The Geometry of the Proton and the Tetryen Shape

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Abstract: The geometry of the proton is unique relative to its same-charge counterpart known as the positron. The proton's structure and its forces on an electron are modeled in this paper, analyzing why the proton has the ability to create an atom necessary for molecules and life to form, when the positron of identical charge interacts with an electron and matter seemingly vanishes.

1. Electron and Positron

The proton is a known composite particle, currently believed to be a formation of multiple quarks. However, quarks are never found in isolation as standalone particles [1], leading to the possibility that quarks are high-energy versions of another known and stable particle.

The electron is one such stable particle. In *The Relationship of Gravity and Magnetism*, the electron was described with the following figure as electrical waves with amplitude of Planck charge (q_P) converging on a *core* of one or more spheres with radius of Planck length (l_P), reflecting such electric waves while introducing the spin of the particle and a new magnetic wave [2]. The values and units for all constants in this paper are found in the Appendix and are based on CODATA values [3]. In-wave energy and out-wave energy is perfectly conserved, but amplitude changes in Fig. 1.1. (b) and (c) as a ratio of the square root of the fine structure constant (α_e).

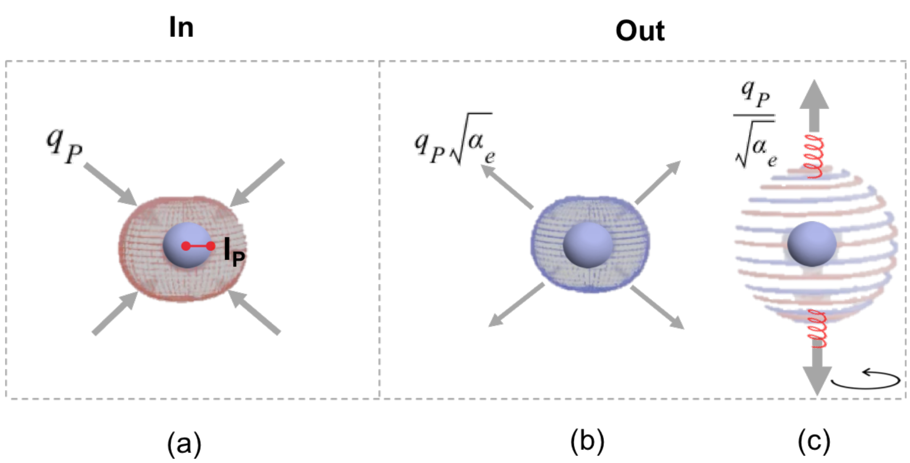

Fig. 1.1 – Longitudinal waves converging and reflecting on a sphere with radius of Planck length

In that paper, the electron particle was described as standing waves, resulting in the combination of longitudinal in-waves and out-waves, and its energy and mass were accurately calculated. A standing wave contains energy due to its in-waves and out-waves, but it is stored energy within a defined structure because there is no net propagation of energy within the volume [4]. Beyond the electron's standing wave boundary, longitudinal traveling waves were derived to be Coulomb's electrical force law and the transverse traveling waves as a result of a spinning particle were derived to be the electric's magnetic moment. This is described in Fig. 1.2.

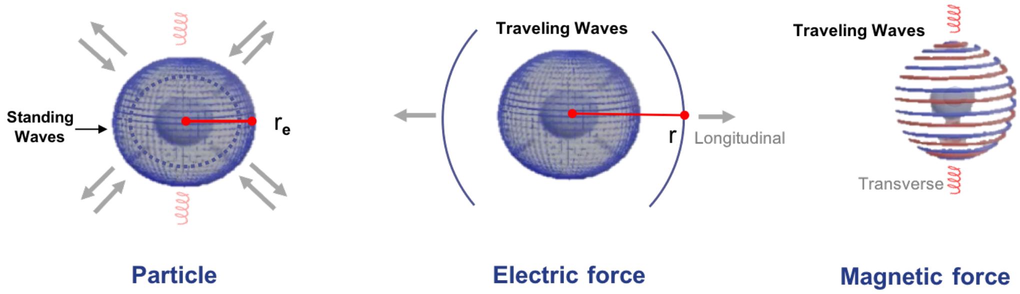

Fig. 1.2 – The electron particle formed from standing waves and its forces as traveling waves

The electron has an antimatter equivalent known as the positron, which is identical in energy and mass. The positron has the opposite charge, meaning that the positron is attracted to an electron, whereas two electrons or two positrons repel each other. If electrons and positrons are formed from longitudinal standing waves, this can be explained by a phenomenon of standing waves in which two nodes form per wavelength where there is zero amplitude (no displacement). This creates a stable position in a standing wave for a *core*. These two nodes are separated a half-wavelength from each other – a 180-degree phase shift on the wave. At this phase shift, the core of an electron and positron would have destructive wave interference measured between the two particles. Without the phase shift, when two particles such as two electrons from the same node position interact, constructive wave interference would be measured. Particles move to minimize amplitude and this causes motion in the direction where it is minimal.

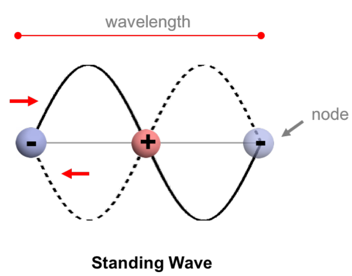

Fig. 1.3 – The two zero-amplitude nodes in a wavelength of a standing wave (-) and (+)

The wave amplitude of Fig. 1.1 (b) is better known as the elementary charge (e_e). Using the Coulomb constant (k_e) and the distance between two particles (r), the equation for the electric force is shown for two particles.

$$e_e = q_P \sqrt{\alpha_e} \quad \textbf{(1.1)}$$

$$F_e = k_e \underbrace{\left(\frac{(q_P \sqrt{\alpha_e})^2}{r^2} \right)}_{\text{Electric force}} = k_e \left(\frac{e_e^2}{r^2} \right) \quad \textbf{(1.2)}$$

Because charge can be constructive or destructive, which is additive, the number (n) of particles in each group is multiplied by the elementary charge. This variable (q) is used in Coulomb's law, found in Eq. 1.4.

$$q = (n)\, e_e \quad \textbf{(1.3)}$$

$$F_e = k_e\left(\frac{q^2}{r^2}\right) \tag{1.4}$$

Coulomb's Law

The wave amplitude of Fig. 1.1 (c) was used in the aforementioned paper on magnetism to derive the electron's magnetic moment, the Bohr magneton. Two transverse waves leave at two poles as a result of a spinning electron. When one pole (½) is measured at the electron's radius (r_e), for a wave traveling at the speed of light (c), the following is the derivation of the Bohr magneton (refer to the Appendix about units).

$$\mu_B = \frac{1}{2}\frac{q_P}{\sqrt{\alpha_e}}r_e c = 9.274\cdot 10^{-24}\left(\frac{m^3}{s}\right) \tag{1.5}$$

Bohr magneton

The electron's magnetic moment is a flow rate of magnetic wave energy. In terms of a force, the magnetic force of a monopole is similar to the electric force from Eq. 1.2, but with the wave amplitude from Fig. 1.1 (c), as it is a conservation of energy of the electron's out-waves.

$$F_m = k_e\left(\left(\frac{q_P}{\sqrt{\alpha_e}}\right)^2\frac{1}{r^2}\right) = k_e\left(\frac{q_P^2}{\alpha_e r^2}\right) \tag{1.6}$$

Magnetic monopoles with one pole are not found in nature. Magnetism is commonly found with two poles, typically labelled as north (N) and south (S). The following figure describes a simple dipole with a single positron (+) and electron (-).

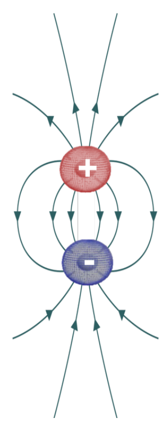

Fig. 1.4 – A magnetic dipole with one positive and one negative charge

The equation for a magnetic dipole force extends the monopole force (F_m) by a ratio of the electron's radius (r_e) and the distance (r) to the particle that the force is being measured. As a result, the force now has r^3 in the denominator. Static magnets follow this rule, where the magnetic force decreases at the cube of distance [5].

$$F_o = F_m\left(\frac{r_e}{r}\right) = k_e\left(\frac{r_e q_P^2}{\alpha_e r^3}\right) \tag{1.7}$$

Magnetic dipole force

A second electron, bottom of Fig. 1.5, is described at this distance (r) from the static magnet. The repelling, magnetic dipole force is labeled as F_o, for an orbital force. Meanwhile, the electric force (F_e) between the second electron and positron is attractive. This scenario is not expected to occur due to the annihilation of an electron and positron, yet it will be used to describe equations that can be used to describe orbitals.

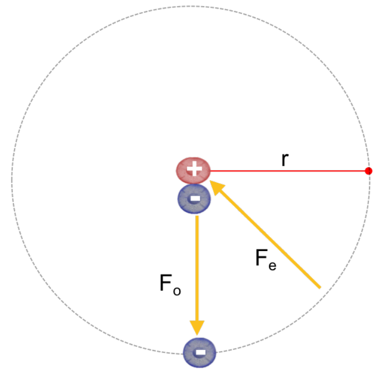

Fig. 1.5 – An attractive electrical force and repelling magnetic force on a second electron

The position of the second electron can be described in mechanics using the sum of forces rule. Its position is found where the attractive electrical force and the repulsive orbital force are equal. In mathematical terms, $F_e=F_o$. Eqs. 1.2 and 1.7 are inserted for these forces in Eq. 1.9.

$$F_e = F_o \qquad \textbf{(1.8)}$$

$$k_e\left(\frac{(q_P\sqrt{\alpha_e})^2}{r^2}\right) = k_e\left(\frac{r_e q_P^2}{\alpha_e r^3}\right) \qquad \textbf{(1.9)}$$

Solving for distance (r) in the previous equation, for a single positive charge and negative charge, results in the most probable orbital distance for an electron in hydrogen. This distance is known as the Bohr radius.

$$r = \frac{r_e}{\alpha_e^2} = 5.29x10^{-11}\,(m) \qquad \textbf{(1.10)}$$

Bohr radius

Yet, an electron does not have a stable orbit around a positron. The two particles seemingly annihilate because there is nothing to prevent the cores of these particles from reaching an extremely close distance to each other such that the electric waves that are reflected from both cores are perfectly destructive. Not only would this collapse the standing waves of each particle such that no energy could be detected, but there would be no forces from traveling waves to attract or repel the second electron illustrated in Fig. 1.5. This scenario is impossible.

2. Proton

The positron and proton have the same positive charge, but there is a key difference between these two particles. The proton is a known composite particle, currently believed to be made of three quarks. More recently, five-quark (pentaquark) arrangements have been detected in proton colliders, consisting of four quarks and one antiquark [6]. Using the latter finding as a model, four particles with negative charges are placed in a three-dimensional arrangement in Fig. 2.1. It is illustrated with spherical waves on the left of the figure and computer simulated on the right.

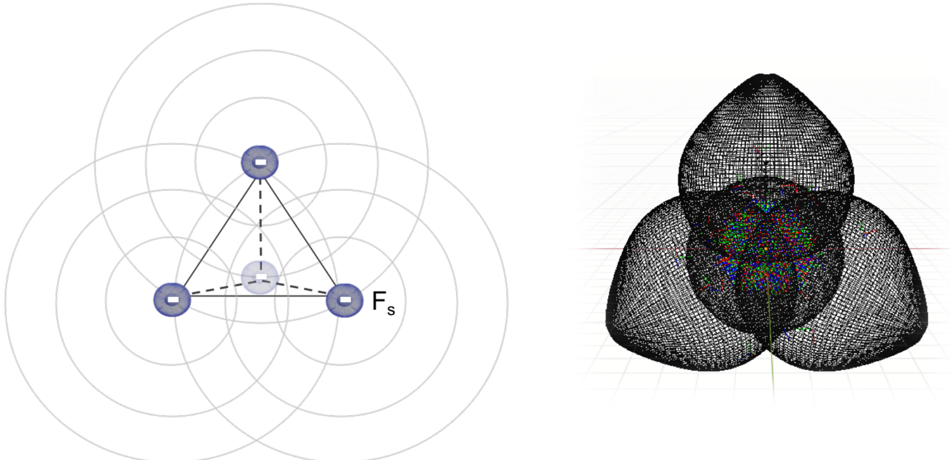

Fig. 2.1 – Arrangement of four electron *cores* placed at standing wave nodes (right – computer simulated)

Fig. 2.1 (left) illustrates spherical longitudinal wavelengths as circles, where the intersection of circles represents standing wave node positions where amplitude is zero in the three-dimensional arrangement. Thus, it could be possible for four same-charge particles, such as four electron cores, to be placed within standing waves at nodes if they can reach this point. Two electrons repel due to traveling waves that are constructive. Yet, if there is significant energy forcing two electrons to the point where they are within each other's standing waves, at nodes, it would meet the requirement for stability as zero wave amplitude. Four such electrons would create a three-dimensionally stable object described in Fig. 2.1. They would have significantly more energy than a standalone electron, stored from motion to reach the node, and its radius may shrink to the size of the particle core and not the electron's standing wave radius as it no longer reflects longitudinal waves.

The in-wave amplitude from Fig. 1.1 (a) is used in the equation that describes the force between these particles. It only occurs at a distance where r is less than the electron's standing wave radius, thus the strong force occurs at short ranges. Furthermore, the only stable position is a standing wave node which occurs at wavelengths.

$$F_s = k_e\left(\frac{q_P^2}{r^2}\right) \tag{2.1}$$

Strong force

The ratio of the electrical force (F_e) and the strong force (F_s) is known as the fine structure constant (α_e). The relative strength of the electric force is roughly 1/137th the strength of the strong force. This can be derived from Eqs. 1.2 and 2.1 as follows:

$$\frac{F_e}{F_s} = \frac{k_e\left(\frac{(q_P\sqrt{\alpha_e})^2}{r^2}\right)}{k_e\left(\frac{q_P^2}{r^2}\right)} = \alpha_e \tag{2.2}$$

The more recent pentaquark findings of the proton includes four quarks and one antiquark. To complete the proposed geometry of the proton, a positron is placed in the center as illustrated in Fig. 2.2 (left). In the computer simulated version on the right of Fig 2.2, the positron is multi-colored in the center as seen through the mesh of the outer particles. This arrangement satisfies proton collision experiments, including a three-quark arrangement due to the annihilation of two particles, and it also satisfies beta decay results where electrons and positrons are ejected. Each of these scenarios were detailed in *The Geometry of Particles* paper [7].

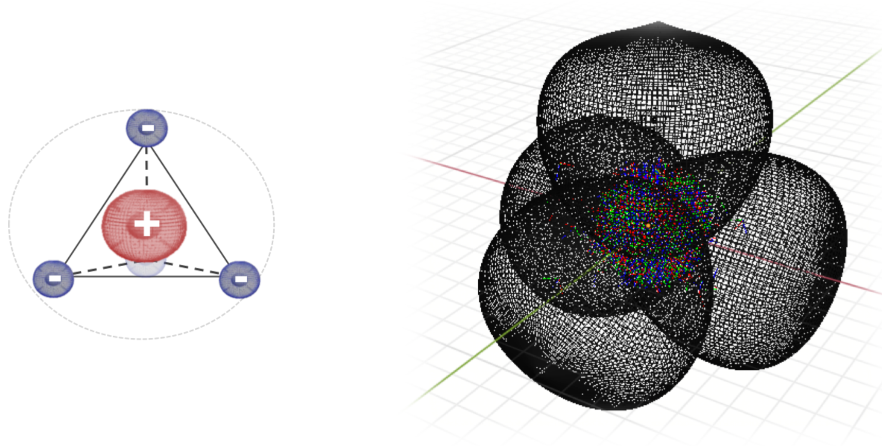

Fig. 2.2 – Proton - arrangement of four electron *cores* and a positron at the center (right: simulated)

Unlike the arrangement of the positron and electron, the proton's geometry satisfies the conditions for stability to repel an electron into an orbital. When energy is used as gluons between electron cores, no out-waves travel as the electric force to repel a distant electron. Only the positron's out-waves travel as longitudinal electric waves, creating destructive wave interference with an electron. This is the electric force (F_e), which is attractive in all directions, decreasing at the square of distance. Meanwhile, the dipole magnetic force, aka orbital force (F_o), requires an alignment of the electron with a dipole in the proton, repelling the electron at the cube of distance. For a single proton and electron (hydrogen), this results in a distance of the Bohr radius, calculated earlier in Eq. 1.10. It is the most probable distance for hydrogen because it occurs only at dipole alignment, being pushed out at this alignment and attracted at other times, varying the electron's distance from the proton as it orbits. *Note: 1) only the Bohr radius is shown in Fig. 2.3 and not the probability cloud, and 2) the computer simulated version is not to scale to illustrate the proton's composite structure in the image.*

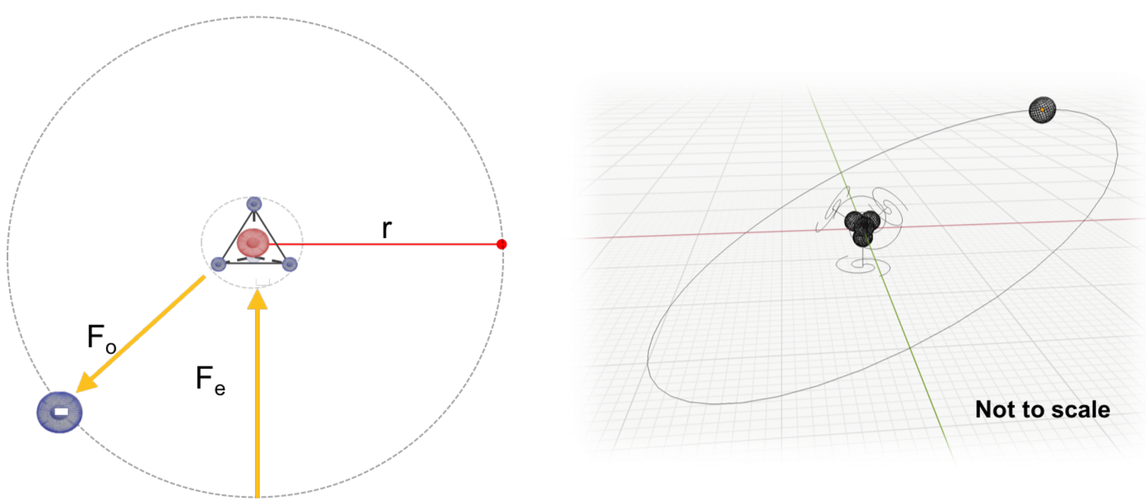

Fig. 2.3 – Orbital - attractive and repelling forces of a proton and electron (right: simulated)

Other atomic configurations share the same principles of attractive and repulsive forces for orbitals, but other atoms must consider additional protons and electrons and their positions to calculate all of the forces. A summary of atoms from hydrogen to calcium and their orbitals is found in the *Atomic Orbitals* paper [8].

3. Tetrahedron and Tetryen

The tetrahedron is the proposed structure found in Fig. 2.1 due to the requirement for cores to be placed at standing wave nodes. These are equidistant points in a three-dimensional structure at wavelengths where stability may occur. The next figure illustrates the core of this structure (marked in orange). It is a curved tetrahedral structure as a result of spherical waves produced by four particles.

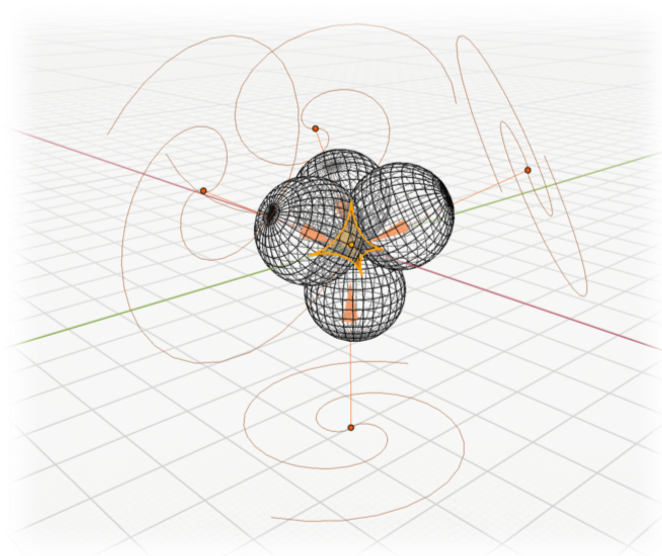

Fig. 3.1 – Curved tetrahedral structure at the core of four particles at the vertices of a tetrahedron

The proton forms the nucleus of an atom. The tetrahedral structure is found in the proton and in orbitals it creates. Orbiting electrons are then shared with other atoms, binding to create molecules. Based on this, it is not surprising that molecules also show tetrahedral arrangements. This continual building process of molecules creating objects that can be seen with the human eye may be a replication of the simple rule of equidistant standing wave node placement.

The tetrahedron's shape may also be found to have curved lines, not straight lines. Due to the spherical wave nature of particles, this curves a tetrahedron. This curved shape is referred to here as the tetryen, illustrated in Fig. 3.2.

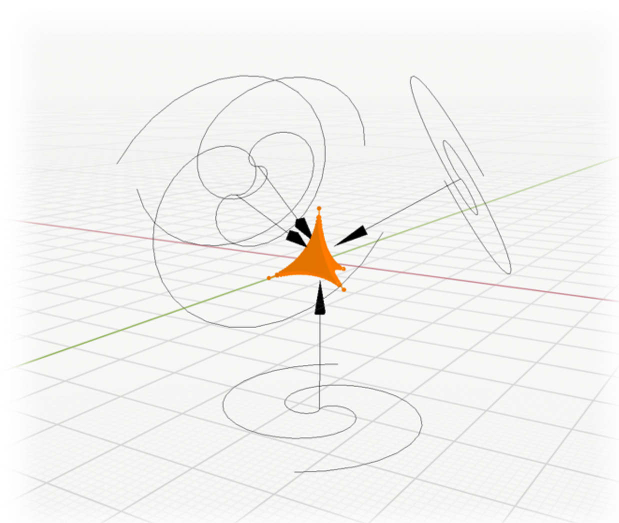

Fig. 3.2 – The core, curved tetrahedral structure – a tetryen shape

A video of the simulation is available on YouTube at: https://www.youtube.com/watch?v=4WY7lxoVF9E.

Conclusion

The geometry of the proton is what makes it unique compared to the same-charge particle known as the positron. While matter is undetectable after the interaction between a positron and electron, the proton is vastly different as it allows an electron to orbit and be shared with other atoms to create molecules. Fortunately for humankind, this unique geometry of the proton allows the formation of visible matter.

The tetrahedron is the simplest platonic solid and may likely be the core of a proton, best described as four particles at the vertices of a tetrahedron and an antiparticle at its center. This matches the results of the pentaquark discovery found in proton collider experiments. Electrons and positrons, which are found in beta decay results for the proton and neutron, may be ideal candidates for quarks if their energies are modified because of wave interference properties when the core of these particles are placed within standing waves.

The center of four particles aligned at the vertices of a tetrahedron forms another, smaller tetrahedron. Due to the spherical wave nature of particles, this tetrahedron is expected to be curved. It is referred to in this paper as a tetryen.

Appendix

Constants

The following constants are used in this paper (CODATA values).

Symbol	Definition	Value (units)
c	Wave velocity (speed of light)	299,792,458 (m/s)
k_e	Coulomb constant	8.9876×10^{9} (kg*m/s^2)[a]
μ_0	Magnetic constant	1.2566×10^{-6} (kg/m)[a]
μ_B	Bohr magneton	9.2740×10^{-24} (m^3/s)[a]
q_P	Planck charge	1.8756×10^{-18} (m)[a]
e_e	Elementary charge	1.6022×10^{-19} (m)[a]
α_e	Fine structure constant	0.00729735
l_P	Planck length	1.6162×10^{-35} (m)
r_e	Electron classical radius	2.8179×10^{-15} (m)
a_0	Bohr radius	5.2918×10^{-11} (m)

[a] – Corrected units when units of Coulombs (C) is replaced with distance (meters).

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