The elusive neutrinos---a paradigm for these leptons among leptons and quarks---

Fred E. Howard, Jr., Retired, US Air Force Armament Laboratory, Eglin AF Base, FL 32542
306 Gardner Dr. NE, Ft. Walton Beach, FL 32548-5106 USA, E-mail: fredhoward1@cox.net

Running header: The elusive neutrinos---a paradigm PACS: 14.60 14.65 14.90 12.60

Abstract: The new structural paradigm of the quarks and leptonic electron is necessarily extended to the neutrinos under the recently published mass and charge power law for structures of the massive subnuclear particles. The other lepton and quark structural background is summarized around the neutrino paradigm for general correlation with the prior Particle Data Group's empirical quantum mechanic tables of massive particle data from which the power law was derived. A structural basis emerges for resolving the neutrinos' multiple uncertainties.

[**Overview**: A new paradigm of the quarks and the electron that makes them functional structures is extended to the neutrinos as leptons among the other lepton and quark (LQ) structures that contribute to the ladder of the massive natural particles from just two interacting subparticles to the nuclei of the atoms which constitute most of the bodies of the known cosmos. The originally published mass and charge power law of substructures for the supposedly elementary particles, that provides the quantitative basis for these LQ structures, originated from the Particle Data Group (PDG) data tables on the massive particles, including the neutrinos. From their beginning, both that law and the new structural paradigm based on it depend on the PDG neutrino data and continue to fit it and clarify other quantum mechanics (QM) derived over the last century. Here the QM neutrino mysteries exhibit a structural base.]

1. Introductory Background on Neutrinos

Even more uncertain in mass [1, 2. 3, 4, 5] and other quantum mechanic (QM) characteristics than the quarks, the neutrinos, among leptons grouped with quarks (LQ), take part in nearly every change of the fusion or decay status of particles in the Particle Data Group's internationally accredited Summary

Tables of particles and unaccredited (but notable) PDG Data Lists and evaluated references.[5] The original QM concept or paradigm of a neutrino as a largely undetectable partner in such reactions was devised in the past mid-century to account for some of the empirical disappearance of mass in various quantities without the release of radiation and equivalent kinetic energy of particles observed in QM experiments.[5] However, a very large accumulation of such data has not yet permitted PDG assignment of any more definite neutrino properties than being even more isolated than electrons, lack of net charge reactivity, "oscillations" between possible mass ranges, and uncertain upper mass limits for some deductively distinguishable prior neutrinos. (These were once named for other participants, such as electron, muon, or tau neutrinos, in some general classes of particle reactions, and these titles are still conveniently useful as names for certain limited mass ranges of deduced neutrinos.)

In the paradigm survey [3] of the quarks in the hadron nuclear particles it was necessary to show that the QM practice of shortcuts, in accounting only for net conserved charge in accredited PDG baryon decay tables, completely confuses the nature and the amount of neutrino participation in baryon decays. The paradigm's resolution of those QM confusions points to an increasing importance of the nature and structure of neutrinos. A similar result occurred in the recently published paper on the mass/charge power law for LQ particles [1], in which a generalized structure of neutrinos consistent with the 2004 PDG accredited data on upper limits of neutrino mass [5] accounted for the mysterious "oscillation" of empirical neutrino mass deductions and for the confusing discrepancies noted by the PDG between local solar or reactor data on neutrinos and astrophysical data from distant stars on smaller microneutrinos. (These discrepancies led to omission of such neutrino lists in the PDG 2006 and later Summary Tables [5], but did not eliminate listing of searches for both smaller and yet more massive neutrinos, which still continue.) Here the paradigm of neutrino structure in its place in the LQ particles accounts for these very widely spread empirical data more completely. [1, 2, 3]

2. Prior paradigm summary (LQ-hadron structures)

The paradigm on quark/antiquark and electron/positron structure extended here to neutrinos is based on spheres (Fig. 1) of synchronized concentric orbits of point-to-point coaxial pairs of energeticly spun conic microquanta with spin-charged uniform mass. Other static spin sites for quanta are at the surface centroids of spheric octants formed by 3 orthogonal orbits on the primary spheric axes. In quarks and larger leptons, there are also 3 orbits whose axes tilt in the plane of a summation axis SO through the centroid of a primary octant around which all the orbits circulate (in balance) in the sense of the majority (if one exists) of the senses of the quantal conic bases at the spheric surface. SO is at the QM quantization angle arccos $1/\sqrt{3}$ from each primary axis. The tilted orbits avoid the octant centroids by at least a 15 degree interference limit. The conic spinning is at one uniform angular rate, and the orbits are at one lower rate. Clockwise base spin at the spheric surface correlates with inward moving screws and conserved positive charge on mass quanta. (The spinning quantal cones represent energetic viscous drivers of turbulent conic vortices with wave interactions quantitatively scaled from lab data for quantum-to-quantum vortical forces of the strong, weak, and electric types in the electron paper.[4] Mutual repellance between like-gyre spins reverses empiricly to attraction at very short range; conserved charge force is exhibited only outward from conic base turbulence, not within a cone's own sphere, where stronger gyre forces act. (This eliminates century-old confusions over destructive self-repulsions within spheric charged particles.) The conic quantal structure paradigm provides a physical framework for location and direction of the separately developed force vectors causally summed between quanta.)

Forcefully stabilized coaxial pairs of spinning conic quanta in the lightest (up) quark sphere occupy the 3 SO-balanced, inclined orbits and the only balanced SO-pair of the 8 spin sites (whereas the electron's three negatively charged pairs of quanta use the 3 orthogonal orbits in its perfectly SO-balanced and stable sphere.) Quarks (and their mirror antiquarks) are always fractionally charged at 1/3 or 2/3 levels of net charge from mixed charged and neutral pairs of quanta (compared to the unique electron/positron's unitary total charge standard with no neutral pairs.) The heaviest (top) quark occupies all the available orbits and spin sites with many allowed (non-interfering) multiple occupances. For each type of quark there are 2 precisely quantized masses toward the upper and lower limits of PDG mass uncertainty. Under a structurally caused exponential extension of the mass/charge power law, systematicly stepped distributions of the dual masses (and isomers) create the baryon series.

The quanta in the tilted orbit around the summation axis S0 in the S Equator (S Eq.) plane can in all quarks be attracted outward from the sphere in an ellipse-like or circular orbit up to twice the sphere radius for synchronously linking three quarks in baryon orthogonal corners (or sets of two's in mesons.) This synced orbital expansion (only in hadrons) removes critical interferences between orbits of quarks (which thus cannot exist outside of hadrons.) If fractured by collisions or decays, baryonic quark triplets (or multiple triplets in large nuclei) yield dual (and multiply dual) quark-type residues which can link together as unstable mesons and scatter among other residues, including randomly caused neutrinos.

Due to its predominance of the lighter up quark (2 out of its 3 quarks), the proton (and antiproton with mirror-image reversal of charge spins and orbits) is the only possible balanced and stable single baryon particle configuration. It can stabilize the slightly unbalanced and marginally unstable neutron with strong structural linkages in a pair of baryons (deuteron) or a pair of pairs of these baryons (alpha particle or ^{4}He nucleus.) These stable attractive groups enable assembly of progressively heavier atomic nuclei, even odd ones (unstable ^{3}H or ^{5}Li, stable ^{3}He or ^{7}Li.)

Thus the mass/charge power law with conserved charged (or charge-neutralized) quantal pairs quantifies the generation by spinning quanta of the interaction-energy mass of nominally elementary massive particles, and of the other massive particles by exponential law extensions.[1, 2, 3, 4] (Due to exponentially stronger attractions with numbers of vortical quanta in an "elementary" particle, causally interactive diameters at which all quantal forces balance may be smaller in some more massive particles; balance convergence depends on many factors.) Collisions may separate two conserved coaxial pairs of quanta, and residues of interaction mass energy may occur, usually as structural kinetic or radiation energy or excitations of isomeric quantal pairs in the orbits or spin sites of quarks in baryon particles.

3. The mass/charge power law & neutrinos amid LQ

The most general form of the mass/charge power law, from the first of the previously published papers [1] which established the basis for this paradigm, defines the broad mass interaction energy structure of neutrinos amid leptons and quarks:

$$m_p = \Sigma m_c N_c^{\,y} F \qquad (1)$$

where $F = (n_\pm/n) + (n_0/an)$, m_p is the mass of the particle in electron-Volts (eV) of energy, m_c is the mass energy of components of the particle (being summed as $\Sigma m_c = N_c m_u$ for neutrinos, other leptons, and quarks), N_c is the number of components (always even and existing only in pairs), n is the number of coaxial pairs of components, $n_\pm$ is the number of charged pairs (++ or − −), n_0 is the number of neutral pairs (+−), a is a coefficient for reduction of weighted effect of neutral pairs in mass [nominally 3 in the usual (U) range of leptons and quarks], y is the power law exponent [5 in the U range of LQ, but <limit 5 as an exponential law in extended ranges (also y' =6 when U terms are fully collected)], and m_u is the uniform mass 10.9525 (rounded) eV of single microquantal charged components of LQ particles in any range, whether U, extreme (E), or medium range (M). [Hadron range (H) also appears as a higher mass, extended exponential law range with variations of the value of y.] The most general form of the mass/charge law converts to other convenient formats in the references [1-4] by use of coefficients and exponents for particular ranges and collection of terms, as for LQ particles in the U range:

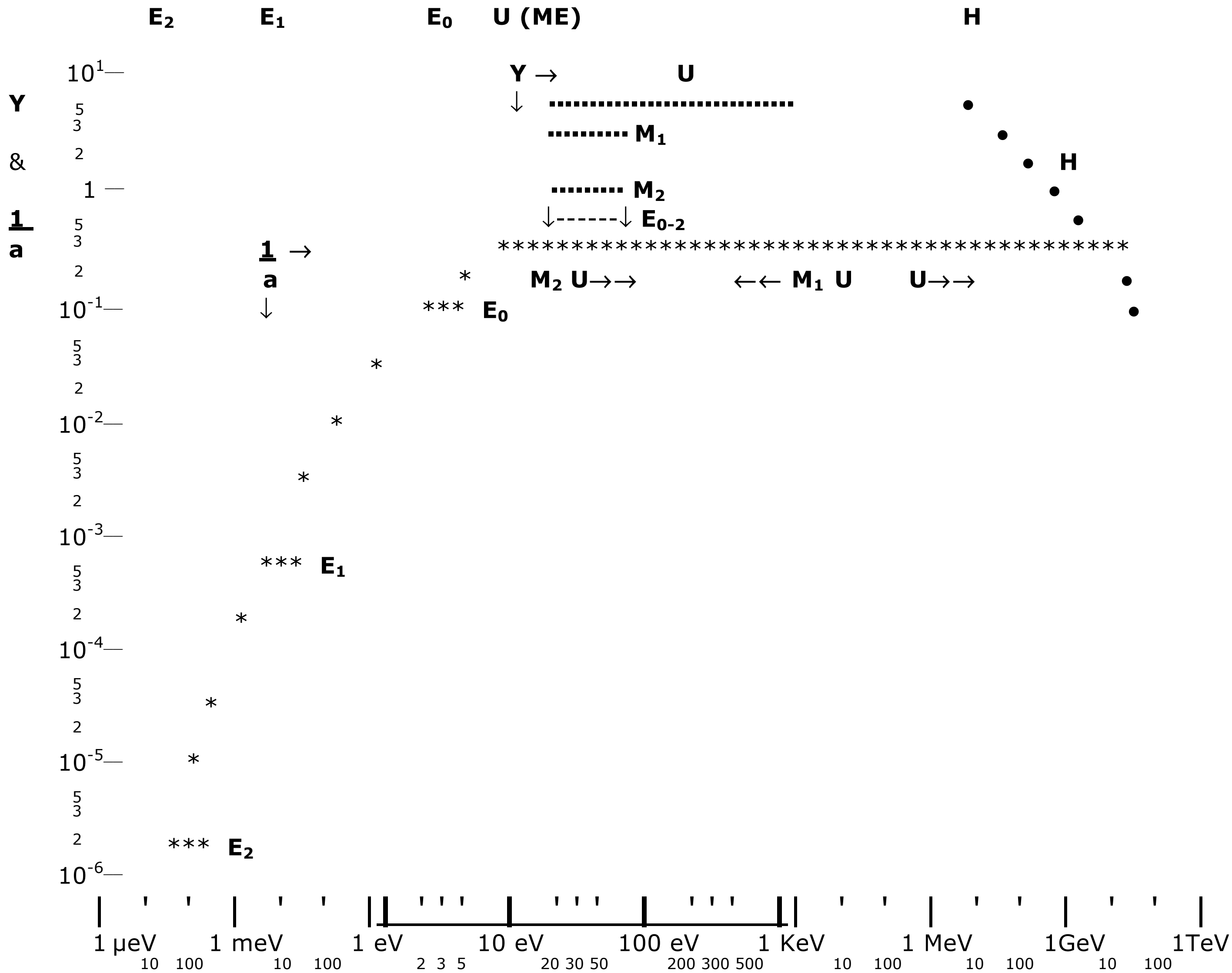
$$m_p = \Sigma m_c N_c^{\,y} F = N_c m_u N_c^{\,y} F = m_u N_c^{\,6} F = 2\left(m_u/3\right) N_c^{\,6}\left(0.5 + n_\pm/n\right), \qquad \text{etc.} \qquad (2)$$

Table 1. Exponents, Coefficients, & Factors for All Ranges of Mass/Charge Law
(Variation with masses of resultant particle structures)

MicroQuantal Component Pairs							
	Non-sphere---------------|		Spheres only--|				
	Spins only--------------------Spin sites--|			Mixed spin sites & orbits-----------------|		
					(Neutrinos/Electron **orbit only)**	(Quarks link orbits)	
	Symmetric+−	Non-Sym'trc	Coaxial only---|				
Particle Mass Range	E_2	E_1	E_0	M_2	M_1	U	H
	Neutrinos··|						
						Ch'rgd Leptons Quarks	
							Hadrons
Units	μeV	meV	eV	eV	KeV	100 eV-GeV	MeV-GeV
Mass	41.2-124	10-30	2.4-7.3	117-263	9.46	"	"
a	3^{12}	3^{7}	3^{2}	3^{1}---|			3^{0}
	531,441	2187	9	3 ---|			1
F	0.00000188	0.000457	0.1111...	0 3333...---------------|		Variable	1
	(No charged pairs---|					$(n_\pm/n)+(n_0/an)$	(NA)
y	5 −5 =0 --------------------------------|			5 −4 =1	5 −2 =3	5 −0 =5	5 −(<5)
	(+1 from $N_c m_u$)---|						Variable with Σm_c
$n_\pm$	0 pairs--|					Variable----|	NA quarks only
n_0	1, 2, 3 pairs----------------------------|			2, 3	3	Variable----|	NA "
				1 not in both conditions above	2 pair has only 1 balanced spin/orbit mix, in only 1 M range, not 2		
n	1, 2, 3 pairs----------------------------|			2, 3 "	3 "	Variable----|	NA "
						Neutrinos 1-6 orbits (at PDG mass limits)	

Overviewing the table, Figure 2 graphs y and 1/a against mass. As in prior paradigm analysis, y is shown versus Σm_c, the sum of masses of components of each resulting particle. The variation of 1/a is shown versus m_p, the mass of the resulting particles. In mid graph y vanishes with low mass, and the masses of 1 to 3 pairs of components do not change in the E ranges below those in the U and M ranges, but resultant particle masses and 1/a vary across the entire graph.

Fig. 2 **Significant Non-Dimensional Neutrino/LQ-to-Hadron Variables**



M A S S   I N T E R A C T I O N   E N E R G Y

1/a VS m_p***

y VS Σm_c ....

-------   ●●●●●●●●●●●●●

Component μquanta Pairs
Non-sphere-----------------| Single Spheres only, except hadrons---------------------------|
Spins only-------------------Spin sites--| Mixed spin sites and orbits (quarks link)---------|
Neutrinos in U range orbit only, limits---|
Symmetric+− Non-Sym'trc Coaxial only--|
Some tumble| Tumble-------------------| M ranges tumble----| All may tumble-------------|

In mid-graph y = ↓------↓ $\mathbf{E_{0-2}}$ = 0 for all E ranges vs Σ for 1 to 3 pairs of quanta, but the arrows indicate that 0 cannot be shown on a logarithmic scale. Note that the middle 3 sections of the mass abscissa scale are expanded to single powers of ten, but the 2 first and the 3 last sections are condensed to 10^3 steps. Neutrinos are involved from tens of μeV mass to hundreds of MeV, to which they are recently empiricly limited. In the U range up to the prior PDG upper mass limit of the tau neutrino, neutrinos require little, if any, occupance of spin sites. --- Neutrinos especially, and other LQ particles that have non-orbiting quantal pairs with exposed spinning bases, must also be in a rapid rotation, called tumbling here, that does not activate mutual power law interaction energy, but is fast enough to average exterior base charge effects at particle scale distance, unless otherwise stabilized. --- Note that in collisions and decays quanta tend to sort themselves interactively into balanced structural groups that can exist at least briefly after the moment of impact. Structures of more marginal balance around a spherical summation axis and its equatorial plane (or non-spheric equivalents) tend to be more vulnerable to less direct impacts from smaller, lower energy, and predictably more numerous other particles (usually neutral), and these structures have shorter mean lives. Due to 3 S Eq. orbit pair sites and A'B'C' orbits there are more orbit sites than spin sites in spheres, and U range energetic quantal pairs usually tend to fill orbital sites before spin sites (if balanced), but a few orbital interferences (especially in the linked quarks of baryons/mesons) tend to work against that trend. However, spin sites may be dually occupied by two coaxial pairs, if balanced. S0 axis pair spins are on the balance axis and, like S Eq. orbits, they are automaticly balanced. Quanta resist mutual intrusion at 15° base diameter on the sphere, but are sketched oversize herein for clarity. In lower energy cases less interactive spin sites may be more isomericly suitable than orbits, or non-spheric spin structures may be even less massively interactive and yet more suitable. In general, if there are very few orbits and they do not cross each other at high angles, making and breaking close interaction approaches to each other at high rates on every cycle, then quanta do not generate the U (usual) range of high interaction energy as readily, and the exponent and coefficient effects are reduced accordingly. But if crossing or make-&-break orbits are present, spin sites are not of significantly less interaction with them for mass generation [except as small isomeric variants beyond the power law basic definition of the smallest mass in each group of isomers in a baryon mass series. This takes effect as a small offset curve for slightly offset values of y (not shown) under the law for the additional members of each isomer group within PDG particle mass series in the H range as resultant baryon or meson particles from quark components wherein the orbit/spin options of isomers occur.(3) Also, in very large quarks in large hadrons (H) the large numbers of gyres tend to shield those in one quark from those in another, so that the mass interaction energy exponent between quarks falls off with greater Σm_c. The nuclear range (N) with negative fractional y is omitted.]

With the constraints from the table, the figure, the power law, and the previous quark, baryon/meson, and electron structures under the paradigm [1, 2, 3, 4], the prior structural paradigm extends to the various classes of neutrinos that will meet the prior empirical requirements of the PDG [5] and astrophysics [1] as a single quantized continuity of self-consistent structures which "oscillate" in mass [5] due to collisions [1] and tend to accumulate in abundance over cosmic time toward a smaller mass range of generally increasing stability [2] and smallest structurally presented cross section for collisions.[3] The paradigm is suitable for adjustment should other necessities arise in empirical data.

4. Neutrino structural variation range

In the paradigm table, assemblies of conic microquanta systematicly vary from the complexity of baryons (H) with many quanta in several quarks (usually in atomic nuclei) on the right to the 1 to 3 pairs of neutrino quanta on the left. This correlates with the power law measure (1, 2) of each LQ particle's mass or stored energy of interactions between the spinnings of the quanta, which is modeled [3, 4] in the paradigm by viscous and vibratory couplings of turbulent vortices around cones. These energies begin in the lab as eddies in the gyre base turbulence [4] which give the quantum its rest mass. They multiply while circulating through interferences of secondary gyres between multiple cones, are reduced by suppression under laminar acceleration in the circulation intakes (fed by general spin radiation pressure) at each conic point and along the conic sides, and are continuously regenerated in each base turbulence. When two gyres of the conic paradigm occur in a sphere as a coaxial pair with the same sense of base spin, they are pulled together by the point intakes, etc.,[4] but their flows conflict, generating many additional eddies which are energeticly disturbed by vibrations that penetrate the whole assembly from each base turbulence. This compounds the disturbed eddy vibrations exponentially to correlate with the independent mass power law. However, when two conic neutrino circulations have opposite senses of spin (as base charge) and are coaxially oriented in opposite directions, their circulations do not conflict grossly where they meet, generating only 1/3 as much mass interaction energy, and this ratio constrains such a pair's interactions through an entire particle assembly, in a critical correspondence to the PDG neutrino and other LQ data under the law. [1, 2, 5] Where conic circulations have other non-coaxial and non-spherical relative positions, both *y* and *a* are affected in proportion to the opportunities for eddy generation as mass and to the extent to which the circulation intakes may immediately consume each others turbulence eddies or to which the base turbulence may be suppressed, as in base to base confluence of opposite spins in certain neutrinos below (a perfectly balanced and ultimately simple and stable configuration.) These situations can lead to such extremely low mass accumulations of interaction energy stores as correlate directly with the micro-electron-Volt energy masses demanded in astrophysical estimates [1], where over long time frames neutrino forerunners may have vast numbers of collisions which have a tendency to disrupt all larger collections of conic pairs at higher mass in favor of small sets, small masses, and tight binding. In such a paradigm a neutrino may be any net neutral structure of quanta (except the defined forms of baryons and mesons made of linked quark spheres.)

Neutrino spheric structures just below the prior PDG upper limits of masses [5] for electron, muon, and tauon neutrinos have been partially described [1, 2, 3] in prior paradigm discussions. All these PDG mass limits are really statements of profound uncertainty about a correct mass for each of three presumed specific types of neutrinos. The PDG also points out [5] that there is further uncertainty about whether the various neutrinos are degenerate (interchangeable.) In the paradigm there are numbers of alternative specific and systematicly quantized mass values in conveniently named family mass ranges for the mu and tau neutrinos (nu mu, ν_μ , and nu tau, ν_τ), as distinguished from the nu_e (ν_e) electron neutrino, and the names are not necessarily for more than the family ranges of multiple neutrino masses (often of decreasing stability with increasing mass) as shown in the original power law papers [1, 2] and in Tables 2 and 3 below.

In baryon decays [3], a definite necessity was found for existence (as decay inputs) of undetected neutral particles with specific, quantally defined masses much larger than the PDG nu tau mass limit.[5] This definition is equivalent to the early evidence for a nu mu and a nu tau. Thus, a family of empirical supra-tau neutrinos, nu_{st}, just above and similar to nu tau (Table 4), has been demonstrated (discovered.) There is necessarily an indefinite mass upper limit until all hadron decays have been analyzed with the methods of conserved microquantal mass and charge accountability [3] currently applied only to major (30 to 100%) baryon decay channels. Members of the family are permitted with specific microquantal structure at quantized mass sites on the higher mass 0 (or 2/3) charge curves [2, Fig. 2] for the *F* variable mass factor (noted above) vs particle mass. {The mass range of this family can extend to the level of hadrons of the bottom or top quarks (4 to 170 Gev) in cosmic ray or laboratory collisions, though the largest necessary, quantally defined, neutrinos firmly demonstrated to date are about 100 MeV, Table 4 below herein (and Supporting Tables [3, Appendix E Decay Tables]. This discovery of such decays shows a major neutrino share in dark matter/energy, not the small share listed in PDG tables [5].)}

Up to this point the discussion of neutrinos has mainly enlarged on the referenced papers on the structural paradigm of conic vortices under a mass/charge power law. Further aspects of neutrinos must include necessary consequences of the paradigm particle structure and interactions of such particles.

5. Prototypical neutrino structures

Matching the upper mass limits of two earlier PDG accredited neutrinos, nu mu and nu tau [5], structures of quanta in Figure 3, at the synchronized start and recurring positions of the orbiting quanta in each cycle of their orbits [1, 2], typify neutrino families in the U (usual) spheric range of LQ particles, which contains the electron, the other accredited charged leptons (the muon and tauon), and the quarks. The largest nu mu is shown in its entire sphere depth (with the quanta on the rear side in dashed lines) since its family is very simple, with only 3 (or fewer) coaxial pairs of quanta, typically neutral pairs. For a family with 3 to 6 coaxial pairs, often with oppositely charged pairs, the figure of the largest nu tau shows only the 6 quanta in its front hemisphere for clarity. In good balance, the nu mu has all its quanta on the orthogonal ABC orbits. Its summations fall on the S0 axis, and it balances around that axis and the S Equator (S Eq.). The typical nu tau, with twice as many pairs, balances and sums similarly with a pair in each of the same synchronized start sites on the orthogonal orbits, as well as a pair on start sites for each of the 3 tilted orbits, including charged pairs on the orbits named for charges and a neutral pair in the #1 pair site (of 3) on the S Eq. orbit.

There are in the paradigm's nu mu family (PDG 2004, <0.19 MeV [5]) 4 possible structures under the charge/mass power law in the U range (Tables 2, 3). There are also 4 in the M ranges (Fig. 4) overlapping the low mass end of U (Fig. 2) with a change of structural criteria, and 2 in the E_0 range (Fig. 5) (above the PDG 2004 electron neutrino limit of <3 eV), for a nominal extended nu mu family total of 10, only 1 of which would have any charged pairs (a case of 2 out of 2 pairs in the U range.) The typical full sets of neutral pairs of the nu mu family are unvaried under the criteria above for all the neutrinos of smaller mass in the E ranges. (Other M range neutrinos [1] may also exist in the paradigm under modified criteria.)

Figure 3 shows the power law's highest quantized mass opportunity for the nu mu family at 0.1703 MeV [1], with 6 quanta in 3 neutral pairs and no charged pairs. This is just 1/3 of the electron mass of 0.511 Mev with its 3 charged pairs in 3D symmetry at net unit charge, and the structure of the two particles is otherwise the same. {The nearly accurate 2004 PDG upper limit of <0.19 MeV compared to 0.1703 (versus 0.511 MeV for 3 charged pairs) was the original clue [1] to the 1/3 mass ratio for all neutral versus all charged pairs of 1/6 charged mass quanta in these two uniquely paradigmatic particles that led to generalized accuracy over its full range for the mass/charge power law and to this paradigm.}

Under the criteria noted above, there are in the nu tau family (Table 2) of the paradigm 9 structural possibilities [2] with a systematic progression of masses under the power law from 3 to 6 pairs of microquanta. Only the 3 cases with 4, 5, and 6 neutral pairs are completely uncharged. The other 6, including the case near the PDG nu tau mass limit, have the typical format for this range of an even number of oppositely charged pairs that neutralize each other (and one set of 4 pairs has all 4 pairs charged. A fully charged set of 6 pairs in the ideal progression would be well beyond the PDG 2004 mass limit of <18.2 MeV.[5]) Figure 3 shows the quantized power law option just below that limit at 18.169 MeV. It has 6 coaxial pairs, of which 1 is charged ++, 1 is − −, and 4 pairs are neutral +−.

The nu mu family is further distinguished from the nu tau family by two cases of combined occupance of the dual S0 and S0' spin sites (necessary for balance) in the M_2 and E_0 ranges. This might occur in isomeric variations of structure of light weights, but is not usually present except in the larger quarks of the U range, where they must be synchronized with any quanta in the ++ and − − orbits by spinning the effective cylinders which contain these dual pairs at twice the uniform orbital angular rate of the pairs. In these cases of very low mass the dual neutral pairs have their charged quanta matched side by side with opposite charges and spins, reducing each other's generation of turbulent eddies in interaction mass energy by confluence of the base and side circulations between them in compensation for their closer interaction than in separated coaxial pairs.

Since all neutrinos, with their net neutral charge, have no majority of rotational sense in their quanta, neutrinos would follow the positive majority in the atomic nuclei of the present matter regime with clockwise (CW) rotations on the S0 axis for the orbits of standard matter neutrinos in the figures here. In the structure paradigm, it actually makes little difference which rotation sense is ascribed to matter or antimatter in neutrinos, since both matter forms have the same balanced and compatible structure that would only be viewed from opposite viewpoints along the S0 axis. Each neutrino is effectively its own antiparticle and could be shown either way.

Tables 2, 3, and 4 summarize the orbit and spin sites of spheric neutrinos.

Table 2, SPHERIC NEUTRINO SERIES (Series Gyre Pair Orbits/Sites & 180°opposites.)

U Series (1) (Orbits Only in Neutrinos)

Name Mu Neutrino Family Tau Neutrino Family

Type	Typical			**PDG Limit**	Typical								**PDG Limit**
Pairs	**1+-**	**2+-**	**1++ 1- -**	**3+-**	**1++ 1- - 1+-**	**4+-**	**1++ 1- - 2+-**	**2++ 2- -**	**5+-**	**1++ 1- - 3+-**	**2++ 2- - 1+-**	**6+-**	**1++ 1- - 4+-**
	0/1	**0/2**	**2/2**	**0/3**	**2./3**	**0/4**	**2/4**	**4/4**	**0/5**	**2/5**	**4/5**	**0/6**	**2/6**
Orbits													
A				**+-**		**+-**			**+-**	**+-**	**++**	**+-**	**+-**
B				**+-**		**+-**			**+-**	**+-**	**- -**	**+-**	**+-**
C				**+-**		**+-**			**+-**	**+-**	**+-**	**+-**	**+-**
A'			**(A' always conflicts with S Eq. #1 & #2 orbits on sphere surface.)**										
B'													
C'													
++		**+-**	**++**				**++**	**++**	**+-**	**++**	**++**	**+-**	**++**
- -		**+-**	**- -**				**- -**	**- -**	**+-**	**- -**	**- -**	**+-**	**- -**
Octant Centroid Spin Axis Sites.('Sites make 2 tangent cylinders around axis with normal sites)													
S0													
S0'													
S1													
S1'													
S2													
S2'													
S3													
S3'													
S Eq Pair Orbits in CW Rotation in S Eq. plane on sphere surface (Self-balanced like S0 & S0/S0')													
7.5°#1.	**+-**				**++**	**+-**	**+-**	**++**				**+-**	**+-**
67.5°#2					**- -**		**+-**	**- -**					
127.5°#3					**+-**	**(#3 always conflicts with ++ & C' orbits on sphere surface, not in quarks &2nd shells.)**							
Mass				0.1703 MeV									MeV 18.17
[PDG Mass Limits of 2004 and prior. (1, 5)]				<0.19 MeV									<MeV 18.2
All Balanced except 4/5 (4 charged pairs of 5 pairs)											**Poor Bal** (Short Life.)		

[See Table 3 (Cont.) balance notes & Ref. 1 series definitions.]
(Mass calculations per Equ. 2.)

Table 3, <u>SPHERIC NEUTRINO SERIES</u> (Gyre Pair Orbits/Sites & 180°opposites.)

<u>Series</u> **<u>E_0</u>** (Spins Only) **<u>M_2</u>**(Spins/Orbits Mix)**<u>M_1</u>** (Spins & Orbits Mixed)

Name e Neutrino Mu Neutrino Family (cont.)

Type	**PDG**	Typical								
	Limit			**NA**			**NA**			
Pairs	**1+-**	**2+-**	**3+-**	**1+-**	**2+-**	**3+-**	**1+-**	**2+-**	**3+-**	
	0/1	**0/2**	**0/3**	**0/1**	**0/2**	**0/3**	**0/1**	**0/2**	**0/3**	
Orbits										
A										**I**
B										**S**
C										**O**
A'										**M**
B'										**E**
C'										**R**
++									**+-**	
- -									**+-**	
Octant Centroid Spin Axis Sites.('Sites make 2 tangent cylinders around axis with normal sites)										
S0	**+-**	**+-**		**N**	**+-**	**+-**	**N**	**NO**	**+-**	**+-**
S0'		**-+**		**O**		**-+**	**O**	**O**		
S1			**+-**					**T**		
S1'								**H**		
S2			**+-**	**M**			**M**	**E**		
S2'				**I**			**I**	**R**		
S3			**+-**	**X**			**X**	**BAL.**		
S3'								**MIX**		
S Eq Orbits in CW Rotation in S Eq. plane ON SURFACE OF SPHERE (Self-balanced like S0 & S0/S0')										
7.5°#1					**+-**	**+-**				**+-**
67.5°#2										**+-**
127.5°#3										

Mass **2.4** eV
[PDG Mass Limit of 2004 and prior. (1, 5)]
<3 eV

All Balanced (For good balance, ++ with − −, or triple orbits like ABC and S1, S2, S3, require both or all three of similar set filled by either all neutral or all charged masses. Quanta pairs on summation axis S0 and its equatorial plane S Eq. are always auto-balanced with ref to that axis.--- Only the expanded linking S Eq. orbits of quarks can avoid the sync conflict of S Eq. #3 with **++** orbit.) [See sync start sites and angle ref plane above.(3) Sync start sites for orbits A'B'C' are 45° in lag from ABC on their intersections.] (Mass calculations per Equ. 1.)

Table 4, SPHERIC NEUTRINO SERIES (Gyre Pair Orbits/Sites & 180°opposites.)

Series U (Orbits Only in Neutrinos until orbits full if balanced) For Comparison

Name Supra-Tau Neutrino Family Charged Leptons

Type Typical electron muon tauon

									electron		muon	tauon
Pairs	**8+-**	**3++**	**4++**	**1++**	**11+-**	**4++**	**6++**	**7++**	**3- -**		**3- -**	**6- -**
		3- -	**4- -**	**1- -**		**4- -**	**6- -**	**7- -**				**3++**
		2+-		**8+-**		**6+-**	**4+-**	**4+-**			**5+-**	**3+-**
	0/8	**6/8**	**8/8**	**2/10**	**0/11**	**8/14**	**12/16**	**14/18**	**3/3**		**3/8**	**9/12**
Orbits										Isomers	High	Low
A	**+-**	**++**	**++**	**+-**	**+-**	**++**	**++**	**++**	**- -**	**I**	**- -**	**- -**
B	**+-**	**++**	**++**	**+-**	**+-**	**++**	**++**	**++**	**- -**	**S**	**- -**	**- -**
C	**+-**	**++**	**++**	**+-**	**+-**	**++**	**++**	**++**	**- -**	**O**	**- -**	**- -**
A'	**+-**	**- -**	**- -**	**+-**	**+-**	**- -**	**- -**	**- -**		**M**	**+-**	**++**
B'	**+-**	**- -**	**- -**	**+-**	**+-**	**- -**	**- -**	**- -**		**E**	**+-**	**++**
C'	**+-**	**- -**	**- -**	**+-**	**+-**	**- -**	**- -**	**- -**		**R**	**+-**	**++**
++	**+-**	**+-**	**++**	**++**	**+-**	**++**	**++**	**++**		**S**	**+-**	**+-**
- -	**+-**	**+-**	**- -**	**- -**	**+-**	**- -**	**++**	**- -**			**+-**	**+-**

Octant Centroid Spin Axis Sites.('Sites make 2 tangent cylinders around axis with normal sites)

S0				**+-**			**++**	**+-,+-(stack**				**+-**
S0'				**+-**			**+-**	**+-,+- cyls)**				
S1					**+-**	**+-**	**+-**	**++**				**- -**
S1'						**+-**	**- -**	**- -**				
S2					**+-**	**+-**	**+-**	**++**				**- -**
S2'						**+-**	**- -**	**- -**				
S3					**+-**	**+-**	**+-**	**++**				**- -**
S3'						**+-**	**- -**	**- -**				

S Eq Orbits in CW Rotation in S Eq. plane ON SURFACE OF SPHERE (Self-balanced like S0 & S0/S0')

7.5°#1 (Would conflict with A' as below)

67.5°#2 " " " " " "

127.5°#3 (Conflicts with ++ & C'orbits except in expanded orbits of quarks or 2nd shells.)

3 ea 3 cases (rest 1 case each) 2 cases

All Balanced, but in the case of 14/18 only by stacking self balanced SO cylinders to twice the sphere diameter in a 2nd shell.
(Mass calculations per Equ. 2 do not include isomer/excited effects.)
[For each of these PDG 30 to 100% baryon decay channel input requirements above 8/8 charged pairs there is a PDG accredited neutral baryon or meson which could, if colliding but undetected, supply the missing quanta for the PDG decay equation. Therefore, only 7 out of 13 such PDG accredited decay cases with missing neutral input requirements in the nu supra-tau mass range can be cited as neutrino existence requirements, plus 5 other such PDG decay cases in the prior nu tau range, for a total of 12 firm cases out of 18 probable PDG cases.(3)]

The relatively simple Figures 1 to 5 demonstrate the structural meaning of the spherical orbit and spin site data summarized in Tables 2 and 3. It is not necessary to repeat that process with the much more complicated figures that would be required for the more massive structures of the presently known supra-tau neutrino family candidates in Table 4.

With masses that just overlap the least massive end of the range of the PDG accredited Light Unflavored Mesons [5], which has been thoroughly checked (3) for equivalent neutral structures of quanta, the 3 smallest of these candidates are supported by 7 PDG baryon 30 to 100% decay channel cases [3, 5] for which there is no other accredited or paradigm particle to match the required [3] net neutral (and unobservable) decay input quanta to complete the PDG listed decay equations.[5] For the five larger candidates, other PDG accredited particles could match the necessary quanta under this paradigm without creating possibly observable decay output not included in the 2004 PDG decay equations.[3]

Figures 6 and 7 exhibit systematic variation of structures for the non-spherical E_1 and E_2 families (Fig. 2, Table 1) of neutrinos under micromass extensions of the mass/charge power law (Eq. 1) to match the summarized astrophysical requirements on neutrino mass.[1] Under the paradigm the particle distribution of these quantal interaction masses should decrease progressively (though isomericly variable) with elimination of energetic quantal orbits, compression of vortex base turbulence and side toroidal eddy storage volumes [4], irregular interference with build-up of conic circulations, early conic point ingestion of base turbulence eddies, and symmetric base-to-base suppression of gyre turbulence between unlike spins by reduction and ultimate removal of steep viscous shear slopes. From the vast estimates [5] of the observed universe of normal matter, under the present paradigm the stability of conserved, sphericly structured, coaxial point-to-point pairs of charged quanta appears to be such that only nova star explosions (or perhaps black holes) should be able to disrupt such quantal pairs in baryons or LQ particles into non-sphere E_1 and E_2 neutrinos (or conceivably separate them as neutrino sinks into single charged quanta, which might accelerate sufficiently under conic point thrust [4] to escape black holes along with the known gravity radiation.) Since the summarized empirical data on turbulently driven conic vortices demonstrate [4] that the quantal mutual attractive (strong) force increases exponentially (to a mutual intrusion limit or effective counterforce) inversely with separation of the conic centroids of volume (CV, a dot in the figures), some of these base-to-base oriented conic pairs scale as far more stable than the more separated spheric coaxial pairs and therefore should have become more abundant over cosmic time than any other form of matter by exceptionally large orders of magnitude similar to, but much larger than, the ratios of occasionally estimated abundances of hydrogen and helium over those of iron and uranium. This is particularly true of the base-to-base coaxial configuration of $E_{2C'}$ and some of its side-by-side relatives whose CVs may be even closer.

This necessity is heightened by the fact that of the 18 PDG accredited cases of 30 to 100% baryon decay channels [5] with adequate data, only one was found [3] that did not positively require additional neutral quantal input to satisfy the PDG (shortcut) decay equations listed. Therefore, by similarity, all hadron decays as a class should not be considered necessarily spontaneous, but instead, predominantly neutrally triggered occurrences. With consideration of potential scales of additional abundances of the required neutrinos, the paradigm offers a simple, though extensive, approach to resolving much, if not all, of the elaborately explored [5] problem of dark matter. A proliferation of specific neutrinos is required. An ideal preliminary test might look for signs of reduction of mean lives in a selection of decaying hadrons near a selection of known neutrino sources at a selection of sufficient downstream distances to allow some oscillation of neutrinos to increase their variety for exact (resonant) matches. (A feasible test might accomplish enough of this to complement piecemeal data from lab notebooks on details of prior experimental mean life data variations versus locations, orientations, timing, and similar records on intense neutrino sources.)

The balancing of decay equations with an additional neutrino input must be taken a step further. By similarity an undetected neutrino input should be more parsimoniously required in the apparent creation of new real matter in the high energy collision of particles. The simplest case is the electron/positron collision resulting in the observation of a muon and anti-muon duo. Where the paradigm electron/positron colliding duo consists of a total of 3− − and 3++ pairs of quanta, the muon [1] consists of 3− − and 5+− for a total of 8 pairs, while the anti-muon consists of 3++ and 5+− with the same pair total. The missing input of 10+− pairs would constitute a neutrino of 233.65 MeV mass (2), though the input may come from the three quarks of a neutron or from any one of several neutral hadrons destroyed by chance in the collision, with small additional neutrino outputs. Cross-sections for such a 3-way collision would indicate an initial collision by two of the three particles with an enlarged cross-section for an immediate second impact. In any of the possible cases a large population of neutral input contributors would be required; only neutrinos would not contaminate a collider's hadron vacuum.

6. Summary and conclusion

Inclusion in the broader paradigm of quantitative generation of the mass energy of the subatomic particles by energetic interaction of microquantal substructures built from spinning conic vortices with inherent electric charge offers systematic resolution of the many QM uncertainties about neutrinos, their relations with the other particles, and their significance in cosmic nature.

Acknowledgements

These paradigm papers could not have been prepared without special assistance from: Matthew Clark, Woodwork Dept. at Okaloosa County Vocational and Technical School, for turning maplewood drive cones for lab vortices; Cheryl Mack, Senior Librarian, & Christi Bufalino, Michael Jackson, & Eleanor Baudouin at the US Air Force Armament Laboratory Technical Library, for much reference and background gathering; H. Blevins Howard & Katherine M. Douglas, for computer support & figure drafting; Fred E. Howard, III, for critical review of texts & physics; Richard G. Henning at the US Air Force Eglin Weather Detachment, Professor Keith G. Blackwell at the University of South Alabama, & D. D. Sentman at the University of Alaska Geophysical Institute, for special data & comments on atmospheric storm vortices (for equation validation by scaling up 10^6 before scaling down $10^{-12\text{-}15+}$.)

References

[1] Howard F E Jr 2005 Elementary particle mass sub-structure power law *Florida Scient.* **68** (3) 175-205; 2006 Erratum Appendix Table C3 (Typesetter's misprint) **69** (2) 148 (For correction in place, see www.electron-particlephysics.org) (3cy enc.)

[2] Howard F E Jr 2006 Sub-structure laws of particle masses and charges---A new systematic classification of subatomic particles *Florida Scient.* **69 (**3) 192-215 (www.electron-particlephysics.org) (3cy enc.)

[3] Howard F E Jr 2009 A new paradigm for the unresolved nuclear quarks (in review, 3cy enc.)

[4] Howard F E Jr 2009 Self-consistent structure for the electron/positron (in review, 3cy enc.)

[5] Yao W M *et al.* 2006 Biennial report of Particle Data Group *Jour. Phys.* **G 33** (1) 1 (www.pdg.lbl.gov for all years.)
Eidelman S *et al.* (Particle Data Group) 2004 *Phys. Lett.* **B 592** (1) 1
Amsler C *et al.* (Particle Data Group) 2008 PL **B 667** (1) 1

--- --- --- ---

FIGURE CAPTIONS

THE ELUSIVE NEUTRINOS---A Paradigm...
Fred E. Howard, Jr.

Figure 1. The prior basic paradigm substructure for the massive particles. Previous and concurrent research reports define this structural sphere composed of 6 synchronized orbits for microquanta of charged mass in particles generally. The quanta evolved as coaxial pairs of spinning cones which symbolize here the turbulent conic vortices they drive in forceful interactions (as separately analyzed from scaled lab data.) Neutrinos were found to be only the particles whose quantal charges balance neutrally. Three orbits (ABC) are orthogonal, with axial vectors summing to balance around a single axis SO through the centroid of a spheric octant, defined by the orbital directions. The Sum Equator orbit and two others tilted in the same plane also balance on SO. An orbit (named − −) tilts as far from axis C as does S Eq., and an orbit (named ++) balances − − around SO. The 3 tilted orbits all avoid the centroids of the 8 octants by the same minimum amount, and both S Eq. and − − orbits bisect all the quadrant arcs they cross. Only in the S Eq. orbit in a quark (in attractively forceful linking to another quark) can the base of a cone rise (ellipse-like or circularly) off the sphere (to twice the radius) to avoid the minimum $\pi/12$ (15°) for synchronized clearance between cone axes.

Figure 2. (This figure is a graph in text, and contains its own caption.)

Figure 3. Structures for the paradigm's two systematic neutrino mass stations just below the named upper mass limits in the 2004 biennial Particle Data Group report (omitted since.) The coaxial cone pairs are shown at the starting sites for orbit synchronization at one fixed orbital angular velocity. (The 3 neutral pairs for the nu mu neutrino matches the 3 charged pairs for an electron or positron.)

Figure 4. Typical structures for the paradigm's named systematic neutrino mass ranges with mixed spin sites and spheric orbits from Table 1. These sites exhibit the reduced mass exponent and reduced mass-building interaction energy between quantized vortices represented by the drive cones at the synchronized start sites for orbits and fixed spin sites at octant centroids. The M_{2A} configuration demonstrates the synchronizable cylindric mounting of two coaxial pairs at a single spin site at an octant centroid. For this the cylinder's angular rate must be twice the standard orbital angular rate in many cases.

Figure 5. Three systematic spin-only spheric neutrino structures, including the mass station just below the PDG 2004 upper limit for the electron neutrino mass (nu_e). (The name is retained in the paradigm for convenient identification of the mass range.)

Figure 6. The paradigm's systematic structures for astrophysically identified neutrinos of intermediate mass. These non-spheric, non-orbiting, and non-symmetric clusters of conic vortical quanta gathered around their centroids of volume (CV) would have intermediate levels of mass-generating interaction energy from their random spin interactions much lower than the orbital and organized spin energetics of the prior figures because many primary, secondary, and tertiary vortex currents will be obstructed, though their estimated forces (from limited unsymmetric data) would keep them bound together.

Figure 7. Systematic paradigm structures for astrophysical neutrinos of extremely small mass. Combinations of only small numbers of vortical quanta and progressive masking, suppression, or reforming of the principal fine turbulence flows generating mass energy from near the drive cone base in the paradigm provide a microrange of masses from the scaling equations. Since these configurations are

symmetric, the scaled lab force data directly confirm configuration strength. Configuration $E_{2C'}$ represents the peak mass suppression by full masking and fully cooperative reduction of turbulence energy with elimination of its principal source in the vibratory turbulence of the base spiral-wave disk. The remaining side flow is typically nearly laminar with reduced shear, giving extremely small mass energy.