LETS KEEP IT SIMPLE

By Arnold G. Gulko

Background

We exist in a particulate nature in which there are only two particles which possess significant mass at rest and long term independent stability. These are the electron and the proton. So when we consider our particulate nature from the perspective of the massive and independently stable particles which abound around us, the nuclear zoo of particles in that nature can be simplified by focusing on only these two.

The association of particles

Most everything of importance to man involves particles in association with one another. For example, particles including protons associate with one another to form the positively charged nuclei of all the elements, and these nuclei associate with surrounding electrons to form the atoms of which we and almost everything around us are constituted . So consideration of our particulate nature can be simplified by focusing on a single issue, namely: the association of particles.

The hydrogen atom

The simplest association of particles is the hydrogen atom in which a single negative electron associates with a single positive proton. There is nothing in the hydrogen atom other than these two particles. So we have simplified the problem facing physics by concentrating upon a single issue, the association of the only two particles possessing significant mass at rest and long term stability.

The simplest test of our understanding of the electron and proton is to see whether that understanding enables us to comprehend the hydrogen atom. Unfortunately, modern physics does not now understand the hydrogen atom, so this simple test has been failed and we are left with no real understanding of the only two independently stable massive particles around us.

History

The problem of the hydrogen atom came to the fore when it was discovered that apparently solid matter was mostly open space with almost all the mass being concentrated into tiny nuclei. With the results of Rutherford's alpha particle bombardment of metal foils in hand, one could not avoid the conclusion that an atom consisted of a tiny massive nucleus surrounded by remotely positioned electrons. But the spacing of the particles in hydrogen presented an obvious dilemma. Electrostatic attraction follows the inverse square law growing immensely strong as oppositely charged particles come close. So the electrons should cling to the positive nucleus or the proton in hydrogen making matter immensely dense and life impossible.

To confront this dilemma N. Bohr assumed the electron maintained its great spacing from the proton in the hydrogen atom by balancing its orbital momentum against the electrostatic attraction between the particles, this orbital action being much like that of a planet orbiting a sun. With that simple assumption he correctly calculated many aspects of the hydrogen atom. Unfortunately, this simple assumption was manifestly wrong, and Bohr finally recognized it was wrong and searched for a different answer to the problem of the hydrogen atom.

Quantum mechanics

In response to Bohr's failure to understand the hydrogen atom, Bohr and E. Heisenberg formulated quantum mechanics based on the assumption that what they did not know (the combination of the size and internal structure of the electron) was of no importance. Then, and with the further assumption the electron was a point particle lacking significant internal structure, quantum mechanics correctly calculated many aspects of the hydrogen atom, and quantum mechanics rules the physics roost today.

With quantum mechanics, unlike Bohr's orbital model, there was no physical model which could be shown to be wrong. Heisenberg assumed that if he could accurately measure both the position and vector of the electron with respect to the proton he would be able to predict what the hydrogen atom would do. But since he could not make those measurements he could never test this assumption. As a matter of incidental interest this writer believes Heisenberg's assumption was wrong. The position and vector of the electron have nothing to do with what the hydrogen atom will do, and this analysis will shed some light on that problem.

In accordance with Bohr's concept of measuring complementary variables, it is difficult to simultaneously measure conjugated variables because the more one learns about one variable, the less one knows about the other. Heisenberg misrepresented that concept to formulate his uncertainty principle. The misrepresentation was to twist a concept relating to the accuracy of measurement from the difficulty of measurement to the constitution of that being measured. With this misrepresentation one could conclude that what could not be measured with certainty was itself uncertain and hence unknowable. This twist was obviously unjustified, but it gave Heisenberg an alibi for his failure to comprehend the hydrogen atom. Physics accepted this misrepresentation for the simple reason that to this day physicists still do not understand the hydrogen atom and thus need the same excuse for their lack of understanding.

But the electron by its energy content must be a large particle to comply with both A. Compton's scattering observations and Planck's law, and not a point particle as assumed in quantum theory. Moreover, the electron must possess important internal structure, such as is needed to explain superconductivity, and this will be discussed herein to a limited extent. So the assumptions upon which quantum mechanics is based are wrong.

One problem is that when incorrect assumptions enable correct calculation we have chaos instead of science. What comprehension can come out of calculations which are based upon assumptions which are not correct? What reliable prediction can be based on calculations based on incorrect assumptions? Projections in science must arise out of observations, not mathematics, especially mathematics based on erroneous assumptions.

Another problem is that if the uncertainty principle were correct, as physics today assumes to be so, then the fundamentals of our nature are uncertain and unknowable. Physics as a science is a quest to understand the fundamentals of our nature, and acceptance of the uncertainty principle makes this impossible. Since there is little purpose in chasing after that believed not to be possible, science is no longer an objective of physics. Quantum mechanics with its uncertainty principle may be useful as an engineering expedient, but it has destroyed physics as a science.

Summary

So the simplest association of particles, the hydrogen atom, is not now understood, and this failure destroys everything which physics as a science has as its objective, namely: to understand the independently stable particles which abound around us and the elements in the Periodic Table of the Elements which result from the association of those particles.

As previously pointed out, if one does not understand the hydrogen atom then one cannot possess a correct understanding of the two particles which are all that is present in that atom. On the other hand, if one does not understand the simplest of all particle associations, then one must seriously question our opportunity to understand the more complex particle associations which form all of the other elements.

The elements

Does physics understand the many elements in the Periodic Table? As we know, the elements each have precise characteristics which differ from one element to the next. The simple difference which distinguishes any element from the others is the number of protons in the nucleus. Going from high temperature resistant highly reactive carbon with six protons to nitrogen with seven protons provides a low boiling relatively inert gas. So one should be able to take the nuclei of the elements and correlate the physical, chemical and nuclear properties of the elements with the constitution of their nuclei. Physics today cannot do this. Instead, recognizing the asserted inability, each of these different properties is poorly accounted for on a separate basis. So not only is there a failure to correlate the diverse properties of the elements with what is in their nuclei (where the determining protons are confined), but this failure is well-recognized.

A simplified analysis of the hydrogen atom

Unless one arbitrarily limits Planck's law to photons (there is no reason why it should not extend to any isolated portion of energy), the radius of an electron assumed to be generally spherical is simply the length of the energy it contains (its Compton wavelength) divided by 2 pi. Division by 2 pi is well known to convert a circumferential length into a radius.

Physics has no reason why the size of the electron (its radius based on its energy content) should determine the size of the hydrogen atom, but the average spacing between the electron and proton in hydrogen can be calculated by simply squaring the energy radius and then dividing by the classical charge radius.

To illustrate the significance of the electron's size in establishing hydrogen's spectrum, if one divides the electron's radius by the average spacing between the electron and proton in the hydrogen atom, one obtains a ratio which corresponds precisely with the fine structure constant of atomic spectra. As a further illustration of the significance of the electron's radius to the hydrogen atom, if one simply divides the electron's energy radius by the electron's classical charge radius, one again obtains a ratio which corresponds precisely with the fine structure constant of atomic spectra.

The above two simple relationships involving the size of the electron are important because the ratio of one size to another is one of the simplest (and hence one of the strongest) mathematical relationships which can be established in physical reality. Despite the overwhelming simplicity of these relationships physics today cannot explain how the fine structure constant comes into existence, and that constant is one of the very few constants in our nature. The fine structure constant calculated by these simple relationships is especially significant in atomic spectra. This constant is present in every line of the spectrum of every element, but it is usually discussed in terms of the spectrum of the hydrogen atom where it exists in its simplest form because hydrogen's spectrum can only involve the interaction of two particles.

The fine structure constant

In view of the significance of the fine structure constant it is helpful to review what it is.

Every line in the spectrum of any element had a has a fine structure because that line is actually two closely positioned lines. Each of these two lines has a different wavelength, one longer than the other. Subtracting the shorter wavelength from the longer wavelength, one obtains the wavelength difference which defines the size of the space between the two closely positioned lines. When one then divides this wavelength difference by the wavelength of the longer of the two lines one obtains fine structure of atomic spectra. It does not matter which line in a spectrum one examines or which element whose spectrum is selected, the above ratio is always the same, and this is why the fine structure ratio is a constant. There are very few constants in nature, and the fine structure constant is one of the few.

But we now see that a simple division involving the electron's radius based on its energy content gives us the fine structure constant. This is itself well known, but physics usually ignores these simple relationships because the electron has no size in quantum mechanics, so the simple mathematics must be ignored. Also, physics does not understand how energy is lost when hydrogen forms, how the size of the electron determines the size of the hydrogen atom or how the structure of the electron (quantum mechanics assumes it has no significant structure) determines the fine structure constant.

The issue here is whether we can employ an analysis of known facts to explain how one of the above simple calculations determines the fine structure constant as a matter of physical reality. Should we succeed, we would then be armed with what is needed to continue to try and comprehend the fundamentals of the nature of which we are a part. This may seem like a small thing, but it begins to restore science to the discipline called physics, and that is of great importance.

The electron

The electron has certain well-known curious characteristics. One of these is the characteristic termed "spin". One property of particles in our quantum nature is they move with one face forward, and that face provides the measurable characteristic called spin. It seems likely that this characteristic is provided by some orientation of the electron's energy (physics is convinced the electron lacks real rotation). If one spins a ball the ball rotates, and when the rotation stops the ball is not in any particular position. But when a moving particle is subjected to a turning force in nature, it either wobbles while retaining its initial posture or it suddenly flips one-half turn and stops with its other side facing forward.

The existence of the above-described spin characteristic establishes two aspects of the electrons around us. First, in order that the characteristic of one side of a particle can be measured, it must possess some substantial size.

Since the electron possesses a spin characteristic it is not likely a point particle lacking significant size. Second, the presence of a spin characteristic establishes the electron to be a two-sided particle to enable it to reverse its spin characteristic when the electron is turned half-way around.

Particles form when high energy photons decay. Since the decaying photon was moving through space at light speed when it released the energy which formed particles, those particles must be constituted by energy moving at light speed. Particles persist in time and space, so the energy moving to constitute these particles must move in a continuous path. Since the electron is a two-sided particle the energy moving to constitute it can be expected to move in two connected portions, one portion providing one face of the electron with one spin character, and the other portion providing a second face which presents an opposite spin character when the electron stops after it is turned with its other side facing forward, as above noted.

This quantum half-turn rotation of the electron as it moves requires a physical explanation. As the electron constituted by two portions moves through the medium filling space it acts like a weather vane with one portion trailing behind the other. When the electron is turned it stops with its other portion in the trailing position, and thus turns only 180 degrees. The total motion length of the energy in the electron would be its Compton wavelength and each of the two portions would possess one-half of that energy length.

Hydrogen

The electron and proton are oppositely charged and should be attracted toward each other and remain together if these particles in the hydrogen atom were free and independent in response to the rapidly increasing attraction as they come close. Since they remain a great average distance apart, simple logic suggests some physical connection must hold them in that spaced-apart relationship. With only energy being present, the only plausible physical connection would be a double shell constituted by energy circulating back and forth between the two particles. This shell would hold the electron to the proton at an average distance determined by the length of the energy moving to constitute the shell, and the shell, on average, would be spherical.

So we have an electron formed to include two connected portions and energy forms a double energy shell circulating between the electron and the proton to associate them in spaced-apart relationship. Since the previously noted calculation establishes that the fine structure is intimately related to the size of the electron, the energy constituting the shell should come from the electron.

What does the described structure of an electron having a spin characteristic and the formation of a double energy shell binding the electron to the proton tell us about the hydrogen atom and the fine structure constant provided when the electron associates with a proton or an atomic nucleus?

The two-sided electron and the fine structure constant

Placing the fine structure relationship previously described in algebraic form, the Compton wavelength of the electron is identified as λ_{ce}, the radius of the hydrogen atom (the average spacing between its two particles) is identified as a^o, and the fine structure constant is identified by alpha (α) This simple relationship is set forth in equation I.

$$\text{I} \qquad \lambda_{ce}/2\ \text{pi}/a^o = \alpha$$

While equation I has been available to physics for a long time, physics has been unable to find any plausible basis for correlating the electron's radial size (as is set forth in the numerator of equation I) with the hydrogen atom's radial size, so we must look for a different relationship which we might be able to comprehend.

Since we have an electron formed in two portions it is reasonable to conclude that half the length of the electron is on one portion of the electron with only this half-length supplying the energy which forms the shell linking the electron to the proton in the formation of the hydrogen atom. To pursue this projection we must modify equation I in a mathematically correct manner to provide a relationship with half the length of the energy in the electron instead of with its radial length. This is simply done by multiplying the numerator and the denominator in equation I by pi. Multiplication by pi converts the numerator from $\lambda_{ce}/2$ pi to $\lambda_{ce}/2$, and this same multiplication by pi converts the denominator of equation I from a^o to pi a^o. The result is equation II in which half the energy length of the electron is divided by the length of a circle of radius a^o.

II $\lambda_{ce}/2/\text{pi } a^{o} = \alpha$

Continuing to pursue the projection that hydrogen is formed by energy taken from the electron and circulated back and forth between the electron and proton to form a generally spherical double energy shell which holds these two particles together at a specified average distance between them, the average distance between these particles will be determined by the length of the energy forming the shell. Considering the length of the energy forming the shell, equation II tells us the energy which is circulated between the particles and which forms the shell is taken from the electron in increments and discharged in increments, this energy loss being determined by the ratio between half the electron's Compton wavelength and the length of the energy circulating between the particles when the last increment of energy is added.

The addition of each increment adds a small amount of energy to the energy in circulation, and Planck's law suggests greater energy will decreases its length. When we come to the last increment of energy prior to the instant when the accumulated energy is released at any stationary state, this last increment shortens the wavelength of the second spectral line of the fine structure, and it does this in a constant ratio to the wavelength of the first spectral line. It is stressed that the fine structure ratio is established by the ratio between the half length of energy in the electron which supplied the energy which is circulated to form the hydrogen atom and the length of the energy placed in circulation.

The length of the energy in circulation is a half circle from the electron to the proton and a second half circle back from the proton to the electron which is defined mathematically when we multiply the distance between these two particles by pi.

As energy is transferred from the electron to the energy shell, more energy is returned to the electron than is leaving it, so some of this excess energy piles up at the electron and is released from time to time (at any stationary state). This provides the spectra whose lines possess the fine structure under consideration.

So equation II allows us to understand the formation of the fine structure as a constant because at any stationary state, the energy loss may include one more or one less energy increment, and this provides two spectral lines with the energy increment determining the differences between the lengths of the two lines.

It is stressed that observations have been projected to reach the conclusion that the electron is formed in two portions with only one of these contributing the energy which forms the shell linking the electron to the proton and which supplies the energy which is lost to form hydrogen's spectrum. In science it is legitimate to project from observations, but it is important to test the projection by checking it against relevant mathematics.

Here mathematical corroboration is available. To corroborate the projection that half the energy length in the electron is the source of energy loss in the formation of hydrogen and that the fine structure constant is an aspect of incremental energy loss, the Rydberg formula which calculates the total energy loss sustained when the hydrogen atom is formed requires the energy of the electron to be divided by 2 and then multiplied by the fine structure constant squared. So mathematical corroboration is available even though physics has possessed the Rydberg formula (which is absurdly simple) for calculating the total energy loss for many years without being able to understand how the energy loss takes place.

Where has this simple analysis taken us.

The two particles which are joined are both very small in comparison with the size of hydrogen. However, the energy shell holding the two particles together is much larger, and this finally gives us a persuasive basis for the large size of the hydrogen atom and for the large size of the atoms of all the other elements. We also see that the electron is carried by the double energy shell, so while its distance and direction from the proton is constantly changing, this distance and direction have no importance in determining what the electron will do. More important, the electron is being carried and is not itself moving. This finally explains why the ground state hydrogen atom and the other atoms in their ground state emit no energy as the electron moves about even though an electron normally absorbs or emits energy every time its velocity is changed.

It is stressed that science is based on projection from observation, the projection being checked by mathematical correlation. In contrast, modern physics is based upon projection from the mathematics of quantum mechanics, which is unscientific, and that mathematics is unreliable because it is based on assumptions which are wrong. This simple analysis helps to establish the erroneous nature of those assumptions.

Does this simple structural analysis provide a scientific basis for calculating all the characteristics of the hydrogen atom including every aspect of the spectrum produced when the hydrogen atom is formed? Well it does, as one can confirm by reading this writer's article in *Infinite Energy* magazine, issue No. 64 (2005), see "The Parting of the Ways" at pages 42-49. One may also read a revised form of this material in this writer's 2006 text "The Vortex Theory, Revised", see Chapter 13 "The Charged Particles and Their Association to Form Hydrogen" at pages 115-126.