Striking matches of a vortex paradigm & power law with quantum mechanics

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Particle Quantum Mechanics (QM) is very fruitful, but still has large uncertainties of crucial particle masses, numerous arbitrary factors, and mysterious "qualities" of unknown provenance. Causally defined mechanisms for QM mysteries resolve its uncertainties in many correspondences summarized here from seven papers on a new paradigm of microquantal vortex substructure for "elementary" massive particles. Scaled from force and flow equations of new lab data on turbulent conic vortices, coupled with a particle mass/charge power law derived from the biennial Particle Data Group (PDG) Summary Tables, the spothericly orbiting coaxial pairs of these spin-charged microquanta of mass energy interact forcibly in balanced and stable electrons/positrons, "oscillating" or residually stable neutrinos, quarks, and superphotic wave mechanisms of entanglement. Gyre orbits link the forces of ephemeral quarks into ultra-stable protons, less stable other baryons, nuclei, and mesons. Uncertain PDG masses of quarks resolve by the new law to two precisely quantized masses for each quark. The dual masses systematicly generate the mass steps of baryon series and meson debris. The QM quantization angle arccos 1/√3, the mysterious 3 colours of Quantum Chromodynamics, and gluon bonds naturally arise from linked gyre orbits. Adding up conserved gyre charges in PDG decays finds overlooked sources of neutral dark matter in many necessary neutrinos. Etc.

The relation of precise baryon and meson masses to the uncertain empirical masses of quarks that compose those hadrons[1,2] is the outstanding, yet most typical, non-intuitive perplexity of last century's arguably most revolutionary achievement, the probabilistic Quantum Mechanics (QM) of subatomic particles. In a new structure scaled from lab force and velocity measurements[3-6], coupled with a new mass/charge[1,2] power law, a turbulently complex vortex (Fig. 1) orbits as a spin-charged microquantum of mass energy in interactive synchrony with similar gyres to form a spheric quark/antiquark, electron/positron, or neutrino. This creates a less perplexing causal paradigm of those particles, with directly resultant hadron and nuclear-sized structures, masses, and forces.

Correspondences to Quantum Mechanics

Seven papers[1-7] on main features of this paradigm are summarized here for its perplexity-resolving, gap-filling, but generally supportive correspondences with QM and the international Particle Data Group data and QM Notes[8]. This summary starts with a solution of the QM puzzle of how "mass" energy is both generated within quarks (or electrons and neutrinos) and then expanded by orders of magnitude (OM) as the PDG quarks/antiquarks construct the PDG hadrons. [The abstract QM theory of a portion of the last half of this process (standing alone) has also just been solved by Dürr *et al.*[9] in a calculation of a lightest hadron mass in each of 12 PDG lighter hadron series through the QM amplitudes of particle wave-functions[9,10,11] and related factors. While outstandingly complete within its scope, this significant QM achievement[10,11], involving 12 authors with support on four supercomputers, does not resolve the initial masses and charges of the three light quark types involved (two of which are treated as degenerate), nor the many heavier masses in the sampled series, nor the heavier series, nor the causes of the mass-by-mass steps in the proliferated series[8] of additional hadrons. That effort also avoids the issue of the critical difference in the masses of the uniquely ultra-stable proton and the unstable neutron, which are considered only as a degenerate Nucleon.]

There are other such QM questions scattered between its civilization-changing successes. In overall correspondence, resolving this particular group of remaining difficulties of QM by the summarized structures of the new paradigm also initiates a basis for resolving many other problems.

The QM mass energy m_p of a lepton or quark (LQ) is generated here by mutual interaction of component numbers N_c of uniform microquantal masses m_u in charged $n_\pm$ or neutral n_0 conserved pairs (totaling $n=N_c/2$), with the relative mass-generation ratio a of those two kinds of pairs, under a general LQ power law of mass and charge[1,2,7]:

$$m_p = m_u N_c^{\ 6}[(n_\pm / n) + (n_0 / an)], \quad (1)$$

derived from Particle Data Group (PDG) Summary Tables of accredited data[8] as shown in the next section. Hadron mass energies are then caused by further interactions of the initially resulting quark components (all charged fractionally compared to electrons) in an exponential variant (2) of equation (1), indicating a continuity in active substructures.

Matched features related to QUARKS

This progression from very low mass microquanta to the components of massive nuclei depends on the relation in the PDG data tables[8] between the deduced quark masses and measured baryon and meson masses from which the recently published charge/mass power law (1) was originally derived[1,2]. When the masses m_p of the most common PDG baryons and mesons of several types were graphed against the sums Σ of the mid-range nominal masses of their PDG quark components m_c in electron-Volts (eV) of mass energy[1], it was found that near any value of Σm_c the masses of any two nearest (hadron) particles m_p were equal to Σm_c times very nearly the same power of the number N (2 or 3) of the components c and then that this exponent variable y made a point-by-point curve in an exponential law of the masses as energy of the interaction of the lower mass quark components, without regard to their charges (all quarks being charged):

$$m_p = \Sigma m_c N_c^{\,y} \qquad (2)$$

where y ranged from 0.1 with the largest masses to an asymptotic limit of 5 with small masses (indicating neither unitary nor mixable, but subdivided ball-like components[1].)

When that exponential upper limit was then extrapolated to the necessarily smaller LQ particles with unknown N_c and minimal uniform mass components for simplicity, it was found that the combined numbers of plus and minus charged mass microquanta structured in varied pairs of quanta distinctively defined the LQ particles in a more basic general mass and conserved charge power law (1, 3) of mass interaction energy[1,2,3] :

$$m_p = \Sigma m_c N_c^{\,y} F_G \ , \qquad (3)$$

where the coefficient function $F_G = (n_\pm/n) + (n_0/an)$, $\Sigma m_c = N_c m_u$, N_c is again the number of components, found only in pairs in LQ particles, n is the number of these pairs, $n_\pm$ is the number of charged pairs (++ or − −), n_0 is the number of neutral pairs (+−), y is the power law exponent 5 in the Usual (U) range of LQ and is corrected by +1 from $N_c m_u$ to $y' = y+1$ in LQ (only) collections of terms [but <limit 5 as an exponential law (2) in extended ranges], a is a coefficient for reduced weighting of neutral versus charged pairs in interaction mass energy with $a=3^{0,1,2,3....}$ [nominally 3^1 in the U LQ range to 3^{12} (or more) in the most Extreme (E_2) range of astrophysical neutrinos below, where both $n_\pm$ and $y = 0$, but $y' = 1$], and m_u is the uniform mass 10.9525 eV (rounded) of single 1/6 charged microquantal components of LQ particles in any range, whether U, E, or Medium range (M)[1,2,7]. [This m_u mass is calibrated for the unique (having all charged pairs of the same charge) n_0=0 case in the U range with 3 negatively charged (− −) pairs of quanta in the electron mass energy. No other calibration (or other y) was found to yield the PDG LQ masses over the U range.] [Hadron range (H) is the higher mass, extended exponential law range (equation 2) with quark components (all n_0=0); and nuclear range (N) has heavier hadron components with y in negative fractions[3].] For LQ particles, except the smaller ranges of neutrinos, in the structurally most

fundamental U power law range, F_G conveniently changes by collected terms[3,7] to F_U = $(0.5 + n_{\pm}/n)$ =1± ≤0.5 in Usual LQ particle classification groups[2] :

$$m_p = N_c m_u N_c^{\,y} F_G = m_u N_c^{\,y'} F_G = 2(m_u/3) N_c^{\,6} \left(0.5 + n_{\pm}/n\right), \qquad (4)$$

the most frequently used form of the power law.

This quantitative basis in general charged-mass microquanta was supplemented with lab experiments on highly interactive conic vortices driven under water by cone cores to quasi-fractal turbulence with about six sequentially less powerful types of wave gyrelets inside each main vortex[5,6] (Fig. 1). (These centrally driven vortices are just the reverse of the familiar sink-drain gyres.) Measurements on the vortices obtained the scalable velocities and dimensions of the flow/wave structures, the stored or transmitted energy, and the forces of single and mutually interactive sets of two gyres matching the qualities of QM charge and strong (or weak) attractions in LQ particles.

These experiments[5,6] included heated or cold water and sugar solutions for a small range of fluid density with 4:1 variation of fluid viscosity in viscously cone-driven symmetric gyres, both laminar and turbulent substructures of circulation including eddies, major force instabilities, mutually interchangeable large-cone to small-cone gyre modelling with two principal and several auxiliary cone sizes and included angles, 6:1 variation of a cone's angular rates and base rim velocities, surface to fully immersed gyre locations, centroid separations and relative spin senses of drive cones, and the 360° circular range of symmetric relative axial angles under the other variations of conditions (plus samples of the quasi-infinitely variable non-symmetric positions and angles[5,6].)

The data from these experiments reduced to two dozen fitted equations which were confirmed by scaling up 6 OM for comparison with numeric force and flow structure data[5,6] of naturally turbulent tornado, storm cell, and hurricane conic gyres driven centrally by heat engines with Coriolis effects (and pressures) in mean local air density and viscosity. The equations were then scaled down ≥12 OM[3,4] to fit PDG particle and space data[8] and QM electron particle requirements (previously analyzed in an independent monograph[12] reviewing published papers.) This extended the lab gyre equations continuously to QM particle scale in a constrained, fluidic medium[4].

The equations, then, define uniformly scaled microgyre quanta with conic base spins in two charge senses at high angular rates and peripheral velocity contours. The physical waves and currents of pairs of such gyres embody the scalable measured[5,6] forces and also the mass energies of interaction defined by the power law. The masses occur in the accumulated energies stored by viscous interaction eddies in and between gyres. Interactions between gyres with like symmetric spins conflict turbulently, even in their otherwise laminar primary currents, and make many eddies in these structures; but between symmetric gyres, main currents of unlike spins (+− neutral, for *a* above) merge with few eddies. Like-spin repulsions also reverse to attract[3,4,6] exponentially (strongly, as do unlikes) with less than a gyre diameter separations, until drive cores interfere, weakening the attraction. There are similar lateral mutual forces which make free gyres circle each other. Each gyre exhibits a strong point-thrust from axial fluid intake, acceleration, and baseward ejection. These high-spin gyres can naturally move in sphericly synchronized orbits at a lower angular velocity of conic gyre pairs that are coaxially locked with bases outward, or such pairs may spin staticly between orbits (for heavier particles.) Variably coaxial or non-coaxially joined unlike pairs in clusters with conic bases inward can naturally reduce or even suppress charge-like spiral waves and mass interaction eddies (*a* again) (as general quanta do in E light neutrinos[3,7].)

All LQ particles (except the lightest E_1-E_2 neutrino ranges), and thus all baryon and meson particles made of quarks, are systematicly built from up to 6 synchronous spherical orbits (with one quasi-elliptical option) for coaxial pairs of gyres (or angularly spaced dual coaxial pairs) and 8 spin sites for 4 (or more) coaxial pairs between orbits in the spheric octants[3]. There is a natural spin summation (and balance reference) axis[3] of the orbits and sites at the QM quantization angle arccos 1/√3 from each of the three dimensional (3D) sphere's primary axes of orthogonal orbits and thus through the centroid of the primary octant and its opposite (so that one set of coaxial pair spin sites and the sum equatorial orbit are fully symmetricly balanced on and along this sum axis.) Spherical particles are held together by each gyre's strong inward point thrust modified by mutual forces between orbiting and static gyres along their conic sides. In addition to a small steady component, the turbulent spiral-wave subgyres across gyre bases (Fig. 1) generate weaker and vibratory spin-charge forces aimed only outward from each gyre cone and sphere of orbits[4] (with special significance in the electron section next.)

Having a causal equatorial orbit that cannot synchronize with other orbits in its own sphere unless attracted outward to twice the sphere radius by linking with nearby equivalents, quarks link up in baryon triplets of quark spheres (or meson doublets and their multiples) as quarks' only existences[3]. [Otherwise a quark does not exist by synchronously completing one cycle of its orbits with 15° core clearances between gyre centers on-sphere and 5° expanded. (There must be lepton preparatory assemblies for phased development of quarks that do not just spring into such complex existences.)]

Expanded link orbits are either circular or quasi-elliptical by systematic rules based on the types of quark triplets (in baryon charge plans.) Since non-circular orbits for balanced coaxial pairs of quanta must expand in opposite directions around its sphere's center, their quantal velocities in orbit cannot be those of elliptical orbits, but retain the uniform orbit angular rate for fully synchronizing all orbits in a baryon (or meson.) The three expanded equatorial orbits of quantal pairs from separate quark spheres in any baryon link each other orthogonally, forming a complete closed ring of links without open ends in a 3D box-corner. The three quark summation axes thus meet and vectorially sum all quantal spins on the axis of triplet corner symmetry for the baryon[3]. [Unstable meson debris from baryon or other large particle breakage or decay are summed in dual orthogonal corners of a quark and an antiquark (without complete closed rings.) A QM quark "soup" could exist only briefly as a gathering or open-end linkage of quark/antiquark meson corners.]

An especially significant result of the power law is resolution of the uncertain QM/PDG quark masses. Over this decade the biennially reported PDG masses for the light up and down quarks[8] have empirical uncertainties of roughly 30% of the mean or 75-100% of the lower mass limit. PDG uncertainties of the heavier quark masses are much larger in quantity, but lower in percentage. The PDG uncertainty for the three light quarks resolves under the power law[1,2,3] to two quantized precise masses for each quark, dispersed toward the PDG upper and lower limits. For the three heavy quarks the law finds three or more such masses near each PDG uncertainty, but weightings[2] emphasize two.

The unique baryonic stability of a proton arises first from the nearly perfect orbital balance and minimum mass within the lighter forms of the two up quarks[2,3], which, with high ratios of (+2/3) charge-to-mass (and to internal momentum), attract over their orbital links the one negative (−1/3), less balanced down quark (in its lighter form.) These linked charge forces act by synchronized fluctuations in support of the stronger and more continuous side forces from all gyres pulling the proton's quarks in toward the triplet axis until the three quarks are in synchronized contact and begin to resist core penetrations. [Though both the proton and the neutron compress the gyres and spheres[4] by attractive forces until they are small enough[8,12] (see electron section) that the gyres in its spheres are closer to each other than the gyre boundary of the reversal at short range of general like-spin repulsions[4,6], these summed strong attractions (of H range) are clearly not quite sufficient, in correspondence with the PDG lifetime data[8], to stabilize the slightly heavier neutron with its two of the less perfectly balanced down quarks and its lower charge-to-mass ratio, even with stronger total cohesive forces due to one more net gyre pair in its two (lighter form) down quarks.] The proton box corner's net stability margin[3] of forces and inertial balance is sufficient to stabilize the neutron's baryon triplet corner when the two orthogonal corners link, with positive quark link orbits linked symmetricly to negative quark links all around the join[3] (and the joint axis), into a complete, 90° synchronized deuteron box (^{2}H) which cannot be a simple cube (for the link-to-link matching and synchronization, one box corner is rotated 90 physical degrees on the axis from a cube.) Similarly, when two protons and two neutrons link in the 45° synchronized helium nucleus (^{4}He, the alpha particle), the protons still stabilize the neutrons. These steps yield two types of stable and strongly cohesive two and four baryon sets that (with proton and neutron singlets when required) can interact to build the more massive atomic nuclei[3,7]. [Some combinations of sets link up in stable abundant balances, especially in every second heavier small nucleus (through ^{40}Ca) after two ^{4}He, which are too tightly rounded to link stably without a bridging third or fourth set, etc.] As linkages are added, the small increment of the weaker charge forces is estimated to become less significant compared to the multiple interactions of the strong side circulations. (Computing accuracy beyond U leptons depends on the limited data on non-symmetric pairs of gyres.) [As exterior forces on their gyres accumulate in various nuclei, individual quark spheres rebalance their internal gyre forces in varied diameters that change interaction mass energies in small fractions due to gyre spacings corresponding to fusion/fission energy (N nuclear range.)]

The resolution of each uncertain QM/PDG quark mass to two masses combines with the force/size equations in systematicly redefining the PDG series of baryons by quantized steps of increasing mass[1,8] (and decreasing stability): In the H range extension of the mass law[3] with declining *y*, the summed lighter paradigm masses of quarks in any type of baryon generate the lowest PDG mass of the series. This particle is the series base Group 0, usually with no nearby PDG accredited isomers of slightly heavier mass because the gyres of the lighter quarks are in the distinctively simplest, best balanced, and thus most stable (and frequently observed) set of synchronous orbits for their quarks. [This is especially notable[3] in the proton, which is not recognized by the PDG[1,8] as the proper base of the partially accredited series of + charged Delta particles, and also in the neutron in its partial recognition by the PDG as the base baryon of the complete accredited series of neutral N (PDG nuclear) particles.] The next PDG mass step is consequently long. In full series it matches changing the lightest quark to its heavier mass in the exponential law. With it, *y* offsets upward a small step, and then typically up to three other small mass steps may be in a Group 1 of isomers of the same quark spheres with larger estimates of orbit/spin-site interaction masses to satisfy the law. [Variation of isomeric quark mass excitations needs an additional equation (fitted also for general lepton excitations.)] The next PDG mass step (in series with more than one kind of quark) matches with the lower mass of the lightest quark and the heavier mass of the next heavier quark for a Group 2 lightest, most balanced baryon (or isoton) with any heavier isomers. The next heavier combination of dual quark masses matches a next PDG mass as the Group 3 isoton unless that mass or group is vacant (not accredited in the PDG Summary Tables.) There must be 4 such progressively heavier groups (if there are no vacancies) in a series with only 1 kind of quark in its three quarks, 6 groups with 2 kinds of quarks and dual masses, or 8 groups with 3 different quark types (ref. 3 and online appendix tables.) (Any group may have PDG vacancy steps to a heavier isomer than the systematic prediction.) This rule redefines and classifies the QM baryons within series[3].

There are also three, and only three, series Prototype Plans of quark charge sets in the neutral 0, +, and −/++ equivalent plans of baryons[3]. This is due to the net −1/3 charge (with some neutral or oppositely charged pairs) of three kinds of quarks, and net +2/3 charge of the other three kinds of quarks.

These two sets of criteria define the proper baryon series[3]. [Some PDG series[8] are reclassified here to fill gaps in differently named PDG series with the same charges and quarks, at times as isomers with variant properties (ref. 3 online appendix tables.)]

The linking gyre pairs with expanded sum equator orbits (one in each quark sphere) embody[3] the QM bond forces and exchanges of the QM gluon hypothetical particles[8]. In baryons the synchronizing start sites of three quasi-elliptical or circular orbits on the sum equators are strictly defined in 60° increments of relative phase angles (plus a 7.5° start) from the outer edge of each sphere's reference plane (containing its sum S and C axes and the baryon's sum axis.) The sequence of the 60° angle increments for the spheres depends on their sequence around the baryon sum axis in the charge plans above. Transition conflicts block these phase angles in specific quarks from changing[3] without sufficient collision force to disrupt all the synchronized orbits in a quark and its baryon. These three bound phase angles in defined quark linking orbits of a baryon correspond as the necessary cause for the three quark "colours" required in Quantum Chromodynamics to track specific quark exchanges in particle reactions.

The QM/PDG accredited data, equations, and notes[8] discuss some four-component "exotic" mesons and indicate that there is "an increasing, uncertain empirical trend" toward inclusion of strange quarks and 4 or 6 quark/antiquark (Q/A) components in the PDG Light Unflavored (LU) Mesons along with the accredited 2 Q/A. Here the new paradigm resolves[3] (for example) that the PDG accredited mass data for the LU mesons as a group (except either one, but not both, of the two lightest π mesons) cannot be generated under the general law without components of strange Q/A, both 4 and 6

Q/A, and 5 specific new quarklet Q/A fragments, as well as employing the dual quark (Q/A) masses throughout. [Typically, obtaining both of the two π_0 and $\pi_\pm$ meson masses accurately requires both of the dual up Q/A masses. Only five of 45 PDG accredited LU meson masses (2006)[8] are obtained with two Q/A components; seven require six Q/A; the remaining 33 require four Q/A; 39 require strange components; and 29 require lighter quarklets which have lost one or two neutral pairs of gyres (ref. 3 online data appendices.)] This necessitates multidimensional reclassification of the meson fragments of broken or decayed baryons[3] on these component criteria. Often multiple gyre structures match PDG uncertainties. Meson instability causes include open Q/A chain ends, incompletely expanded link orbits, unbalanced orbits, etc.

Matched features related to ELECTRONS

As noted, spheric orthogonal orbits of three negatively charged coaxial pairs of conicly driven gyres with their base spin-charge forces of the spiral waves directed only outward cannot interact within the electron sphere[4] to exhibit the last century's self-defeating Poincare' paradigm[12] of infinite internal charge repulsion that was one of two factors which forced a hundred years of QM efforts on electron structure into widely rejected impossibilities of infinitely strong and rigid "mass" material, infinitely small point charges, and other singularities.

The >120° force cones of gyre base charges (from the spiral waves) in synchronized orbits offer with the minimum number of six sources (other than impossible forms of one source) the QM required[8,12] all-directional and constant exterior charge force for the electron[4] within one integration cycle.

In the PDG data on massive spinning particles[8] only the proton and the electron have empirically measured mean lifetimes many OM beyond the computed present life of the universe instead of less than a few minutes. Such stability requires very precise balance around and along the spin summation axis. Other than some of the impossible and rejected structures, none that has the required charge coverage can improve on the perfect axial balance of six uniform conic gyres orbiting synchronously in coaxial pairs on three orthogonal spheric orbits. Arriving at the number six by the independent LQ power law from other PDG empirical data[1,2] confirms this structurally balanced number (and calibrates the 1/6 charge of each gyre.) In result, this structure shows inherent cause for the electron's QM/PDG stability. Yet the particle is an assembly of driven circulations and waves (in a constrained fluidic space medium), inherently embodying the QM wave-particle duality as a basic prototype for the massive subatomic particles[3,4].

As mentioned earlier, comparing electron mass of 0.511 MeV from three quantal pairs, all uniquely of the same charge, and the 2002 PDG mass limit of <0.19 MeV[8] for the muon neutrino (just over 1/3 the mass, intuitively with three neutral pairs of quanta) yielded the original[1] critical 1/3 ratio in the mass/charge power law for the generation of interaction mass by neutral quantal pairs compared with charged pairs. This coefficient (equations 1, 3, 4) fitted the general power law of microquantal mass substructure[1,2,3] to the prior PDG masses[8] of all the LQ particles and pointed the way to the rest of the interactive vortex paradigm[2,3,4-7,12] of the massive particles.

The gyre experiments[5,6] above demonstrated mutually interchangeable large-cone to small-cone gyre modelling with equivalent nested flow velocity contours. Using this mode, the fitted lab equations were numericly run[4] for effectively simultaneous force balances, flow velocities, and dimension convergences to two complete but dimensionally separate electron performance specifications consistent with both accredited PDG data[8] and supposedly inconsistent QM atomic orbital and collision dimensional requirements as analyzed for the electron in Mac Gregor's monograph reviewing published papers[12]. At computing cut-off, dual convergences (that also perfected the scaling equation fit) were good to a few per cent (<2% deviation in scaled dimensions and internal force balance) within the electron sphere[4], where all gyres are symmetric to each other about a center as in the lab. (Deviation was 12% in separately calculated external force between 2 static electrons where most summed gyre pairs are only in balanced asymmetry to each other, for which there are few lab data.)[4] [Quark gyre forces between an expanded link orbit and other orbits in its sphere[3] (or between spheres) are also non-symmetric.] The convergent orbital structure computed from the quantal power law and scaled equations on lab data matches[4] the requirements for QM spin summations analyzed in summary for the electron by Mac Gregor[12]. In atomic orbit and other cases of sub-photic particle velocity the larger structure has[4] the modified Compton radius then required[12]. Also, forces of acceleration to near photon velocity can compress the electron structure and gyres by orders of magnitude toward the ultimate gyre cores[4], until the internal forces and velocities rebalance at dimensions meeting empirical collision radius data[12], exhibiting the numeric convergence[4] of paradigm structure/velocity/force equations at both required core sizes[8,12]. [Due to OM reduced gyre separations under this compression and acceleration, interaction mass energy also must rise by the same ratio as mutual gyre attraction[4] (as if relativistically.) This rise is from the power law mass for steady external conditions at ≤ atomic orbital electron velocities of <1% of *c*.]

This constrained[8,12] electron structure of viscous and viscoelastic flow velocities and waves requires[4] internal existence of force waves at high superphotic velocities that also occur at distance in present large quantities of empirical QM entanglement data[4], for which the paradigm[4] thus supplies a tuned radiation and reception mechanism and relevant equations to resolve causally this 100 year QM mystery and source of conflict. Quasi-unique and discrete recognition signatures for typical coherence intervals are available from coherent phase locking of multiple modulations between variable frequencies within the involved series of wave and particle resonances of less than infinite sharpness (ref. 4, supplementary information for online posting.) Conflict is resolved directly with respect to entangled particles and indirectly as to photons emitted by electron actions and necessarily having commonality with force waves from electron gyres (not entirely unlike those of smaller neutrinos[7] in the next section.)

The synchronized orthogonal orbits of this electron necessarily exhibit around the summation axis a QM[12] "Zitterbewegung" pseudo-vibration or trembling effect when all gyres simultaneously transit the sum equator at 60° apart and orbit to (π/2)− arccos 1/√3 (35.3°) from its poles twice in each orbit cycle. (The QM muon and tauon[8] are similar, multiple pair spheres[1,2], that are not restricted from small isomeric variation of gyre orbits and mass when excited immediately after their creation by impacts.)

Matched features related to NEUTRINOS

For baryon decays[3,7], the PDG data tables[8], and others, commonly show empirical equations that add up only in net charge shortcuts, not in conserved charges. To balance such shortcut equations for the charges of the established QM quarks, etc., not for the paradigm structures alone, it is necessary to add an unobserved input neutrino (or a neutral baryon or meson will do in some cases) to all but one PDG case of accredited 30% to 100% decay channels of baryons. A similar number also require additional unseen output, usually another neutrino. The unbalanced PDG cases include a classic QM beta decay of $n \rightarrow p + e^- \bar{\nu}_e$ + energy [where conserved LQ charge subtotals −1/3 −1/3 +2/3→ +2/3 +2/3 −1/3 −3/3 ±0, requiring an added input neutrino of (+2/3 −2/3) to balance the subtotalled charges of the quarks involved, aside from rebalancing the mass energies. In full accounting of quanta in the charge subtotals, the original output is also short an additional neutrino neutral pair that was already present in the prior input.]

Using the paradigm's strict quantal charge accounting under the PDG-based mass power law[1], significant numbers (half) of the PDG decay equations can only be balanced by a neutrino input with much greater mass than the prior PDG upper limit for the tau neutrino, but less mass than any neutral PDG hadron[8]. (No other estimates change this, though two or more adjacent neutrinos might at times merge with strong gyre forces[3,4].) These well documented[8] baryon decays show by their weight of PDG accredited empirical evidence that such neutrinos necessarily exist.

Further, this result of the empiricly based mass/charge power law[1,2] in conjunction with the long established[8] baryon mean lifetimes demonstrates that the rapid decays are not spontaneous, but must be caused by neutral particle (largely neutrino) impacts, and that the abundance of the specificly noted[3,7] neutrinos alone must necessarily be far in excess of prior estimates, with neutrino mass totals that necessarily must be a major rather than very small[8] contributor to dark matter. [This implies a rule that decays of particles which are found to exist, even briefly, including mesons and "oscillating"[1] neutrinos, should be re-examined by the paradigm's conserved quantal charge and pair accounting method[3] for collision initiation of decay, specific neutrinos, and their abundances. (Stability in lifetimes shows balanced impact resistance.) This may apply to excited, unstable, or metastable particle, atom, and molecule states generally.]

The paradigm structures and power law demonstrate[1,2,3] a quantized mechanism for neutrino "oscillation" of masses[8] that lead directly to stably balanced U to M and E_0 range spheric neutrinos and astrophysical E_1 and E_2 microneutrinos[1,2,3,7]. As noted earlier, the smallest neutrinos of two unlike gyre spins suppress mass generation in base-to-base forms. Coaxial spheric quanta pairs are evidently conserved, except in nova star[7] (and black hole?) emission of base-bonded non-coax/coaxial pairs. (Debated[7] superluminal waves in black hole jets could also involve temporarily separated quanta emissions with their continuously self-generated point-thrust propulsion and minimized point accumulation of compressed mass and charge wave radiations with retro-forces.)

Space is more richly supplied with energetic neutrino matter than prior estimates[7], as it is with medium compressions by accumulated wave energy of past charge, mass, and entanglement force radiations (as well as QM photons.) The constrained fluidic space[4] medium supports storage in each particle's gyres of its lifetime total of dispersed energy. Thus residual (dark) neutrinos with paradigm structure are widely explanatory (including QM paired virtual particles that spring in and out of "vacuum" existence[8].)

For neutrinos with simple structures, antineutrino mirror images are only oppositely viewed along the sum axis[7,3]; neutrinos can be their own antineutrinos, without QM incompatibility. The observed QM antiparticles[8] are only re-assortments of conserved coaxial pairs in collisions and nominal PDG decays[3]. Link orbits in quarks[3] have one 6° spheric clearance of a conic point rather than the more common 15° lower limit for stability; refined lab data may demonstrate asymmetric matter forces there.

There are many fruitful correspondences between Quantum Mechanics, with its empirical PDG data tables, and a new paradigm of structure for the subatomic charged leptons, quarks, and neutrinos, with its mass/charge power law. The summarized papers of this paradigm resolve many serious QM uncertainties, supply consistent causal structures for many QM mysteries and arbitrary factors, systematicly reclassify the subatomic particles, and provide testable consequences, as well as indicating approaches for decades of further research. Such basic deterministic additions to the prior QM paradigm may in time make it more understandable, fundamentally simpler though still complex, and also yet more fruitful.

1. Howard, F. E., Jr. Elementary particle mass sub-structure power law. *Florida Scient.*, **68** (3), 175-205 (2005); & Erratum, Appendix Table C3**, 69** (2) 148 (2006). See www.electron-particlephysics.org for correction in place.

2. Howard, F. E., Jr. Sub-structure laws of particle masses and charges---a new systematic classification of subatomic particles. *Florida Scient.* **69** (3) 192-215 (2006). (Also displayed at www.electron-particlephysics.org.)

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LEGENDS

Figure 1. Scaled schematic features of turbulent conic vortices. a Core flow structures and parcel centrifugal trajectories in the vibratory turbulence of the central spiral-wave disk which generates the paradigm of scaled "charge" force (here in clockwise sense of rotation.) Each spiral wave core is a bent centrifugal vortex with smaller fragmentary gyres spiralled around it from the viscous impetus of the cone base. At the gyre diameter boundary, turbulence subsides abruptly into smooth, outward waves and circulating eddies. **b** Elevation partial section of core currents by line-weights around the spiral-wave disk and around a drive cone used in lab experiments to simulate the outer flow contour of a natural gyre energy source in the paradigm of vortex microquanta as particle substructures. The weak upper toroidal ring current is impulsively distorted by spiral wave outputs which override it. The strong lower toroid and laminar upflow around the cone into the underside of the centrifugal spiral waves create the three dimensional "strong" forces of a gyre by several mechanisms.