movement to spin or spin to transfer movement. And according CPH has a constant mass of m, so its energy is being stable too.

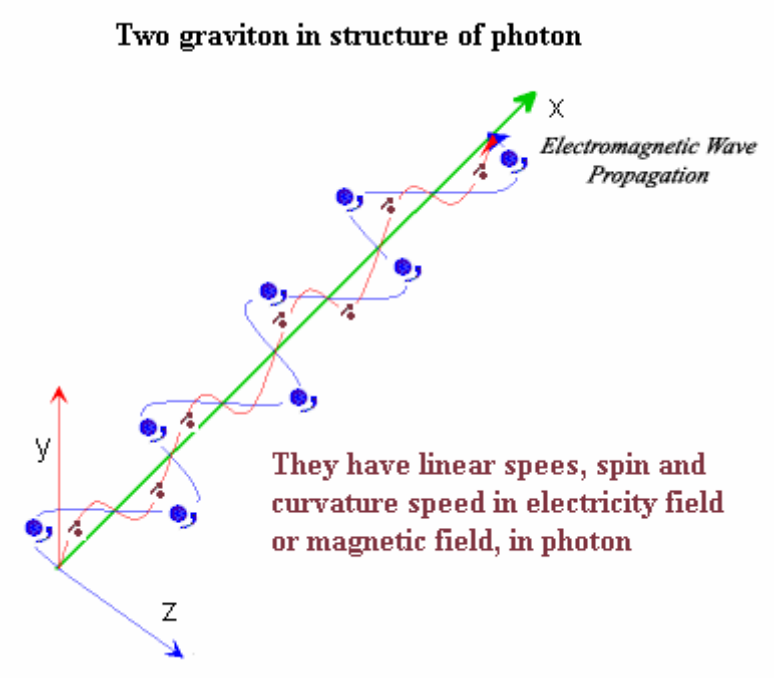
Color charge and magnet color equations

Suppose a CPH enter to photon. According **gradVc=0**, it has spin,
We can write;

$$gradVc=0 \Rightarrow a_x\mathbf{i}+a_y\mathbf{j}+a_z\mathbf{k}=0,$$

Which a_x is accelerating on x axis, a_y is accelerating on y axis, a_z is accelerating on z axis and **i, j** and **k** are unit vectors.

Suppose it transfers on x axis, but in an electromagnetic wave, v_x is constant and equal c, in an inertia frame (see following Figure).
So, its speed changes on y and z axis only, because $a_x=0$ and $a_y+a_z=0$. when $a_y=0$, then a_z is maximum. And when a_y is maximum, then $a_z=0$.



One CPH is color charge. Suppose it is accelerating on z axis, and we can show its moving with a wave function as;

$$Ec=EcmCos\omega(t-x/c),$$

Ec stand of color charge and Ecm is its maximum amount of color charge. Because there is a relationship between its spin and speed on z axis. Remember its $v_x=c,v_y=0$ (in structure of photon), and v_z is changeable, only.
When spin of color charge increases, v_z decreases. If it is negative color-charge, there is a positive color-charge that behavior same as negative color-charge.
For magnet-color we can show it is moving with a wave function too;

$$Bc=BcmCos\omega(t-x/c),$$

Bc stand of magnet-color and Bcm is its maximum amount of color magnet-color. Also, there is a relationship between its spin and speed on y axis. Remember its $v_x=c,v_z=0$ (in structure of photon), and v_z is changeable, only.

Color-charge and magnet-color in usual form

The number color-charge in a photon is even, because half of it is for negative color-charges, and other half is positive color-charges. Also, according E=cB, so, we can write;

$$E=nEcmCos\omega(t-x/c)$$
$$B=mBcmCos\omega(t-x/c)$$

Which n is an even number and $m=n/2c$.
When a photon is falling in a gravitational field, n increases. So, the amount of E and B increase too. It means a lot of CPH enter to structure of photon.

Speed of light

As above explains, a photon made of a number color-charge and magnetic-color. They have spin in structure of photon. So, photon falls in gravitational field, spin of color-charges and magnetic-colors change to linear speed and the speed of light increases.