

The Proof of the Quantum-Dimensional Electron Orbital Structure

The mathematical formulations to be employed

Deriving Orbital Velocity and Wave-Phase Time from Dawson's Tensor

α = fundamental quantum space; f = orbital frequency; h = Planck's Constant;

e = elementary charge; m_e = mass of electron; Q = quantum orbital distance or radius

$$\text{orbital velocity} = \sqrt{\frac{2f(h)}{m_e}} \quad \text{Energy of orbit equals absorbed/ output light energy}$$

$$f = \frac{Q^2}{\alpha^2} \quad \text{From Dawson's Tensor applied to Quantum orbit}$$

$$v = \sqrt{\frac{2 \frac{Q^2}{\alpha^2} (h)}{m_e}} = \frac{Q}{\alpha} \sqrt{\frac{2h}{m_e}}$$

$$v = \frac{\pi Q}{2t_\psi} = \frac{Q}{\alpha} \sqrt{\frac{2h}{m_e}}; \quad \frac{\pi Q}{2t_\psi} = \text{Non-accelerated velocity across one standing-wave phase.}$$

$$t_\psi = (\text{wave phase time}) = \frac{\pi Q \alpha}{Q 2 \sqrt{2h/m_e}} = \frac{\pi \alpha}{2 \sqrt{2h/m_e}} \quad \text{Wave-phase time is shown to be a constant.}$$

Deriving Root Orbital Distance and the Alpha Space from Dawson's Tensor

$$f = \sqrt{2k} Q^2 = \frac{Q^2}{\alpha^2} \quad \text{From Dawson's Tensor Equation}$$

$\lambda_{root} = 91.143 \text{ nm}$; From hydrogen spectrograph and Rydberg equation.

$$f_{root} = \frac{c}{91.143 \text{ nm}} = 3.289253788e15$$

$$v_{root} = \sqrt{\frac{2f(h)}{m_e}} = 2187495.85530702 \text{ m/sec.}$$

$c = v_{root} + (\text{standing-wave acceleration terminal velocity})$

$$(\text{standing-wave acceleration terminal velocity}) = \frac{Q_{root} \pi}{2} 2f = Q_{root} \pi f$$

$$c = (2187495.85530702 \text{ m/sec.}) + Q_{root} \pi f$$

$$(299792458 \text{ m/sec.}) - (2187495.85530702 \text{ m/sec.}) = Q_{root} \pi f$$

$$297604962.144693 = Q_{root} \pi f$$

$$Q_{root} = \frac{297604962.144693}{\pi f} = 2.8800028132e-8$$

$$Q_{root}^2 = 8.2944162041e-16$$

$$\alpha^2 = \frac{(Q_{root}^2)}{f_{root}} = 2.5216710958e-31 \text{ meters}^2$$

$$\alpha = 5.0216243346e-16$$

Deriving the Wave-Phase Time Constant, “ t_ψ ,” and Planck’s Constant, “ h ” from Dawson’s Tensor

$$\text{orbital velocity} = \sqrt{\frac{2f(h)}{m_e}} \quad \text{Energy of orbit equals absorbed/ output light energy}$$

$$f = \sqrt{2k}Q^2 = \frac{Q^2}{\alpha^2} \quad \text{From Dawson's Tensor Equation}$$

$$Q^2 = f(\alpha^2)$$

t_ψ = time across one potential acceleration / deceleration wave - phase without acceleration

$$\text{orbital velocity} = \frac{Q\pi}{2t_\psi}$$

$$\frac{Q\pi}{2t_\psi} = \sqrt{\frac{2f(h)}{m_e}} = \frac{Q}{\alpha} \sqrt{\frac{2h}{m_e}} \quad \text{combining above equalities}$$

$$t_\psi = \frac{Q\pi}{2(Q/\alpha)\sqrt{2h/m_e}} = \frac{\pi\alpha}{2\sqrt{2h/m_e}} \quad \text{time is a constant}$$

$$t_\psi = 2.0680715025e - 14;$$

" t_ψ " is wave - phase time of velocity and electron 1 / 2 spin time.

$$t_\psi^2 = \frac{\pi^2\alpha^2}{4(2h/m_e)} = m_e \frac{\pi^2\alpha^2}{4(2h)}$$

$$h = \frac{\pi^2\alpha^2}{2(2t_\psi)^2} \quad \text{Planck's Constant is a function of the alpha space and the time constant}$$

Planck’s Constant is shown to equal the spin energy of of the electron using the formula $E=m(v^2/ 2)$:

$$h = m \frac{v^2}{2} = m_e \frac{\alpha^2\pi^2}{2(2t_\psi)^2} = m_e \left(\frac{\alpha\pi}{2t_\psi} \right)^2 \frac{1}{2} = m_e \frac{(v_{e\text{-spin}})^2}{2} = \text{Energy}\{\text{of free electron spin}\}$$

$$h = m_e \frac{\alpha^2\pi^2}{2(2t_\psi)^2} = m_e \frac{(5.0216243346e - 16)^2\pi^2}{2[2(2.0680715025e - 14)]^2} = 6.6260755e - 34 \text{ joules}$$

SI value of Planck's Constant = 6.6260755e - 34 joules

Mass of proton provides the spin time constant (wave-phase time constant)

$$h = \text{Planck's Constant} = x \left(\frac{m_e}{m_p} \right) \left(\frac{\alpha^2\pi^2}{2} \right) = x \left(\frac{9.1093897e - 31 \text{ kg}}{1.6726e - 27 \text{ kg}} \right) \left(\frac{(5.0216243346e - 16)^2\pi^2}{2} \right)$$

$$h = x(6.7772792299e - 34); \quad x = 0.9777$$

$$m_p = (0.9777)(2t_\psi)^2 \quad \text{by substitution in the above equalities.}$$

Mass of proton is providing constant time value for spin energy of electron.

The Quantum-Dimensional Model of the Electron Shell/Subshell Structure: substitutes rational “cause and effect” for the irrational “uncertainty principle” of quantum mechanics.

By substitution of the discovered principles of four-dimensional quantum geometry for irrational “quantum mechanics,” and application of those principles to the earlier quantum discoveries of Max Planck and Janne Rydberg, a mathematically rational model of electron orbital structure emerges— one for which motion is predictably governed by Newtonian mechanics and for which the Heisenberg “uncertainty principle” has been eliminated.

Momentum and positional certainty are provided by Newtonian mechanics— rather than suffering quantum mechanical uncertainty. Newtonian certainty characterize the orbital shell/subshell structure in the four-dimensional quantum model. The electron is certain in its orbital position while its energy state can be simultaneously known.

This certainty in position and energy state is a function of four-dimensional space. The above set of equalities identify Planck’s Constant as the energy of electron spin with a constant time of spin mostly provided by the attached proton. Planck’s Constant identifies the energy state of all subshell orbitals and does so by identifying the velocity of orbital electron spin in relationship to orbital distance. Orbital energy is found by multiplying Planck’s Constant by the light frequency associated with the orbital. This is a straight forward application of Planck’s original principle. In turn, light frequency is a direct mathematical function of orbital distance by the application of Dawson’s Tensor, a formulation which emerged from four-dimensional quantum geometry. That is, in knowing the frequency of light output, both the energy state of the orbital and the orbital distance are also known:

$$\text{Orbital energy} = f_{orb.}(h) \quad \text{By Planck's principle.}$$

$$\alpha = \text{fundamental quantum space which is a constant } 0.50216243346e - 15 \text{ meters}$$

$$(\text{Orbital distance})^2 = Q^2 = f_{orb.}(\alpha^2) \quad \text{By Dawson's Tensor.}$$

Orbital light frequency *times* Planck’s Constant gives a new spin energy value to the orbital:

$$\text{Orbital energy} = f_{orb.}(h) = \frac{(f_{orb.}\alpha^2)\pi^2}{2(2t_{\psi})^2}$$

$$f_{orb.}\alpha^2 = Q_{orb.}^2$$

$$\text{Orbital energy} = \frac{(f_{orb.}\alpha^2)\pi^2}{2(2t_{\psi})^2} = \frac{Q_{orb.}^2\pi^2}{2(2t_{\psi})^2}$$

Orbital energy is the energy of electron spin with spin distance determined by orbital distance

The electron’s spin within any orbital acquires a new spin distance with the time of spin remaining constant. The new spin distance is determined by the quantum orbital distance. There would be more energy in the spin of a 40 meter orbital (completed in one second) than in the spin of a 10 meter orbital (completed in one second). Spin distances differ by orbital distances while spin times do not.

The light frequency and orbital distance relationship is firmly anchored in classical Newtonian physics. The model employed is that of a tensioned string. A tensioned string, when plucked, gives off a certain frequency of sound. The frequency of this sound is determined by a Newtonian formula. Frequency is shown to be equal to a tension constant *times* the length by which the string is stretched into tension (see *Dawson’s Tensor* in *The Quantum Dimension*). This frequency resides as a potential in the stretched and tensioned string whether or not the string is plucked, whether or not it outputs sound.

The electron orbital bond is also under tension, but of a different type than that acquired by a stretched string. The bond between the electron’s negative charge and the proton’s positive charge formulates the “quantum squared.” This is true because the charge of a particle is its definition of and projection towards the geometric dimension which is not contained in the definition of its volume (see *The Quantum Dimension*). The electron is a quantum particle in that its definition of volume incorporates the quantum dimension as one of its three dimensions of volume. The extra dimension is an Euclidean dimension towards which the electron’s negative charge is projected. In contrast, the proton is a completely Euclidean

particle in that its three dimensions of volume are all Euclidean. The proton's extra dimensional positive charge is projected towards the quantum dimension. When the extra dimensional charges of the proton and electron attach to one another they form the "quantum squared" which is defined as a quantum dimensional distance *times* an equivalent Euclidean dimensional distance.

The bonds of the opposite charged particles try to force a merger between the two which is impossible and which violently forces one of the bonds to rotate 90° relative to the other bond. This merger is impossible because quantum defined volume cannot be merged with Euclidean defined volume because the dimensional space is defined differently.

The electron is actually a Euclidean plate spinning in quantum space. As a quantum particle, the electron's spin is crucial to its definition of volume. When the electron's Euclidean charge-bond is forced 90° to the quantum charge-bond of the proton, the electron's axis of spin is also rotated. The electron's charge is always projected 90° to the axis of spin. When the charge is rotated, so is the axis of spin.

The electron's rotated Euclidean charge must be "kinked" into curvature by the intersecting quantum charge of the proton. This is in accordance with the geometric rules governing the quantum-dimensional intersection with any Euclidean-dimension (see *The Quantum Dimension*, chapter 1). The electron begins following this forcibly curved line of charge at the rate of its spin. That is, the curved line becomes the path of orbit as well as the path of spin with the velocity of orbit being the same as the velocity of spin (see *The Quantum Dimension*).

The forced curvature of the rotated electron bond into an orbital spin-path stretches the bond, generating tension. This stretching into tension has an identifiable tension constant. That tension constant relates the light frequency associated with the tension to orbital distance just as the string tension constant relates sound frequency to the length a string which is stretched into tension.

A tension constant, even for the stretched string, is a measure of the counter force exhibited by a dimensional shift. When one stretches a string, the thickness of the string is exchanged for the increased length. As the string is stretched longer, it simultaneously gets thinner. The string's resistance to this dimensional shifting is the measure of the tension because it puts a counter force against the force of stretch. Tension is defined as forces in opposition to one another. The oppositional force of thinning to the force of stretch is a constant which increases tension by the amount of the stretch (see *Dawson's Tensor* in *The Quantum Dimension*).

This oppositional force of dimensional shifting which causes tension can be intuitively grasped in the familiar object of a stretched string. However, it is also a known force governing the "1+1 dimensional kink" of what may be an unfamiliar four-dimensional quantum geometry (see *The Quantum Dimension*, chapter 1). Any Euclidean line intersected from an outside quantum-dimensional point must be "kinked" into curvature to retain the integrity of the quantum. A straight line has a one dimensional definition, but a curved line must be graphed upon a plane and, therefore, has a two dimensional definition. The "kinked" line moves from a definition in one dimensional space to a definition in two dimensional space. There is a counter force of resistance to this "kinking" into two dimensional space.

The concept of the "1+1 dimensional kink" comes from soliton physics. This "kink" is not a construction from a single dimensional line onto a preexistent two dimensional plane. Rather, it is a forced projection into dimensionless space, into geometric "vacuum." It is a projection from the single-dimensional line which forces space between intersecting dimensions (a "1+1" dimension). The plane of the quantum-squared becomes a volume by the "kinking" of an Euclidean line into curvature from an intersecting quantum dimension. This volume is not three dimensional, but "kinked" two dimensional. It is actually four-dimensional within three dimensional space (see *The Quantum Dimension*). The orbital of the electron is the "kinked" plane of the electron's orbit (orbits are normally graphed on a two-dimensional plane).

It is the "kinking" of the plane of orbit which is supplying tension. A stretched string exchanges stretched length for string width with the exchange providing counter force against the force of stretch. This force-counter-force provides tension. This tension is a constant which when multiplied times stretch length provides the frequency of tension (see *Dawson's Tensor*). Frequency is the number of times per second the string will vibrate when plucked. The plucked string will generate a sound wave at the frequency, or, alternatively, a sound wave at this frequency will cause the stilled tensioned string to vibrate sympathetically. The frequency of vibration is actually a function of the tension constant and string stretch.

The electron orbital plane being “kinked” into volume also supplies tension. The orbital plane resists being “kinked” into volume and the force of this resistance against the quantum force “kinking” the path of the electron’s charged bond into curvature provides a tension. Again, tension is defined as a force resisted by a counter force which geometrically exists by the “kinking” into and the resistance of four-dimensional space by three dimensional space. “Kinking” supplies tension in exactly the same way that stretching a string supplies tension.

This difference between the stretched string tension constant and the “kinked” plane tension constant is that the quantum-dimensional tension constant can be known but the string tension constant can not be. The stretched string tension constant is a function of the thickness of the string and the material of its construction. The quantum-dimensional tension constant is a function of the fundamental quantum, “the alpha space.” The alpha space is itself a constant (see *The Quantum Dimension*) so the quantum-dimensional tension constant is universal.

The alpha space fundamental quantum must accommodate the smallest known measurable objects. Theoretically, it must be equal to the radius of the proton and 1/2 the shortest wavelength (radiation of 1240 MeV). The diameter of the proton and the shortest wave length are known to be of the same order of magnitude (empirically estimated by general physics to be 1.00 e-15 meters). These estimations are calculated by the quantum geometric orbital model to actually be 1.00432e-15 meters (see above). Thus, the calculated alpha space using the orbital model is shown to equal the empirical estimations. This calculation comes from the application of Dawson’s Tensor to the standing wave within the electron orbital.

There has been a consensus in quantum physics for nearly a hundred years that the electron orbital contains a standing wave (reference: Schrodinger’s eigenfunction). A “standing wave” is the wave generated by a vibrating string. It is a wave, the path of which, returns upon itself as with a vibrating string, making the wave “stand in place.”

It is mathematically graphed as the perfect square of the sine wave: “ $y^2 = \sin(x^2)$.”

Dawson’s Tensor is an advance in Newtonian mechanics which demonstrates that the frequency of a tensioned string is a function of a tension constant *times* string stretch. It is derived from a new tension model for string vibrational energy which can be equated to vibrational energy as determined by classical Newtonian acceleration for any vibrating string. The validity of the tension-energy model is proven by the fact that it derives all known characteristics of tensioned strings. The frequency of any tensioned string is shown by the model to always the same regardless of the amount of vibrational deflection. The energies of all vibrational states are shown to resolve to a potential energy based upon a common frequency as a function of the tension in the stilled string. The subdivisions of any tensioned string are shown to increase frequency by the factor of the subdivision. All are derived from the tension-energy model as equated with the Newtonian determination of the energy of vibration. (see *Dawson’s Tensor* p.p. 283-296 in *The Quantum Dimension*).

The tension in any stretched string is simply the square of the force required to stretch the string. The *tension constant*, however, is a function of all possible energies of vibration which all resolve to a common frequency of vibration. The tension constant is the following:

$$\text{tension constant} = k = \frac{f}{\sqrt{2}(x_{\text{stretch}})}$$

The tension constant equals frequency divided by the square root of “2” times stretch distance. Distance of stretch must be measured in the same units as the deflection distances used to calculate vibrational energies by the Newtonian acceleration formula with the common value of “frequency” establishing the time of acceleration. Frequency of sound is made proportional to string stretch by the tension constant, as any tuner of stringed musical instruments knows to be the case.

The Application of the *Tension Constant* to the Electron Orbital

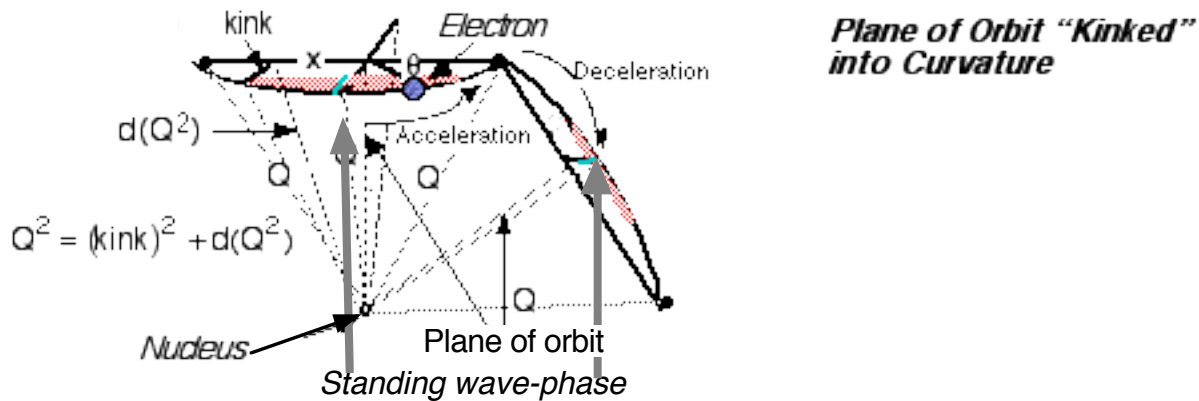
All quantum spaces are “stretched space” under tension. A quantum is, geometrically, two points separated by “some” space and this space of separation requires force to accomplish (see *The Quantum Dimension*). Since a force of opposition resides in both quantum points, the actual force of separation is the force squared which is equivalent to the definition of “tension” above.

The electron’s charge-bond— rotated relative to the proton’s charge-bond and kinked into curvature— is

placed under tension by the kinking. Tension, however, is not the equivalent of the tension constant. Tension is defined by stretch-force squared while the tension constant is defined by frequency of tension divided by stretch space.

We know from geometry that the quantum-squared is under tension. We also know that the the kinking of the electron's charge-bond into curvature provides an acceleration pattern.

The Three-Dimensional Standing Wave in Four-Dimensional Quantum Space



The "kinking" of the electron's charge-bond into curvature represents a tension-vector of the proton's quantum charge-bond which is also under tension. The quantum-squared orbital distance "Q²" is produced by the square of the force separating the quantum end points. It is, therefore, a distance "under tension" by definition. The "kinked curvature" of the electron's charge bond is a vector of this tension by the following formula:

$$F_Q^2 = F_{kink}^2 + F_{\sqrt{d(Q^2)}}^2; \quad (tension)_Q = (tension)_{kink} + (tension)_{\sqrt{d(Q^2)}}$$

$$d(Q^2) = Q^2 - (kink)^2$$

By the originator's of the "1+1 dimensional kink" concept, such "kinks" are susceptible to light radiation pressure¹. The "kink" concept came from soliton physics, a system of nonlinear mathematics which emerged from J.S. Russell's discovery of the soliton water wave in the early 19th century; a phenomenon which has never been adequately explained physically but which did spawn a system of nonlinear mathematics some of which has anticipated the recent discoveries from quantum dimensional geometry.

By the above illustration it can be seen that kink tension increases from the beginning of the curvature, reaches an apex at the mid point and descends again to "0" at the end point. An electron following the path of curvature can be accelerated by radiation pressure against kink tension, as per nonlinear soliton mathematics. Those electrons will then be decelerated as downside wave-pressure from the radiation is overcome by increasing kink tension.

Acceleration and deceleration by increases and decreases in additional tension is also the principle governing the vibrations of a deflected tensioned string. It is the principle governing the standing wave. Such strings can be provoked into vibration by sound waves of equivalent frequency. Similarly, electrons can be provoked into acceleration/deceleration by light waves of equivalent frequency. Potential acceleration/deceleration of the electron in the orbital will establish a standing wave of exact frequency equal to the light frequency.

There is one great difference between the potential standing wave in an electron orbital and that of a tensioned string, however. Both might be provoked by entanglement with an external wave of equivalent frequency, but both don't exhibit the same level of "coherence" between the external wave and the vibration. For the stilled string, coherence is not a problem as the maximum amplitude of any externally supplied sound wave will hit at the "0 point" (non vibrational state) of the string and accelerate it into motion at frequency. This is not the case for the electron's standing wave.

¹ For a discussion of radiation pressure against kinks see *Negative radiation pressure exerted on kinks*; Forgacs, Lukacs, and Romanczukiewicz: *Phys. Rev. D* 77:125012, 2008

For the electron to accelerate/decelerate, the peak of the external wave must “hit” at the apex of kink-tension located at the midpoint of the curvature. Since the electron is already in orbital motion, how is it possible that the electron will arrive at the kink-apex at exactly the same time as the wave peak hits? There must be a coherence between the electron’s position in its orbital and the externally supplied wave form in order to provoke acceleration/deceleration.

The answer has been given by experimental physics. The position of the electron is independent of its position along the curved orbital path. The curved charge-path can be reformulated to provide coherence with an impeding light wave. The electron’s position relative to kinked curvature can adjust electronically to an external light source. This orbital adjustment to an external light wave is proven by cesium generated lasers which forces cesium atoms in distant cesium clouds into wave-phase coherence with the laser wave. The electrons in the distant cloud adjust to the wave-phase being output by the laser originating cesium.

The tension constant for the kinked quantum orbital is an absolute constant whereas it changes for different tensioned strings. The tension constant for any stretched string is a function of the string’s material composition and the string’s width. Musical instruments take advantage of this variability to provide strings of differing pitch. For the quantum orbit, however, the tension constant is a function of the minimum distance which electrons and protons can close before the charge of the electron is forced to rotate relative to the charge of the proton producing the kinked orbital path. This minimum distance is the alpha space—the fundamental quantum distance which is equal to the radius of the proton and 1/2 the smallest wavelength. The alpha space is the shortest spatial distance into which these smallest measurable objects must fit.

The orbital tension constant can be determined because the frequency of the internal standing wave at an orbital radius which is equal to the alpha space is known to be “1 Hz.” Since Planck’s Constant is the quantum value of electron spin energy, it cannot be subdivided. That is, “frequency of spin” cannot be less than “1.” Above, Planck’s Constant has been shown to be the energy of electron spin. There must be at least one full “spin” for the “quanta” designated as Planck’s Constant to exist as a “quanta.” Therefore, frequency cannot be less than “1.” Since frequency is a function of orbital distance this frequency of “1” must occur at the shortest possible quantum orbital distance which is the alpha space.

$$f = \sqrt{2k(Q^2)}; \quad 1 = \sqrt{2k(\alpha^2)}; \quad \sqrt{2k} = \frac{1}{\alpha^2}$$

The tension constant formula, as applied to the orbital, multiplies two dimensional (squared) orbital radius. The string is tensioned by stretching it in one dimension. The orbital is tensioned by kinking the orbital plane. The string distance of stretch is one dimensional. The orbital distance of stretch (kink) is two dimensional. Further, the “stretch length” of the string is the full distance of the orbital radius. There is no part of any orbital radius which is not under tension as there is with a tensioned string.

The actual value of the alpha space can be calculated using the root orbital. The orbital distance for the root can be calculated because orbital speed plus the terminal velocity of the acceleration/deceleration internal standing wave equals the speed of light. Both orbital velocity and acceleration terminal velocities are functions of orbital distance:

$$f_r = \text{root frequency} = \frac{c}{\lambda_r} = 3.289253788e15 \text{ Hz.}; \quad Q_r = \text{root radius}$$

$$v = \text{electron velocity} = \sqrt{\frac{2eV_r(e)}{m}} = 2187495.85530702 \text{ m / sec.} = (0.0072967)c$$

$$(\text{terminal velocity}) = \frac{2Q_r\pi}{4} 2f_r = Q_r\pi f_r$$

$$Q_r\pi f_r + (0.0072967)c = c$$

$$Q_r\pi f_r = (0.9927032992)c = 297604962.144693 \text{ m / sec.}$$

$$Q_r = \frac{297604962.144693 \text{ m / sec.}}{\pi f_r} = 2.8800028132e - 8 \text{ meters}$$

These values of the root frequency and the calculated quantum distance, “Q_r,” can be used to determine the value of the alpha space using the tension constant:

$$3.289253788e15 \text{ Hz.} = \frac{1}{\alpha^2} (2.8800028132e-8 \text{ meters})^2$$

$$\alpha^2 = \frac{(2.8800028132e-8 \text{ meters})^2}{3.289253788e15 \text{ Hz.}} = 2.5216710958e-31 \text{ meters}$$

$$\alpha = 0.5.0216243346e-15$$

$$(\text{calculated proton diameter}) = 2\alpha = 1.0043248669e-15$$

$$(\text{SI measured estimate for proton diameter}) = 1.00e-15$$

The calculated distance for the proton’s diameter using the four-dimensional quantum model for the electron orbital is in complete agreement with the current SI estimate of the proton’s diameter.

The Orbital Distribution of Shell/Subshell Frequencies

A set of shell/subshell orbitals for electrons have been identified for the periodic table of elements. All electron orbitals are actually composed as a limited number of the seven total subshells which are contained within shells of differing energies. These seven subshells are designated the “s, p, d, f, g, h and i.” A greater number of the subshells are contained in shells of greater energy. The highest energy shell is the “7” which contains all seven subshells. The lowest energy shell is the “1” which contains only one subshell the “s.”

The existence of seven subshells within seven shells have been empirically proven to be true by one of the early quantum discoveries, a discovery which physic failed to understand completely. The shell/subshell structure was identified by the Rydberg distribution of hydrogen spectrography. Although not recognized at the time, Rydberg had discovered that the wavelengths of hydrogen’s spectral lines were distributed by a formula for the negation of subdivision for the quantum squared (see *The Quantum Dimension*, chapter 1). This quantum-squared distribution of hydrogen light frequencies were negations of a root frequency identified by the shortest 91.143 nanometer wavelength which appears in the hydrogen spectrograph.

Hydrogen’s ultraviolet frequencies were identified by quantum-squared negations of “1²” times the root frequency. Visible frequencies were identified as quantum-squared negations of the “(1/2)² subdivision” times root frequency and so forth:

$$(\text{ultraviolet frequencies}) = \left(1^2 - \frac{1}{n^2}\right) f_{\text{root}}; \quad 2 \leq n \leq 8; \quad f_{\text{root}} = \frac{c}{91.143 \text{ nm}}$$

$$(\text{visible frequencies}) = \left(\frac{1}{2^2} - \frac{1}{n^2}\right) f_{\text{root}}; \quad 3 \leq n \leq 8$$

$$(\text{high infrared frequencies}) = \left(\frac{1}{3^2} - \frac{1}{n^2}\right) f_{\text{root}}; \quad 4 \leq n \leq 8$$

If each one of these frequencies represent an electron orbital, it can be seen that the system mimics the shell/subshell structure of the periodic table of elements. Ultraviolet mimics the “7” shell with its “7” subshells. There are “7” negations of the root frequency. Visible frequencies mimics the “6” shell with its “6” subshells. There are “6” negations of the “(1/2)²” subdivision of the root frequency. High infrared mimics the “5” shell. There are “5” negations of the “(1/3)²” subdivision of the root frequency. The pattern continues until the “(1/7)²” subdivision of the root frequency with its “1” negation [(1/7)²-(1/8)²] which mimics the “1” shell with its “1” subshell.

The premise that Rydberg’s distribution of hydrogen frequencies identifies the shell/subshell structure of the atom makes perfect sense because hydrogen’s one electron is free to take any and all possible orbital position in outputting light radiation. The electrons of heavier elements cannot do this since they have electrons in fixed orbits.

However, quantum mechanics could never allow a coherence between Rydberg and the shell/subshell structure because it had no model for a standing wave within the orbital which could explain the output and absorption of light frequencies. Instead, Niels Bohr's mathematical error in proposing subdivisional quantum orbits (a quantum cannot be subdivided) between which electron's "fell" was accepted as the explanation of light output. The Rydberg formula supposedly identified these falls between subdivided quantum orbitals. As a consequence of inadequate geometry, physics took an irrational turn.

The quantum dimensional model and its internal standing wave provides the needed coherence between the Rydberg distribution and the shell/ subshell structure of the periodic table of elements.

Further, the quantum dimensional model identifies why the Rydberg formula distributes orbital energy into seven subshells contained within seven shells. By restricting the negation of subdivision distribution from the root orbital to a maximum of seven, the full range of possible orbital energies are covered which allow for internal standing waves which are coherent with available light frequencies. That is, impeded light waves can provide the acceleration/deceleration frequencies which orbital energy requires by Planck's Constant:

$$(orbital\ energy) = f_{orb.}(h) = \frac{f_{orb.}(\alpha^2)\pi^2}{2(2t_\psi)^2}; \quad h = \frac{\alpha^2\pi^2}{2(2t_\psi)^2} \quad \left(\begin{array}{l} \text{Planck's Constant is the} \\ \text{energy of electron spin.} \\ \text{Time provided by proton.} \end{array} \right)$$

$$f_{orb.} = \frac{Q^2}{\alpha^2}; \quad f_{orb.}(\alpha^2) = Q^2 \quad (\text{By orbital tension constant})$$

$$(orbital\ energy) = f_{orb.}(h) = \frac{Q^2\pi^2}{2(2t_\psi)^2} \quad \left(\begin{array}{l} \text{Orbital energy is calculated by the rate} \\ \text{of electron spin. Orbital rate of spin} \\ \text{is provided by orbital radius "Q."} \end{array} \right)$$

"Frequency" is a time fact. It is calculated as the number of acceleration/deceleration vibrations *per second*. The time required for any one vibration is the inverse of frequency:

$$t = 1/f$$

The vibration composing the internal standing wave must occur across the kinked wave-phase planes (see above illustration). There must be enough time across the wave-phase plane in order to accelerate and decelerate the electron at frequency. Such time is problematic because the electron is already in motion. The time of electron motion across the wave-phase plane (excluding acceleration/deceleration) is a constant. This constant is known as "the wave-phase time constant" (see *The Quantum Dimension* for its calculation).

The electron must reside upon the wave-phase planes for enough time such that it can be accelerated/decelerated at frequency. This is not the case for all frequencies. The electron crosses all wave-phase planes in the time constant which is equal to "4.136143005e-14 seconds." If the time required for a single vibrational is less than this, then such vibration can occur. If the time required for vibration is greater than this, then such vibrations cannot occur.

Take for example, the simplest frequency of "1" which occurs at the orbital radial distance of the alpha space. A frequency of "1" requires "one second" per vibration. That is, there must be one second of time across the wave-phase plane in order for vibration at this frequency to occur. However, there is only "4.136143005e-14 seconds" of time provided by the wave-phase time constant. There is not enough time for the electron to be accelerated/ decelerated at a frequency of "1."

Without standing-wave frequency supplied by orbital tension, the total of energy required by the orbit must be delivered by the attached proton. By the quantum dimensional formula for Planck's Constant, we can see that the attached proton, without the aid of orbital frequency and/or nuclear heat energy, can only supply energy for the lowest "1 frequency" orbital at the alpha space radius. The energy for all other orbital radii must be supplemented by tension or heat energy from the nucleus.

The Rydberg shell/subshell distribution identifies the orbital range in which supplemental tension is possible. It identifies the orbital distances which produce frequencies which exist as supplemental aids to orbital energy:

**Time of frequency for Rydberg's least energetic "1s" subshell
vs. the time constant**

$$\text{frequency of "1s" subshell} = \left(\frac{1}{7^2} - \frac{1}{8^2}\right) \frac{c}{\lambda_r} = \left(\frac{1}{7^2} - \frac{1}{8^2}\right) 3.289253788e15 = 15733038003147.6$$

$$\text{wavelength time} = t = \frac{1}{f} = \frac{1}{15733038003147.6} = 6.3560515127e-14 \text{ sec.}$$

$$\text{wave - phase time constant} = 2t_{\psi} = 4.136143005e-14 \text{ sec.}$$

"1/f" is 153.67% of "2t_ψ" and therefore requires more time

than is provided by the time constant.

**Time of frequency for Rydberg's next lowest "2p" subshell
vs. the time constant**

$$\text{frequency of "2p" subshell} = \left(\frac{1}{6^2} - \frac{1}{7^2}\right) \frac{c}{\lambda_r} = \left(\frac{1}{6^2} - \frac{1}{7^2}\right) 3.289253788e15 = 24240532451272.7$$

$$\text{wavelength time} = t = \frac{1}{f} = \frac{1}{24240532451272.7} = 4.1253219252e-14 \text{ sec.}$$

$$\text{wave - phase time constant} = 2t_{\psi} = 4.136143005e-14 \text{ sec.}$$

"1/f" is only 99.74% of "2t_ψ" and therefore of shorter duration

The Rydberg distribution precisely identifies the range of quantum defined orbitals for which standing wave tensions provide orbital-energy supporting frequencies. Orbitals below this range do not have functioning frequencies. Orbitals above this range would produce acceleration terminal velocities which would exceed the speed of light.

If this is true, why is the "threshold subshell" — the next-to-lowest "2p" (frequency time is 99.74% of time constant) — not presented as the lowest subshell? If all "s" subshells were taken out of the shell/subshell structure, an orbital structure of 6 shells incorporating 6 subshells would replace the current 7 subshells in 7 shells. In this case, the "p" subshell would determine the lower threshold of subshell energy. The lowest energy subshell would be the "1p" with a frequency of 99.74% of the wave-phase time constant. That is, all subshells would be within the range of functioning frequencies and the lowest frequency would be at the very threshold of functioning frequencies.

Why doesn't atomic structure provide a completely functioning six shell/subshell system rather than presenting the actual seven subshell structure with its dysfunctional low energy "1s" subshell? The answer is that the inclusion of the dysfunctional "1s" provides atomic structure with additional molecular bonding capacity.

A good example of this additional capacity for molecular bonding by inclusion of the "1s" is the energy gain through the oxidation of carbon (a component of flame). The quantum-dimensional reformation of the Schrodinger pattern of subshell electron in-fill (see *The Quantum Dimension*, chapt. 1) is proven by the chemical groupings of the periodic table of elements. Precise valence-subshell parameters are identified for the various chemical groupings by the quantum-geometric in-fill and by using the "1s" as a "potentially vacated subshell" (see chart below).

Carbon, atomic number "6," has its 6 electrons distributed by: 4 into the "2p;" 2 into the "2s;" with the lowest "1s" subshell vacated. When oxidized, carbon ionically bonds with one or two atoms of oxygen which "lose" two valence electrons from oxygen's "2s" valence subshells to become positive ions. Oxygen electrons are incorporated into the carbon atom which then becomes a negative ion. These electrons are incorporated in the following manner: the 2 valence electrons in carbon's "2s" subshell drop into the vacated "1s;" 2 oxygen electrons then replace the carbon "2s" electrons making carbon a negative ion which completes the molecular bond. The energy exchanged by bonding is the following: oxygen gives up two electrons of an energy of 0.1653 eV each; carbon loses energy from dropping two electrons into the "1s" of 0.0651 eV each; carbon then gains "0.1653 eV" from the oxygen electrons.

Total Energy Gain by Oxidizing Carbon =2(0.1653)eV-2(0.0651)eV=+0.2005 eV (as heat)

