Atom Model and Relativity

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Abstract

What is the theoretical explanation for fine structure? What is the mechanism behind relativity? These questions have bothered numerous physicists for a very long time. Atom Model and Relativity explains the mechanism behind fine structure, hyperfine structure, energy levels and relativity based on ToEbi. The result is a new atom model.

Building blocks

Spinning proton (at rest $8.98755 * 10^{16}$ 1/s on Earth) generates a complex force transfer ether (FTE) environment for particles like electrons, photons and neutrinos. Atom nucleus is constructed from protons and neutrons. Both of these are constructed from three electrons [1] currently named as quarks.

Three electrons form a standing equilateral triangle. The reason why it's a standing triangle is because particles change their spinning orientation according to surrounding FTE density. Nucleus electrons are the keys for understanding of an atom and the mechanism behind (hyper)fine structure, energy levels and relativity.

Size matters

When particles have an approximately equal cross section (mass) and they are not disturbed by other particles, II Law of ToEbi applies directly. It means that same spin direction generates pulling force and opposite spin directions generate pushing force between particles. However, our universe is filled with particles and systems of particles, so idealized conditions between two particles are fewer.

In case of complex FTE environment, like conditions on Earth, things change into an interesting. Good examples are gravitational interaction and antimatter. Our bodies hold a nice amount of atoms. Each and every one them experiences gravitational interaction. No matter what's the spin orientation on horizontal plane. And yes, they all are spinning in an alignment with Earth's idealized surface thanks to the equilateral triangle shape of protons and neutrons! This alignment is naturally broken all the time due to different collisions and orbiting electrons but protons and neutrons are heading towards

that alignment constantly. Concept of inertia is very much involved with the phenomenon described above.

So why don't those particles which have a different spin orientation just fly away from Earth? A single particle is interacting with whole FTE generated by Earth and because this FTE is generated by huge number of particles there is no single spin preference for a particle to interact with. There most certainly is a preference to other stellar objects though! But a single particle just experiences Earth's FTE and spins towards the thicker FTE. This is the explanation why we experience gravitational interaction even though our bodies contain equal amount of particles and antiparticles. It's important to remember that particles are, at the same time, antiparticles. It all depends on their spinning orientation in relation to other same massed particles.

Based on III Law of ToEbi atoms have their own kingdom so to speak. Dampening generated by Earth doesn't effect subatomic particle interactions. However, dampening effect generated by nucleus effects interactions between other subatomic particles. Due to mass difference of an electron and nuclei, orbiting electrons experience mostly pulling force towards nucleus. At the same time, orbiting electrons are capabable of experiencing those electrons inside a proton or neutron (same masses!).

Mass

As defined in ToEbi, mass is the cross section of an independent particle. Elementary particle has the shape of sphere (axiom in ToEbi) hence the cross section is πr^2.

Because elementary particles are sphere like (ToEbi axiom) and hadrons are more or less sphere like then effected volume around them is sphere like. We can define particle as

$$V_{particle} = \frac{4}{3}\pi f^3$$

Hence particle's spin frequency change

$$k = \frac{f_{rest} + \Delta f}{f_{rest}}$$

where (based on ToEbi energy relation) $\Delta f = \frac{1}{2}v^2$ would effect by factor of k^3.

Quark

Particle collider gives the electron near c speed hence the new particle will be 1.5^3 times the electron at rest. For example, the new mass would be 1.7 MeV. Calculated mass pretty much matches with the lowest measured mass of Up quark (measured after particle collisions). Calculated and measured values matches and this indicates that Up quark didn't get any additional mass from the collision. In reality all quarks have the same mass but due to collisions incident quarks are able to gain more mass.

Electron vs. Photon

Another good example of mass is when two electrons annihilate, resulting two photons. Based on ToEbi, electron's energy is

$$E = m_e f_e$$

Based on conservation of energy the decrease of masses $m_e \rightarrow h$ results increased spin frequency for the created photons (incident electrons). Same can happen inverse but due to smaller cross section it's much more unlikely event. Photon-photon scattering is more probable outcome. It might also require that incident photons collide in such a manner that their spins are opposite which allows them to decrease the spin frequency.

Repulsive force

In order to calculate the distances of particles and behaviour during their interactions we need an equation for the repulsive force. If we think about for example electrons inside a proton, they all have the same spin frequency which is capable of keeping those electrons apart. Each electron confronts so large amounts of FTEPs that it can't spin through them. At balanced situation pulling force, which is due to thicker FTE between particles, equals with repulsive force, which is due to so many FTEPs between particles that particles can't spin through them.

Factors involved in such dynamic system are

- spin frequency f of particles
- surrounding FTE density ρ

If two particles come close enough to each other then created FTE barrier starts to slow spin frequencies down. Because energy is conserved it means that particle masses are increased. Phenomenon is observed in high energy particle collisions.

Proton

Based on proton's structure it's likely that proton is just constructed from three electrons. Hypothesis is also supported by the fact that proton's and electron's energy can be calculated with the same spin frequency.

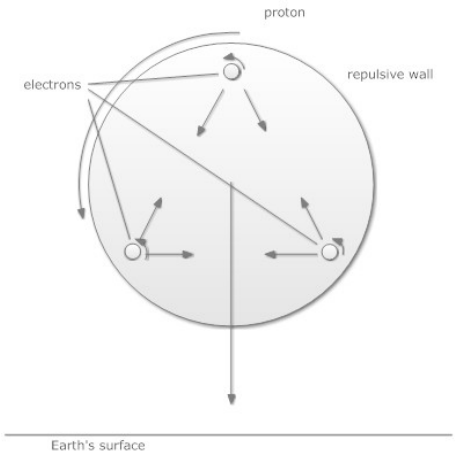

Figure 1: Proton

Radius of an electron (at rest on Earth) is $\sqrt{\frac{9.10938291*10-31}{\pi}} \approx 5.3848 * 10^{-16}$ m. Proton is a composition particle made of three electrons and based on its mass the radius is $2.3074 * 10^{-14}$ m (at rest). Measured diameter is something like $1.6 * 10^{-15}$ m. The difference is due to the fact that proton is a composite particle. If you probe its size with scattering particles then you'll get misleading results. Those three nucleus electrons under particle bombarding just go closer to each other.

Hydrogen

The simplest atom, hydrogen, is a good starting point for ToEbi based atom model. It is usually thought that an electron orbits around a nucleus which implies that the electron is moving around the nucleus all the time. Certainly it can move around the nucleus but it doesn't have to! It's velocity can be pretty much anything but considerably under c (due to thick FTE which causes acceleration hence radiation) and its path depends on many things like distance to other particles (inside and outside the atom), collisions with another particles, its orientation in relation to another particles and surrounding FTE conditions.

However, electrons do not move around the nucleus when they are a part of the bond with another atom's electron. Those two bonding electrons function as a buffer between two nucleus. The mechanism which leads to this phenomenon is obvious. Two atoms create higher FTE density between them which causes those atoms to move closer to each other. At certain point two free electrons confront and find a balanced position between those two nucleus.

Paired electrons in an atom are pretty much invisible to the magnetism. Repulsion between electrons in paired configurations breaks down the waves generated by electron spin. In another words, it means that those paired electrons won't experience waves generated into FTE by other electrons (magnetism).

Photon

Photon is created by compressing FTEPs together (as well as all known elementary particles besides FTEP). Compression happens usually when an electron approaches nucleus. With big enough velocity combined with acceleration, photon compression is also possible outside of atom. Good example is synchrotron radiation created by high speed particle while experiencing acceleration within ordinary FTE conditions. Annihilation of electrons at rest is another example.

Based on First Law of ToEbi, photon has a mass which equals Planck constant. Photon's energy is

$$E = hf,$$

where h is Planck constant and f is the spin frequency of photon. During photon-electron interaction photon's energy (or a part of it) is converted into electron's energy inside an atom. In case of perfect absorbition, photon loses its energy totally and dissolves into the surrounding FTE.

What is the physical mechanism behind the absorption? Incoming photon experiences the repulsive wall of the incident electron and vice versa. Due to interaction (colliding FTEPs) photon loses its spin frequency and gains mass until it matches electron's mass which is also increased because emerged thicker FTE decreases its spin frequency (Energy conservation). During the interaction incident particles changes their spin directions to opposite and start to generate pushing force against each other. During repulsion phase gained masses will be lost causing increase of spin frequencies for the incident particles. Because photon donated some of its energy (increased electron's mass) for the electron it won't gain its previous spin frequency.

Only photons which have a momentum away from the nucleus during the photon-electron collision can change the energy level of an electron. Otherwise Thomson scattering occurs.

Radius of a photon is $\sqrt{\frac{h}{\pi}} \approx 1.452289 * 10^{-17}$ m. Radius of electron is roughly 36.8 times the radius of photon.

Allowed orbitals

The mechanism causing atom's energy levels, fine structures and hyperfine structures is actually quite obvious. In case of hydrogen atom, there is a single proton and a single electron around it. The first energy level is the closest to the nucleus. In that level there is an adequate repulsive force against the pulling force between nucleus and electron. First energy level contains two allowed sublevels (hyperfine structure).

Difference between those sublevels is due to electron's two possible spin directions in relation to nucleus electron. If their spin directions are opposite then an additional small pushing force is generated. Because the pushing and pulling force ratio stays the same through the atom this hyperfine structure is observable in every allowed orbital.

These two sublevels of the first energy level generate second energy level's fine structure (obviously!) and both those second level's allowed orbitals contain two possible orbitals depending on electron's spin direction.

Reason for these emerged allowed orbitals is due to a barrier which emerges around spinning electron. Obviously there is a barrier between nucleus and electron which provides the needed repulsion. At the same time, there is a barrier, although much weaker, created around the rest of electron. Let's call this barrier as Electron Spin Barrier (ESB). Barrier between nucleus and electron is based on repulsion which is based on pressure from colliding FTEPs between the spinning particles. ESB on the other hand emerges from FTEPs pushed away from electron's volume.

Emerging ESB determinates needed energy for the next allowed orbital. If electron receives needed energy it gets pushed to the next energy level (at the same time, creates a new ESB), if not, received energy just distributes to thermal energy. Depending on atom mass, current electrical configuration and energy levels involved, previous ESBs vanish after certain time and electron drops back to lowest unoccupied energy level and emits its potential energy away.

Photon-electron collision

There is two non-trivial cases.

Head-on collision

During head-on collision electron and photon have their momemtum vectors at the same line. Let's consider that electron is stationary (it most certainly can be!) when a photon hits it.

$$h\vec{c}_1 = M_{electron}\vec{v}_{electron} + h\vec{c}_2$$

Electron's velocity after impact is $\approx$ 237.5 m/s. Let's say that electron's velocity is roughly 110 000 000 m/s (reasonable velocity for electron in a synchrotron) and, as we know, photon's kinetic energy stays the same before and after the impact. Therefore photon stores the increased energy into its spin frequency and the increase is roughly 8.3e18 Hz which corresponds to X-ray radiation (as observed). It is called inverse Compton scattering when photon increases its energy due to collision.

Other collisions

Far more common is a collision type where electron and photon have their momemtum vectors crossed or at least not opposite at the same line. in cases where photon's momemtum vector points away from nucleus, Compton scattering equation applies.

If photon's released energy isn't enough to elevate incident electron to any allowed orbital then released energy is not absorbed into atom's electronic configuration. Released energy just increases atom's thermal energy. If released energy is too much for the atom to hold in its electronic configuration then photoelectric effect occures.

Electron pair production

If photon has a collision trajectory with nuclei there is a chance for pair production. Photon's energy must be at least twice the electron's energy at rest. Photon has a small cross section which allows it penetrate very close to a nuclei. FTE density near nuclei is much higher than in case of normal encounters between electrons and photons inside atom. Thick FTE provides excellent conditions for particle production.

In right conditions the photon can interact with two nucleus electrons at the same time resulting so called electron pair production. Incoming photon gain mass (spin frequency decreases) while approaching nucleus electrons. Due to high FTE density and compression two new particles starts to emerge between the photon and those two nucleus electrons.

These two new particles won't be ejected from nucleus until they are gained the cross section of electron and therefore are capable of interact (in pushing manner) with other electrons. If photon is ejected before the needed cross section then pair production won't happen and the photon is ejected away from the nucleus (normal scattering).

Pair production occurs next to the stopping photon. Naturally, because those two emerging particles are created at the different sides of photon trajectory they'll gain an opposite spin directions which explains why pair production particles are always particle and its antiparticle.

Mechanism of Relativity

Mechanism of relativity is pretty simple if we look at it through ToEbi and it's very much originated from the mechanism of an atom in certain FTE (gravitational) environment and its velocity in it.

Gravitational environment is constituted by mass and its spin frequency. For example, without spin frequency of Earth we would weight nothing at all. Importance of spin frequency is actually observable on different planets. Good example is Venus, which is spinning extremely slowly. Due to low spin frequency heavier elements are dominating Venus's atmosphere which explains the pressure of 93 bar at the surface!

FTE density relates directly to mass density. Therefore we define the gravitational factor of relativity

$$R_G = (\frac{m^3}{kg})\frac{M}{\frac{4}{3}\pi r^3}$$

where M is the mass of gravitational source and r distance from its mass point. FTE density changes near particle distribute to particle as much as particle's spin frequency changes.

Velocity

In addition to the gravitational factor also particle's velocity near the gravitational source distributes to relativity. Why? And how much?

Let there be two particles, A and B, near gravitational source (like Earth) at the same distance from the center of gravitational source (The reference

frame). Particle A moves at speed V_A and particle B at speed V_B. Based on ToEbi energy relation, particles velocity generated additional spin frequecies define the kinetic factor of relativity.

$$R_K = \frac{\Delta f_B}{\Delta f_A} = \frac{\frac{1}{2}V_B^2}{\frac{1}{2}V_A^2} = \frac{V_B^2}{V_A^2}$$

Relativity factor of particle

Based on both gravitational and kinetic relativity factors we can define relativity factor of particle as

$$R_{particle} = R_G R_K$$

which gives us information regarding the conditions near particle.

Time dilation

What is time? We measure elapsing time (at its most accurate form) based on events in the atom. We say that 1 second contains 9,192,631,770 events (absorbtions or emissions) in cesium-133 atom. Cesium-133 was selected due to its symmetric structure which provides a good conditions to measure hyperfine structure events on the valence electron. The way of measuring time this way makes a perfect sense, after all, everything is constructed from atoms including human beings. The most exciting part is that the rate of measured events varies! So time actually can change its speed. It has been proved in many ways over the years.

Change factor between relativity factors of particle A and B is

$$k = \frac{R_A - R_B}{R_A}$$

GPS satellite

Typical GPS satellite has the mean distance from Earth's center 26560 km and the orbital mean velocity ≈ 3874 m/s. Change factor k would be

$$k = \frac{\frac{1}{6371000^3} - \frac{8.321^2}{26560000^3}}{\frac{1}{6371000^3}} \approx 0.044428$$

Because $k^3 \approx 8.769 * 10^{-5}$ is distributed into sphere shaped volume the effective change factor is

$$k_{effective} = \frac{k^3}{\frac{4}{3}\pi} \approx 2.09 * 10^{-5}$$

Electron's and nucleus combined effect would be ${k_{effective}}^2 \approx 4.38 * 10^{-10}$. It means that the valence electron's volume (particle itself) has to spin through $\approx 4.38 * 10^{-10}$ times less FTEPs than on Earth. In case of an atomic clock this means more "tics" when compared to an atomic clock on Earth. In other words, there will be $\approx 4.38 * 10^{-10}$ times more cesium-133 atomic events per second!

Cumulative gain during a whole day is ≈ 37.7 ns which agrees the observations.

Atomic clock on the aeroplain

If we had an imaginary aeroplain (equipped with the atomic clock) hovering exactly 10 km above us then how much that atomic clock would gain extra time in 24 hours? Obviously that aeroplain would have a velocity 1.0021459227467811 times our velocity. Hence k would be

$$k = \frac{\frac{1}{6371000^3} - \frac{1.002146^2}{6381000^3}}{\frac{1}{6371000^3}} \approx 1.567 * 10^{-3}$$

and the total gain would be $7.3 * 10^{-14}$ s. That's a pretty small time gain. During the 79-year lifetime the gain would be (calculated with exact time) $\approx 2.099 * 10^{-9}$ s, still pretty small time gain.

References

[1] Kimmo Rouvari, `http://www.vixra.org/abs/1211.0027`