Charge and the Shape of the Proton

James Decandole
1602-3 Massey Square, Toronto, Ontario, M4C5L5, CANADA
e-mail: dcndl@esuite.ca

A model of a torus-shaped proton and a three-planed atom with a layered nucleus is derived from atomic phenomena. The model is compared to other nuclear and atomic models and its explanatory value is discussed.

1. Introduction

The constituent particles of atoms are distinguished by having different charges. The proton has a positive charge and the electron has a negative charge. The neutron, a transformed proton, has no charge or a neutral charge. The effects of charge are observed when these particles pass through an electromagnetic field which deflects their motion towards one, the other, or neither electrode. The proton is attracted to the negative electrode and the electron to the positive, while the neutron's motion is not affected.

The charge of an intact atom is neutral since the equal charges of the proton and electron cancel each other. When the proton and electron separate, in the process of ionization or radioactivity, they are described as charged particles and as positive or negative ions.

What is charge? Why are radiation and neutrinos chargeless, while the particles of matter possess charge? Why are there three kinds of charge? What are the microcosmic meanings of magnetism, electricity and the electromagnetic force?

Nature is simple. We assume that the observed phenomena are solely determined by variations of the spatial relations of three-dimensional objects. Such differences in orientation refer to dimension, plane, direction, distance, angle and phase; and positive, negative, parallel, perpendicular, and other physical, geometric and dynamic parameters.

Since Ernest Rutherford and the other atomic physicists discovered the atomic nucleus and the proton, the proton has generally, but warily, been depicted as a sphere, similar to a billiard ball. There are suggestions of solidity and opacity. In this picture there is no designation of the proton's plane or axis, nor indication of motion. Neutrons are depicted as spheres of a different color. The protons and neutrons are grouped randomly into a spherical nucleus. Mathematical physicists are content to leave this picture unchanged because their method is by calculation rather than visualization, by equation rather than diagram or model, algebraic rather than geometric.

2. Torus

Let us assert that the proton does have a plane, an axis, a rotation and a direction, that can be described by ordinary geometry.

Let us assume that the proton has the shape of a torus. The internal frame of reference of an object of this shape is immediately apparent. The rotation of the proton is defined by the plane of the torus.

Let us also assume that each of the three differently charged particles moves in its own plane.

"Torus" is defined as a shape generated by the rotation, in space, of a circle in its plane but not cutting the circle. Familiar objects having this shape are donuts, Lifesavers candy, rings, inner tubes, man-overboard life belts and chain links. The formula for the volume of a torus is $v = 2\pi^2 k r^2$, as shown in Fig. 1.
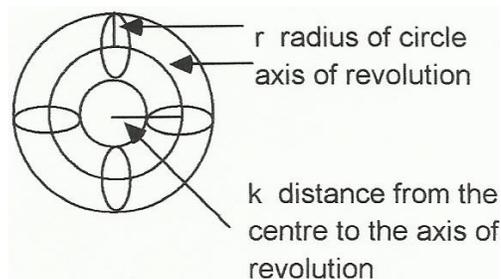

Fig. 1. Schematic diagram of a torus or anchor ring

The mass of the proton is 1836 times that of the electron. Assuming that mass and volume are equivalent quantifications of size, then the proportions of a toroidal proton and a spherical electron are as shown in Fig. 2, where the ratio $k/r = 4.9537/4.3333$ and $k - r = 0.6204$.
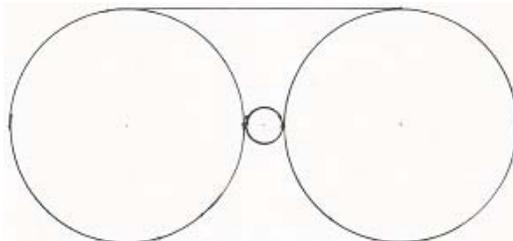

Fig. 2. Relative size of the proton's torus and hole

3. Proton, electron and neutron

A torus has a hole at its centre. Its plane and axis of rotation are constant. A proton of this shape has an empty centre of minimal radius which is conveniently available for the passage of an electron in the course of its rotational motion. Thus the vertex of the electron's trajectory is fixed at the proton's centre, and the centre or focus of the trajectory is variable.
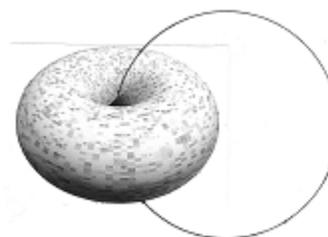

Fig. 3. The interaction of a proton and an electron: a hydrogen atom

The plane of the electron's motion is at right angles to the plane of the proton's rotation. This leaves the third of the planes in three dimensions available for a neutron, with its motion at right angles to both the proton and the electron. The correspondence of their internal dimensions is as follows:

Dimensions of proton	Electron to proton orientation	Neutron to proton orientation	Electron to neutron orientation
radial	radial	axial	tangential
tangential	axial	tangential	axial
axial	tangential	radial	radial

Table 1. Dimensional relations of the motion of atomic particles

A helium atom consists of two protons, two electrons and two neutrons. The protons are co-planar and they form the plane of the atom. Their rotations are opposite, one clockwise and the other counter-clockwise. The electrons are co-orbital, both passing through the centres of the protons, and the angle between them is π. The neutrons are co-planar in the third plane, one above and the other below the plane of the protons, and their centres coincide with the electrons' trajectory. The distance between a proton's centre and the centre of the atom is 1.1547 proton radii, the minimum allowed in their common tetrahedral frame of reference. The distance between a neutron's centre and the common centre is two proton radii and the electrons' trajectory is elliptical.
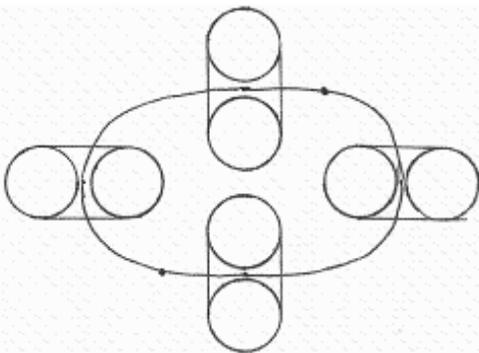

Fig.4. Cross-section of a helium atom: 2 protons (vertical plane), 2 electrons (shared orbit) and 2 neutrons (horizontal plane).
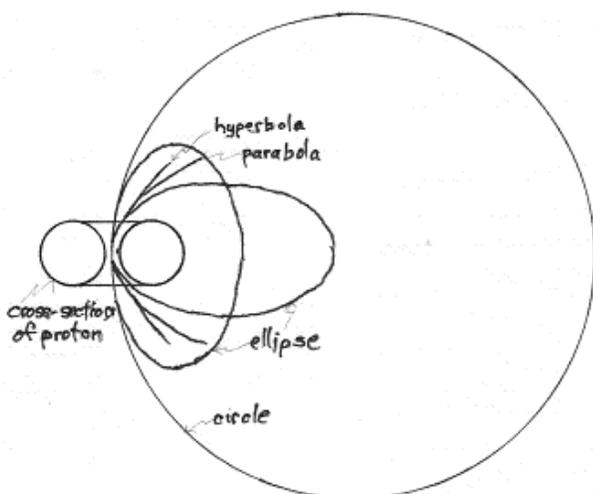

Fig. 5. Variations in the trajectory of an electron

A hydrogen atom consists of a proton and an electron. The electron's trajectory is a plane curve, a circle, ellipse, parabola or hyperbola, with its vertex at the centre of the proton.

The fact that the atoms of most elements contain more neutrons than protons but that this disparity never exceeds twice as many, suggests layering. A layer of protons forms the base of the nucleus and above and below this middle layer is a layer of neutrons.

4. Atom

The Rutherford-Bohr model of the atom was proposed by Neils Bohr soon after the discovery of the nucleus and has since been modified but not replaced. It introduced the useful ideas of co-orbital electrons and varying electron trajectories referred to above, along with shells of electrons and wave functions. The model also contained the doubtful assumption of the electron leap or jump, the solar system analogy and an implication that the atomic structure is determined by the electronic structure. It omitted, and has not since produced, a model of the form and constitution of the proton, an ordered spatial arrangement of protons and neutrons, and a spatial explanation of charge.

The emphasis on the behavior of the electron and the corresponding neglect of the proton led to the misleading view that atomic structure was largely dependent on the actions of the electron. This view involuntarily prompts the image of "the tail wagging the dog". It is an idea that flies in the face of the fact that the proton is 1836 times larger than the electron. This disparity in size means that whatever the system relating electron to proton, the proton is bound to dominate. The proton is the "headquarters" and the electron is "the agent in the field".

In every atom there is always one proton per electron. A proton can handle only one electron and the pairing is fulfillment for both. The passage of the electron through the proton's central hole in every circuit illustrates their close, dependent interaction. When the electron is in the hole, it is at the vertex of its path, and it is anchored to its proton whatever variation takes place in its trajectory, whether from ellipse to parabola or from near-centered to far focused.

The notion of an electron leaping from one orbit to another can only be characterized as unnatural. Such a trajectory, such a species of motion, does not seem possible in a mechanistic universe where processes are continuous. Only the voluntary action of a terrestrial animal fits this kind of motion. Nevertheless the electron is known to have a variety of behaviors, such as ground state and excited, chemical bonds, sharing, electricity and shells, which are manifest by their different trajectories.

When the electron changes its motion, the atom experiences a transformation. Having a proton shaped like a torus provides a place where this change can plausibly occur. When the electron is in the hole the distance between the two particles is minimal and the "influence" of the proton is greatest. If this process involves a transfer of energy from one to the other, their proximity facilitates it. The electron enters the hole from its old trajectory and emerges with a new one. The radial dimension and the vertex of its cyclic motion are constant, while its focal radius, eccentricity, period or range may change.

5. Conclusion

The physical difference between positive, negative and neutral charge is accounted for by the spatial arrangement of proton, electron and neutron within the nucleus of the atom. The trajectory and plane of motion of each particle is at right angles to the others. A neutron leaving this stable configuration reverts to a proton with a half-life of 12 minutes.

The coincidence of the vertex of the electron's trajectory and the centre of the proton permits the electron's motion to be as flexible as necessary, while keeping it tethered to and controlled by the nucleus. The jump of the electron is no longer necessary. The intimate dependence of the electron on the proton is established.

The universality of spatial relations, of familiar Euclidean solid geometry, of the common frame of reference, as an explanation of natural phenomena is enhanced. The analogies of the solar system and billiard ball are discarded and a chain link analogy is introduced.