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, hyper fine structure, energy levels and relativity based on ToEbi. The result is a new atom model.

Building blocks

Spinning nucleus (at rest 8.98755e16 1/s on Earth) generates an unique force transfer ether (FTE) environment for particles like electrons, photons and neutrinos. Nucleus itself is constructed from protons and neutrons. Both of these are constructed from ("nucleus") electrons (3 inside proton, 4 inside neutron) [1] currently named as quarks.

Three electrons form a standing equilateral triangle. In case of neutron, there is one additional electron (+ antineutrino) orbiting inside the repulsive wall hence reducing externally observed and experienced spin frequency (shielding effect). Nucleus electrons are the keys for understanding of an atom and the mechanism behind fine structure.

Size matters

When particles have an approximately equal cross section 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 the whole FTE generated by Earth and because this FTE is generated by huge number of particles there is no single spin preference for a single 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.

Based on III Law of ToEbi atoms have their own kingdom so to speak. Because the bigger size of nucleus those orbiting electrons experience mostly a pulling force towards a nucleus. At the same time, orbiting electron experiences one of those nuclear electrons. Because of the same cross section between these two they experience the predicted effects (pulling or pushing force) of II Law of ToEbi.

Hydrogen

The simplest atom, hydrogen, is a good starting point for ToEbi based atom model. If two spinning particles generate pulling force then what will prevent them from colliding? The answer is repulsion. Physical mechanism behind repulsion is the pressure of colliding FTEPs between particles. At certain point the pulling and pushing force will be an equal. Therefore approaching (under certain energy threshold) electron won't crash into a nucleus. Incoming electron releases its kinetic energy in a form of created photon(s) while slowing down inside an atom (called Bremsstrahlung). After releasing its kinetic energy, electron slides back to first free position where repulsion and pulling force are equal. Incoming electron will gain the exact same spin frequency than nucleus electron has. This happens because FTEPs between colliding particles have the biggest spin frequency (particles change their spin orientation because thicker FTE) and they connect these two particles.

It is usually thought that electrons orbit a nucleus which implies that an electron is moving all the time. Certainly it can move around a nucleus but it doesn't have to! It's velocity can be pretty much anything but considerably under c (due to thick FTE) and its path depends on many things like distance to other particles (inside or outside atom), collisions with another particles, its orientation in relation to another particles and surrounding FTE conditions.

However, electrons do not orbit a nucleus when they are bound to another atom's electron. In this case those two 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).

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 from three electrons so it's not possible to calculate its radius directly based on circular area.

Photon

Photon is created by compressing FTEPs together (as well as all known elementary particles excluding FTEP). Compression happens normally when an electron approaches an atom nucleus. But different setups are equally valid, for example when two electrons annihilate (positron is an electron with a different spin direction).

Photon has the maximum velocity what any particle can have. Further velocity acceleration isn't possible because photon's spin orientation is aligned with its trajectory so it's only possible to bend photon's path.

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

$$E = hf,$$

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

What is the physical mechanism behind the absorption? Incoming photon experiences the repulsive wall of orbiting electron and vice versa. Photon (due to its smaller mass) changes its spin orientation orthogonal to the contact area and starts to emit its energy (spin frequency) into the buffer between itself and the electron. Increased pressure pushes the electron (if possible) to another energy level. 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. The radius of electron is roughly 36.8 times the radius of photon.

Energy levels

Mechanism behind the atom energy levels 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 FTEP pressure (repulsion) against the electron. Repulsion prevents an electron from crashing into the nucleus. Due to proton's shape this orbit isn't a perfect sphere just an approximation of sphere.

The reason why any atom won't absorb whatever amount of energy into its electronic configuration is due to a barrier which emerges around spinning electrons. Obviously there is a barrier between the nucleus and the electron which provides the needed repulsion. At the same time, there is a barrier, although much weaker, created around the rest of the electron. Let's call this barrier as Electron Spin Barrier (ESB). Its creation process is a bit different.

Barrier between the nucleus and the 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 position.

Emerging ESB determinates the needed energy amount for the next energy level. If electron receives needed energy it gets pushed to the next energy level, 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.

Spinning electron in first energy level generates (in case of hydrogen) every other allowed energy level. Other than the first ESB emerges from interfering FTE waves caused by the nucleus and the orbiting electron.

Photoelectric effect

What actually happens when a photon ejects an electron away from an atom? Does the photon actually crash into the electron and pushes it away from the atom? Something like that. Both electron and photon have a huge spin frequency. So, just like in case of proton and electron there is a repulsive wall as a buffer. There is two non-trivial cases.

Head-on collision

During a head-on collision between an electron and a photon their momemtum vectors are at the same line. Particles repulsive walls just bounch particles apart. Let's consider that electron is stationary when a photon hits (it most certainly can be!).

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

hence electron's velocity change after the impact is $\approx$ 237.5 m/s. Let's say that electron's velocity is roughly 110 000 000 m/s (reasonable velocity for an 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 a photon increases its energy due to collision. Based on probability (can be calculated based on cross sections) of inverse Compton scattering it's possible to calculate matter densities in universe when applied to CMB.

Other collisions

Far more common is a collision type where an electron and a photon have momemtum vectors crossed (the momemtum vector of the photon points outwards) or at least not opposite at the same line. In these cases Compton scattering equation applies directly.

If photon's released energy isn't enough to elevate incident electron to any above energy level then the released energy is not absorbed into the electronic configuration. Released energy just increases (atom's) thermal energy. If

released energy is too much for an atom to hold in the electronic configuration then photoelectric effect occures.

Pair production

If a photon has a collision trajectory with a nuclei there is a chance for pair production. Photon's energy must be at least twice the electron's energy at rest. Photon is an elementary particle so why wouldn't it behave exactly the same as an electron when the electron is colliding with the nuclei? Actually it does but due to electron's cross section it will more likely interact with only one of those nucleus electrons.

Photon cross section is a much smaller and therefore it's not attracted towards one of those nucleus electrons. Within a right conditions a photon can interact with two nucleus electrons at the same time! And that's the reason for pair production. Incoming photon breaks down and at the same time compresses two new particles between itself 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 with other electrons. If the photon is stopped before the needed cross section then pair production won't happen and the photon is ejected away from the nucleus (normal scattering).

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

Finer orbital structures

Orbiting electron in first orbit can have momentarily a pretty much any spin orientation on horizontal plane in relation to nucleus (spin orientation) but normally it's the same or opposite than nucleus spin (if there is an angle RFAA removes it).

Difference in spin directions causes phenomenon called hyper fine structure. In case of different spin directions, orbiting electron and the closest nuclear electron generate small pushing force which causes the hyper fine structure. Because the pushing and pulling force ratio stays the same through the atom this hyper fine structure is observable in every energy level.

As earlier described, in first energy level orbiting electron generates every other energy level in hydrogen atom. Due to hyper fine structure there is two different versions from every energy level. Energy difference between these versions is called fine structure.

Mass

Defined in ToEbi, a mass is the cross section of a particle (πr^2). Obviously an elementary particle has the shape of sphere (axiom in ToEbi). Based on

ToEbi axioms, factors distributing into the particle's local FTE environment are

- spin frequency f of the particle
- particle's squared (equatorial) velocity (particle's cross section interacts with incoming FTEPs) in relation to the reference frame of a gravitation source
- surrounding FTE density ρ

There is an interesting phenomenon with the factor of the particle's squared velocity. The largest velocity of a particle at rest would be on the equator (obviously!). When the particle is moved towards one of the poles its surface velocity drops. However, at the same time the surrounding FTE density increases and compensates the dropping surface velocity! This compensation mechanism is due to the spin frequency difference of FTEPs. Therefore we can treat particles at rest residing on the same orbital plane equally in terms of surface velocity.

Because particles (most of them) are a sphere like (ToEbi axiom) effected volume is a sphere like. Therefore we can define a particle volume as

$$V_{particle} = v^2 \rho \frac{4}{3} \pi f^3$$

where ρ is the density of the surrounding FTE. Therefore change factor

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

in spin frequency effects the particle volume by factor k^3. Let's interpret $f_{rest} = r_{rest}$, where r_{rest} is the radius of a mass at rest. Particle collider gives the electron near c speed and hence $k = 1.5$. Energy of accelerated electron at rest is

$$E = M_{electron} f = \pi (1.5 r_{rest})^2 1.5 f_{rest} = 1.5^3 \pi r_{rest}^2 f_{rest} = 1.5^3 E_{rest} \approx 1.7 MeV.$$

Calculated energy pretty much matches with the lowest measured energy of Up quark (measured after particle collisions). Calculated and measured values matches and this indicates that Up quark didn't get any additional energy from a collision.

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

In an addition to the gravitational factor also velocity changes distributes into the amount of FTEPs in an atom. Increased amount of FTEPs obviously increases the size of an atom. Also in the case where FTEP amount decreases the size of an atom decreases.

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.

GPS satellite

Typical GPS satellite has the mean distance from Earth's center 26560 km and the orbital mean velocity $\approx$ 3874 m/s. The change factor k (negative value means increasing atomic volume) in case of particle volume is

$$k = \frac{\frac{1}{6371000^3} - \frac{8.321^2 * 1.0000000002504778}{26560000^3}}{\frac{1}{6371000^3}} \approx 0.044427958$$

totalling $k^3 \approx 8.769 * 10^{-5}$. Because k^3 is distributed into a sphere shaped volume the effective volume change factor is $k_{effective} = \frac{k^3}{\frac{4}{3}\pi} \approx 2.09 * 10^{-5}$. Valence electron's and the rest of the atom's combined volume change factor is therefore ${k_{effective}}^2 \approx 4.38 * 10^{-10}$.

It means that the valence electron's volume (particle itself) has to travel $\approx 4.38 * 10^{-10}$ times less than in the reference frame. In case of an atomic clock this means more "tics" when compared to an atomic clock in the reference frame. In the 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 $\approx$ 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 our reference frame (ignoring a fact that the atmosphere isn't a vacuum hence distording FTE density at 10 km altitude in comparison to idealized case) then how much that atomic clock would gain time in 24 hours? Obviously that aeroplain would have a velocity 1.0021459227467811 times our velocity. Increase of the spin frequency of a particle would be negligible. 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. But during the 79-year lifetime the gain would be (calculated with exact time) $\approx 2.099 * 10^{-9}$ s.

References

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