

## *Blondes, Brunettes & the Flaw of the Excluded Middle*

Peter Jackson

### **Introduction**

The foundations of mathematics are in logic. The foundations of logic were built by the Greeks. But maths is proving unable to model & predict the complex physical universe. Even powerful Chaos theory & 'Fuzzy' logic haven't identified a cause. Is '*something rotten in the state of logic*' limiting physics? It seems possible. All logical systems are ultimately beset by paradox (as *Sorites* below) so *are* the fundamental '*Laws of Thought*' as sound as we assume? We test changes which may now resolve the wide uncertainties in physics.

The 3 laws;

**1 The Law of the excluded middle** A proposition is true or its negation is true, & nothing between.

**2 Law of identity** Each thing is identical with itself (=)

**3 Law of noncontradiction** "*A is B*" & "*A is not B*" are mutually exclusive.

We noted apparent flaws in the laws in 2013<sup>i</sup> The critical first step is to rigorously distinguish strictly PHYSICAL *entities* from the META-PHYSICAL; *concepts, abstractions, attributes & thoughts*, which INCLUDES symbols and *numbers*. Abstraction has adequately served philosophy but we only consider *entities*, a change we find allows only causal, logical, coherent physics. Quite a change!

**The law of the reducing middle.** We wrote<sup>ii</sup>

*"Probability amplitudes between propositions can vary infinitely in nature with curvature profiles, reducing to the middle. It is then suggested that a new "Law of the Reducing Middle" describing Bayesian distributions replaces the Law of the excluded Middle, long disputed by Brouwer etc.."*

The metaphysical *excluded middle* is '*filled in*' with Gaussian/Bayesian or sine curve *n-value* distributions for all things **physical** (& valid in 3 dimensions). We invoke 'Fuzzy Sets'<sup>iii</sup> from many valued Fuzzy Logic, but *generalized, to include QM probabilities*. A surprising consequence is a *physical* analogue for 'entanglement' as 180° antiparallel 'pairs', so *mechanistic* sequence violating Bells Inequalities<sup>iii</sup> (& below). We start on firm ground with a case of distributions between 2 'opposites';

### **Blonde or Brunette**

In reality hair colour is *not* exclusively one or the other. We can take 'darkness' measurements and find a 2D distribution curve. But that tells us little. Many other qualities vary, and in the end we find every persons hair is different, distinguishable by colour and ultimately DNA coding. Similarly the spectrum between Blue and Green, and ALL colours has unlimited intermediate values. Clearly no excluded middle exists in reality, or '*nature*'. Binary maths is then **metaphysics**, an 'approximation' of nature. Little wonder perhaps that our trans-ocean binary signal 'square waves', are reduced to sine curves by nature so have to '*squared up*' again at relay stations.

## ***The Laws of Identity & Noncontradiction***

A direct consequence of the '*reducing middle*' is that, for '*reality*', the OTHER two laws must be flawed! Unlike in metaphysics there can only be ONE of anything in physics. Shockingly that means even the = sign only applies to metaphysical approximation. The '***approximately equal***' notation  $\approx$  must be the default for all 'entities'. *Self equality* is only true metaphysically. Only "***A is not B***" is true. In ¶ we noted, as did Bertrand Russel, that Predicate Logic derived maths & calculus all ends in paradox which no system claims to overcome. Also Infinities, irrational & transcendental numbers (i.e.  $\pi$ ) **outnumber** rational numbers! We found 'sub-propositions' are equivalent to 'bracketed functions', But also;

*"The foundational logical proposition;  $A = A$ , or Aristotle = Aristotle is **false** (so) inapplicable to (real) physical entities and interactions. Aristotle is a Proper Noun, the definition of which is a **unique entity**, so there **can't be more than one Aristotle**.  $A = A$  can only be true metaphysically. Studying physical entities afresh it becomes apparent.. that for sizes at observable scales **no two physical entities are identical**. ..no two galaxies, planets, trees, people, snowflakes or grains of sand will be found absolutely identical ...at a molecular level.*

## **The Heap of Sand ('Sorites') paradox**

A 'Heap' is a vague predicate, yet we can have 2 or more separable heaps. One grain of sand is not a 'heap', but adding one at a time makes it so. But when?! Taking grains away does the inverse. For maths we assume 2 heaps of sand can be equal, which is our first approximation. But can't we weigh them? or even count the grains to be sure? Of course, but just more approximations. It would take an infinite supply of 'final grain' sizes to ensure weight equality. The irony then is that of course each grain is different, so abstraction to equal *numbers* also won't give us equal heaps!

The problem here is **not** then the 'vague predicate' but that *no grain of sand is physically identical*. Now we must think more broadly and ask "*Is anything in the universe precisely identical?!*" Clearly no Cluster, Galaxy, Solar System, Planet, Creature, Snowflake, or particle of *anything* physical we can observe with our best instruments are absolutely identical!

So we've then identified a fundamental problem. The ancient Greek laws are valid for metaphysics but **not** for nature, where they're only approximations. Our algebraic symbols are all such metaphysical 'abstractions' as are 'numbers' themselves, 0,1,2,3, *representing* heaps, grains or other abstractions. 'Heads' and 'Tails' are *abstractions*, as are 'blue and green' with an undecidable middle. It seems the ancient *Ying & Yang* have a wavy line between for good reason.

Expectations of simply solving issues of complexity mathematically are then over optimistic. But using the new laws, Gödel incompleteness, fuzzy logic, chaos theory, fractals, higher orders maths, recursion, infinities, non-linearity, quantum uncertainty, Incomputability and all related areas can then start to be coherently unified and rationalised, *without* reliance on fundamental presumption of '*non-computability*'. What's more PHYSICAL further orders are implied, at scales *below* the lower limit of condensed fermion pairs detectable with Electromagnetic (EM) spectroscopy, and *above* the scale of our visible universe. But first we consider each current Law and suggest improvements.

So do we need to change our whole methodology to resolve the issues. A solution lies in simply to decide and specify in each case what degree of precision we **use, or require**. Kurt Gödel's incompleteness theorems, consistent with the 'fuzzy'  $\approx$  'implicitly proved' = ' to be *false* for physical entities. Gödel both identified the problem and pointed to a solution; **Gödel logic**. ...infinite (n) valued' ..'fuzzy' Logic, giving *non*-Cantor sets.

## Fuzzy sets

Fuzzy sets were introduced independently by Lotfi A. Zadeh and Dieter Klaua in 1965 as an extension of the Cantor or classical notion of set. They were not intended to replace probability distributions but we suggest may now be generalised to do so. Each set has a '**continuum**' of **grades of membership** and is characterized by a membership (characteristic) function which assigns to each object a grade of membership ranging between zero and one. Each set may have concave or convex distributions, or indeed a combination, and can overlap, with 'intersections'. Each is a '*space of objects*' with a characteristic or '*membership*' function  $f_A(x)$  giving a number between 0 and 1. The set can be any scale, becoming 3D via matrices. But we can't envisage a 'mogul field' of humps & dips as all continually moves. A persons physical state 'now' is very different to his state 'now' seconds later. Without motion, including particle spin, there could **be** no material universe! Approximations are always then of the past. Predictions are ever more uncertain, as Chaos theory has shown.

We can't go into Chaos theory or Fuzzy Set details here but identify the founding principles and formulation as sound bases for handling smaller value distributions between integers and binaries, and evolution of interactions. In our scheme all is *causal*, but infinite complexity defies precise predictions. An inherent problem with sets is their infinite number. We don't suggest a finite limit but a recursion to higher orders equivalent to string theory 'dimensions', becoming trivial.

**The law of noncontradiction** A consequence of our schema is that to say that "**A is B**" and "**A is not B**" are '*mutually exclusive*' is false. Maybe arguably useful for non-physical abstractions, but when describing the *physical* universe as we **can't** say any '**A**' **IS** precisely any '**B**'. We can say *A is similar to, or part of a set with B*;  $A \approx B$ . The 2nd part; "**A is not B**", is then universally true! For philosophy we may add; '*For abstractions...*' before the definition.

To accompany the new '**reducing middle**' A replacement law for physical entities using a 'fuzzy set' basis' of defined limits may then be;

**" $A \approx B$ " and "A is not  $\approx B$ ." are mutually exclusive.** So we may say;

***"Only one of any entity exists. Things are most similar to ( $\approx$ ) things in the same set."***

## Below Matters Lower Limit

'Indivisible' Atoms, founding the 3 laws, are long gone. The infinite higher order 'dimensions' of string theory may have a physical analogue, which *may* become trivial but FAR from trivial is the **first step** down in scale from condensed matter to the condensate. We hypothesise a form apparently able to offer solutions for the 'action at a distance' plaguing physics since Faradays field lines, Casimirs vacuum force and beyond. Gravity, and Bell's search for a physical basis for Quantum Mechanical (QM) statistics may be a bridge to far, or are they? We can only test the hypothesis. A solution to *any* of these would be a rigorous test, but can we not expect one fundamental solution to inform more than one mystery if correct?

Any new model *must* be different to the familiar, and to 'expectations' as H.A. Lorentz said in 1906 "*we can make no progress without some hypothesis that looks somewhat startling at first sight,*" Feynman echoed that in 1981 saying new solutions **first** "*look wrong*" before '*turning out simpler.*' Similarly John Bell predicted QM's classical solution will need "**radical conceptual renewal**".<sup>iv</sup> [p172] and an **imaginative leap that will astonish us** [p27]. Solutions often exists, hidden well, in plain sight! We point to one in<sup>3</sup> and below. But what IS certain is

that dismissal and default to embedded beliefs will STOP new solutions emerging. Good science has no place for beliefs, but we can hypothesize.

We quoted Paul Dirac in<sup>v</sup> “*the limitation in the extent to which mathematical theory applies to a description of the physical universe.*” and agree; “*...if it is only to a part...this part ought certainly to be sharply distinguished from the remainder..*” But; “*...there does not seem to be any natural place in which to draw the line.*” (P Dirac 1939)<sup>v</sup>

We now identify this *natural place*, as the scale at which matter condenses, as, *the smallest scale at which electromagnetic (EM) fluctuations will 'couple'*, that of fermion pairs. The Higgs process, commonly seen as essentially an '*additional rotation*' then defines the divide.

Condensed electron/positron pairs form an important lower size limit as the smallest scale which 'couples with' electromagnetic (EM) fluctuations, we'll call 'light'. (The other fermions, the 'quarks' we'll leave bound in the protons for now.) We'll refer to e+/- 'vortices' as 'electrons', and 'Couples with' as the 'absorption and re-emission' which electrons do *very strongly*, as 'requantization'. We'll also assume all electrons 'spin' as a spherical or 'toroidal' (twin vortex) rotation and **all at the same speed**. 'Annihilation' is then simply e+/- vortex 'cancellation' on meeting.

## Matter from Motion

If creating 'matter' is just 'stirring up' the condensate a number of questions arise. What IS the condensate (what is matter made of, so *What is rotating?*) and what stirs it? Occam may agree simply *smaller* scale rotations, so a 'field' of '*sub*'-quantum 'particles' often considered as 'dark energy' or a continuum. We characterise this field as the '*Higgs Condensate*' (HC) as described in<sup>vi</sup>

To visualise the HC we might imagine the particles making up a vortex in water or cyclone in air (or in 3D a wing tip vortices). But here the electron is the vortex, the HC the constituent particles. We now consider *how & why vortices form, and the implications*. We consider pairs spherically in the same way galaxies are toroidal 'discs' embedded in oblate spheroidal halos.

We propose the very simplest dynamic 'MOTION ITSELF' creates the vortices. Motion of *anything* with respect to the HC 'rest state', including other HC rest states, so forming a *boundary zone*. All motion, linear or circular, creates **shear planes**. The shear plane is the key concept in our model. On *each side* of a plane rotation generates paired opposing vortices. Taking a fresh closer view of the boundary fine structure to all matter, from lenses to astrophysical shocks and coma, that's precisely what we find. At boundary transition zones (TZ) we have dense free electrons each side, at rest in each frame, so structured as a '*2-fluid plasma*'<sup>vii</sup>, in two states of motion with complex electro-hydrodynamic (EHD) turbulence between. These occur precisely at Maxwells' NEAR/FAR field TZ positions, well known to antenna engineers, where EM waves inversely change wavelength and frequency but maintain *constant speed c in BOTH systems!*

Lorentz's LT was derived from Maxwell's boundary TZ. In 1951<sup>viii</sup> Einstein identified that such "*boundaries*" between real "*spaces in motion within spaces*" should become "*part of scientific thinking*" in searching for a **physical** solution completing Special Relativity. If all electrons re-emit at c in their **own local** rest frame, then Einstein was correct and that solution emerges in a 'discrete field' model (DFM), also finally resolving the B&B/Kantor anomaly.<sup>ix</sup>

As Nixey shows<sup>x</sup> we have good cross section data but don't understand the energy change found across this TZ.<sup>23</sup> Pair production in both frames offers a solution. As electrons have more energy than EM fluctuations, the *boundary zones* will implement constant  $c$  and the LT *physically*, so giving Einstein's mechanism. Nearing  $c$ , fermion density nears '*optical breakdown*' mode  $\sim 10^{23}/\text{cm}^{-3}$ , oscillation constraint producing 'LT' non-linearity.<sup>xi</sup> Logic also returns as the case of remote *angular displacement rate* calculation of a pulse in a moving IRF (of collimated jet 'layers') **can** find *apparent*  $c+v$  without  $<c$  violation as no **Proper** speed (local propagation) **exceeds**  $c$ . Surprising perhaps, but new solutions *must* be. NASA findings of  $<60c$  are then rationalised<sup>xii</sup> (fig.1)

**The need for 'exotic' Dark matter**, the balance of the 'dark' 96% of the universe, after 68.3% (Planck) 'dark energy', reduces as free fermion pair plasma refractive index is  $n\sim 1$  so all but 'invisible'. Gravitational lensing should emerge as actual *refraction* by a graded diffuse medium around mass. Group motion of plasma clouds has also been shown to produce '*kinetic reverse refraction*',<sup>xiii</sup> <sup>xiv</sup>poorly understood, but if considered as a simple Faraday rotation of the optical axis **on each** interaction, reproduces the troublesome *stellar aberration* effect, for which no relativistic algorithm exists (USNO)<sup>xv</sup> <sup>xvi</sup> <sup>xvii</sup> We now consider other 'action at a distance' & emergent solutions.

## EM waves in the HC

Our Higgs Condensate may only possess the attributes of 'matter scale' particle fields. **Group motion** gives Lagrangian 'flows' and **Density gradients** around the macro rotations ('pairs') mirror the air particle density around rotating weather systems. Particles will have a primary **polar spin axis**, locally common. Here the recursion emerges; Magnetic fields will be orthogonal to polarity, induced by the similarly 'paired' electron momenta. Electromagnetic (EM) '*action at a distance*' and Faradays 'field lines' are then implemented. The same question then arises; how do these HC particles communicate. It seems that *physical reality* may be recursive, as string theory suggests.

Euler and Bernoulli, close colleagues, gave useful insights into motion and nature's behaviour. Euler's helical paths and fluctuations inspired string theory, which we suggest may acquire new direction, as may 'quantum computing' in 3D 'IQ bits',<sup>¶</sup> *quaternion* not binary. Bernoulli showed us what drives sailing yachts to windward, and how cyclones work. He wrote "*a moving fluid exchanges kinetic energy for pressure.*" We write '**change in flow speed** changes pressure, so **high rotation speed lowers pressure**.'

## Sub Quantum Gravity

A surprisingly simple solution to gravitational potential is then allowed by our model. The HC **pressure** density gradient around all condensed matter is retained due to the spin, **and is additive**. Invoking Euler and Bernoulli, that *gradient* around massive bodies, as approximated by Newton and General Relativity, is *physically inevitable*! The pressure gradient also obeys Boyle's Law for a gas; Electron spin leaves lower content, so pressure 'volume' around it, graded with distance. Gravity takes **2** bodies of mass to detect. **One** has equilibrium, but **two** close by would introduce asymmetry of pressure, so **the two will 'gravitate' together**.

Additionally the problem of pair production / annihilation violating conservation laws is removed. Net total energy is constant. **Gravity 'waves'** also emerge; Motions of matter cause density fluctuations to propagate through the medium. Can physics be this simple? Occam suggests so, but much work will be required so it would need to become a new field of study.

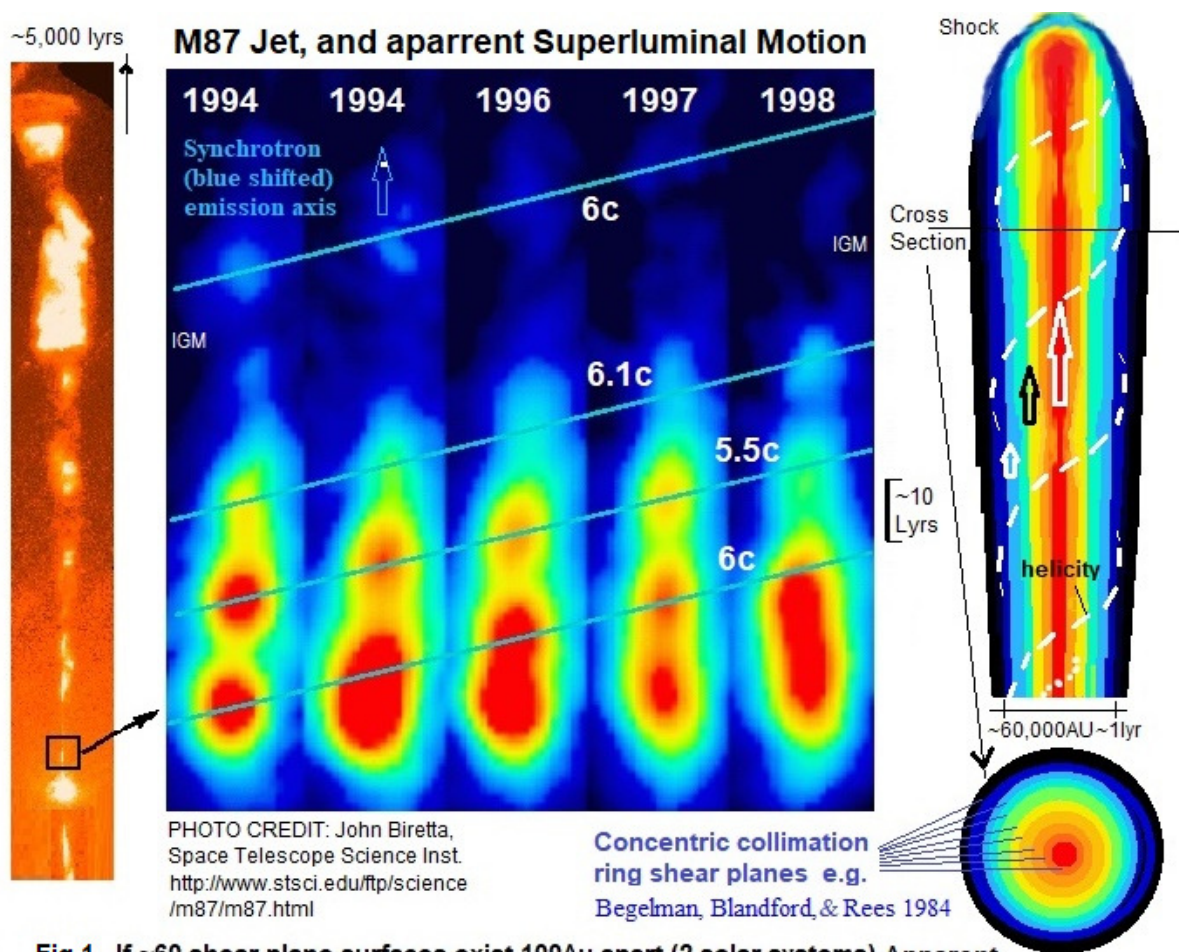
## Black & Grey Holes & Mexican Hats

If sound, our new foundations *should* suggest a more causal Cosmology & QM, free of inconsistency, anomaly & weirdness. To much to ask? Implications of PLANCK data led project head Tauber to confirm the "*anomalous features in the CMB (are) ..more serious than previously thought, suggesting that something fundamental may be missing from the standard framework,*"<sup>xviii</sup> Two main underlying mysteries are an 'axial flow' and helicity.

**Axial flow** has a radial energy gradient, so asymmetry for all bodies, also the 'gyrokinetic' rotation force of space<sup>xix, xx</sup> The axis aligns with a 'point of origin' suggested in 3D models.

**Helicity** of the background is equally unexplained, but clear in computer analysis as an large scale expanding spiral background anisotropy, apparently centred on the flow axis.

We've identified that both phenomena exist at smaller scales<sup>xxi</sup> when analysed from points off axis of quasar jets from active galactic nuclei (AGN). Polar jets obtain opposite helicity



**Fig.1. If ~60 shear plane surfaces exist 100Au apart (2 solar systems) Apparent 6c core displacement rate requires Ave. proper velocity across shear planes = 0.1c PJ**

from precession at their origin; the 'cusp' of the wound toroid paths of the accreted galaxy disc matter. Stellar scale nuclei do the same, as we can see at the Crab Nebula core, often dubbed a *black hole* or a *'neutron star'* due to the 'Gamma Ray Bursts' (GRB's) from the cusp. AGN eject ALL accreted disc matter (fig.1) as polar outflows, and *more* mass is found in the jet 'cones' than was accreted! Sir Martin Rees<sup>xxii</sup> first cited the pair production at collimation shear planes, which we invoke. If we allow the (100's of light years long) columns of re-ionised & new matter to undergo gyrokinetic rotation,<sup>xxix</sup> then new blue barred open spiral

galaxies emerge, common after eons of quasar activity. Galaxy mass growth over the eons is assumed to be from 'mergers', but few mergers are found, many studied having 2 different redshifts. Quasar phase pair production may help explain mass growth.

Quasars suggest that Black Holes as theorised can't exist. AGN toroids do the exact *opposite* to singularities, ejecting ALL accreted mass, so maybe a "**grey**" *or* **NO** "hole", as <sup>xxiii</sup> A cyclic galaxy evolutionary sequence is then suggested <sup>xxi</sup> and at the next fractal scale a cyclic *cosmology*, deriving the CMB peculiarities and conditions prior to the problematic 'start' of the universe. The 'big bang' may prove to be more like a '**big blast**' over a period, as a *small phase* of the cycle.

An additional redshift effect emerges from Euler's expanding helical orbital path length at local *c*. Radial expansion of Schrödinger causal sphere at *c* would lead to measured *wavelength* growth, only modulated by re-quantization events. No *accelerating expansion* is then required. 'Anomalous' magnetic moments also resolve, via 2D spiral fractals.<sup>xxiv</sup> If cosmology *is* cyclic, then tracking right back to zero *something moved*, a waved finger, or flap of a butterfly wing?

We suggest the *singularity* is replaced with the "**Mexican Hat Potential**" of atomic physics. (fig.2). This *vacuum expectation*, returns us to the Higgs process, with *condensation* as "*Spontaneous symmetry breaking*". (New interpretations of LHC anomalies agree the Higgs Boson scale may NOT be the most fundamental).

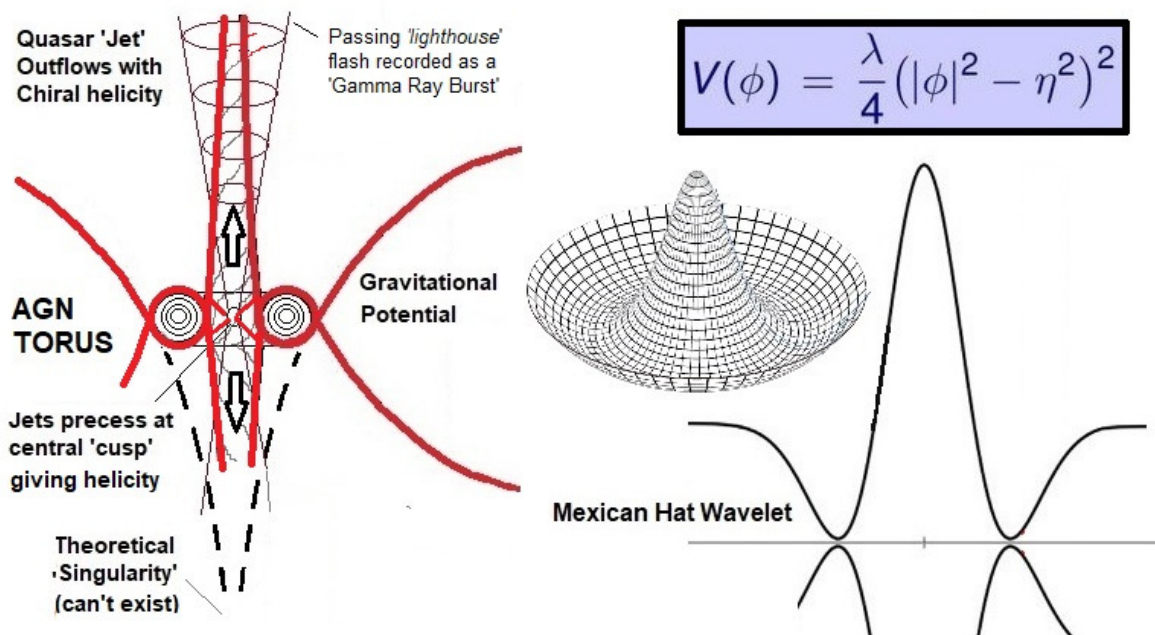


Fig.2 a) Active Galactic Nucleus (AGN) or 'GREY HOLE' reflecting b). The 'Mexican Hat' vacuum expectation. PJ

String & Brane Theory can be characterised as a 2D and possibly '3D reality' equivalent of 1D strings. In AGN and gravitational terms the potential does NOT then take a 'dive' to infinity, but *reverses* to give the polar jets.

## Classic QM

The most rigorous test of new foundations is; *do they lead to classical QM?* Stern-Gerlach (SG) experimental data is so far only described probabilistically. It's oft forgot that John Bell believed;

"( $\Psi$ )..would prove to be a **provisional or incomplete description**.. It is this possibility, of a homogeneous account of the world, which is for me the chief motivation of the study of the so-called "hidden variable" possibility." J S Bell 1987<sup>iv</sup> Ch.4 also believing; "the founding fathers were in fact wrong" <sup>iv</sup> p171.

What is required is a **physical** mechanism reproducing the Dirac Equation, or a 3D version of the ancient Egyptian Malus' Law; Intensity  $[I] \propto \cos^2\theta$ , of intensity of light. Was some initial QM assumption flawed? Can we prove Bell correct? It seems we might: A common SG set up 'splits' a beam, and 'conjugate pair/states' go in opposite directions. Detectors A & B have dials rotating polarising electron screens. 2 orthogonal analyser channels 'measure the state' & one 'clicks'. Feynman said "**It's to hard**" to rationalise (it's **impossible** if assuming **different** particles) so reverted to maths.

But OUR pairs are identical, with a random but parallel ('entangled') axes  $\theta$ , Sent opposite ways, the hemisphere with  $e+$  leads one way,  $e-$  the other. But A & B, with 3 degrees of freedom, can reverse their own polarity, so on arrival spins **either** add or subtract! Bell really showed QM's assumption of **different pairs** was flawed. In OUR analysis A & B can reverse their OWN finding, which works. Our essays <sup>iii</sup> <sup>xxv</sup> derive in detail & verify by experiment. Polarisers **change** polar axes, so also *amplitude* subject to  $\theta$ . As both Bohr & Von Neumann said "*The detector/meter is part of the system.*"

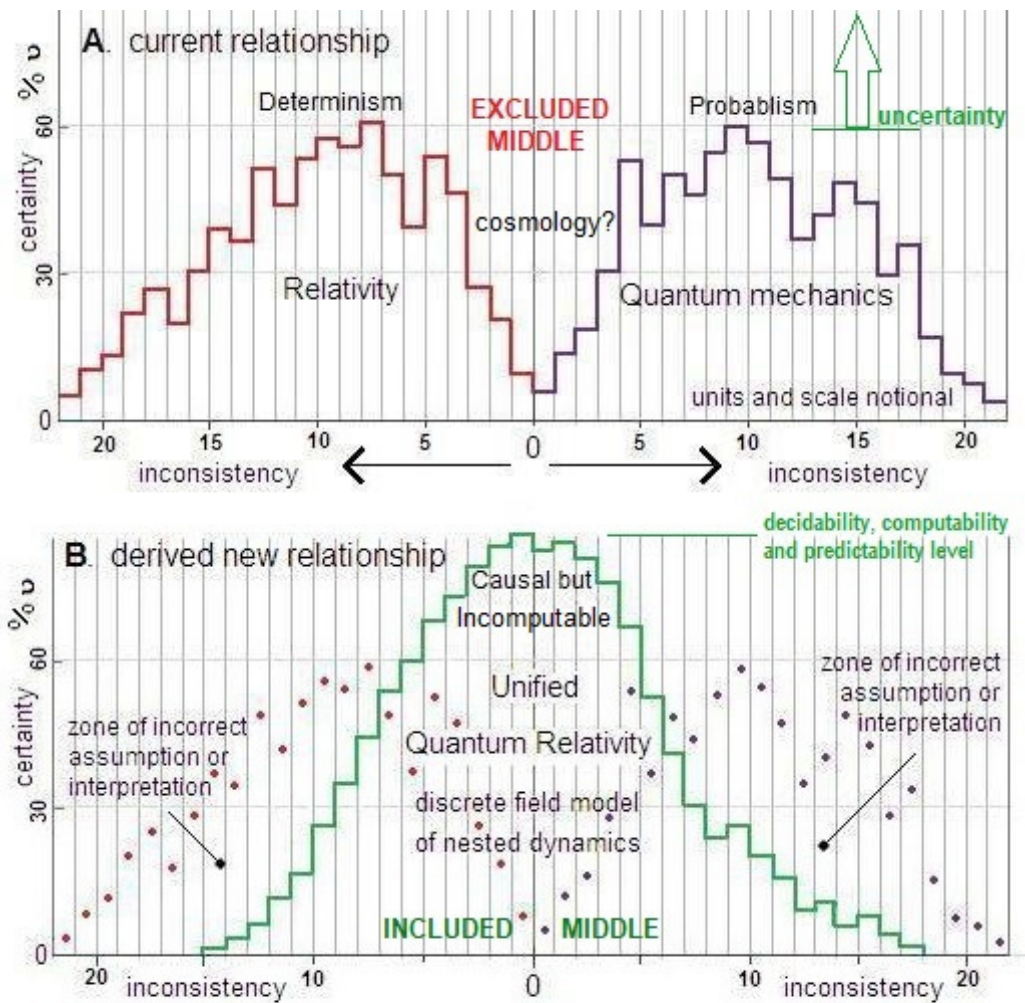
We now focus on interactions - at some tangent point with a 'latitude angle'  $\theta$ , but momentum reverses at the equator. Amplitudes are then from 1 to 0 over  $90^\circ$  then 0 to -1. Now with the 'included middle' we study momentum **distribution between** 1 and 0. We find this is a *Cosine* distribution, (as the *rotational velocities* of Earth's surface, which change by  $\cos \theta$  Latitude). But we need  $\cos^2$  not just  $\cos$ . Well the re-emitted amplitudes then undergo the same 'vector addition' at the **2nd** interactions, which then give  $\cos^2 \theta$ !

But we're not there yet. All polarity has ellipticity, so orthogonal channels get either a major or minor axis energy, only the *major* value triggers a 'click'. A *Poincare Sphere* gives these momenta, but also shows that LINEAR momentum, 1 at the equator 0 at the poles, is the **inverse** of rotation' or Maxwells 'CURL'. So the 2 are orthogonally "**superposed**", changing inversely by  $\cos\theta$ , so then  **$\cos^2 \theta$** . See Fig1 in <sup>xxvi</sup>. Click data then gives the Dirac equation, as verified by computer plot.<sup>xxvii</sup> Gaussian distribution in physics [Fig 3] may now **include** 'probabilities'.

Shockingly non-integer spins also emerge. A point P returns in just  $1/2$  a pole rotation,  $180^\circ$  with concurrent **y axis** rotation, or ('spin') 2, 3 < as *slower* y,z axis RPM. See video <sup>xxviii</sup>

Our results support Dirac's view that solutions **can't** be found in "mathematical terms" but need "*physical entities*."<sup>xxix</sup> Physicists skill in thinking beyond maths has waned. Can we recover it? Methodologies do exist. i.e. in <sup>xxvi</sup> <sup>xxx</sup>.





**Fig. 3. Overview Analysis Estimated comparison between consistency and rationality of physics theory on present and proposed foundations. PJ**

## Conclusions

Flaws in our deepest foundations, the 3 '*Laws of Thought*' underlying Philosophy, Logic & Mathematics cause paradox & uncertainties.

Revised laws can release a *flood* of new coherent & unified physical interpretations across all Physics and Cosmology and inform Logic & Philosophy.

The "*Law of the excluded middle*" gains a Gaussian *Included* middle allowing a real but sub 'matter' scale 'Higgs Condensate' medium and *all* 'action at a distance' as EM won't couple below Fermion scale. We place Dirac's similar 'cut off' between computable *meta-physical abstractions* and his *unique physical entities*.

Our high inertia system makes it hard to learn new ways to think, or explore & assess new physics, but we now *must* to advance understanding. It *was* "*to hard*" to rationalise nature, but we show it's now possible from sound foundations. *We are unique and can amaze.*

## END NOTES fqXi 2020. Undecidability, Uncomputability, and Unpredictability

**Non-linearity.** Is proposed as a universal norm, in which case 'straight' lines' or 'circles with zero ellipticity won't exist.

**Octonians.** We must consider multiple causes, so complication increases by at least the square of the number. As reality is 3D, complexity may increase by the cubic function. Quaternions are non-commutative continuous field potential functions of two compound parts, real scalar and 'imaginary' 3D vector. We suggest that the 16 symmetry sets may be a handed hierarchy, 7 (x2) rotational, 1 (x2) quasi-translational. Quaternions and Octonians may aid higher order *approximation* of the evolution of the dynamic rotations and translation of complex 3D systems

**Fuzzy Sets.** At recursive fractal scales can be equivalent to orders of approximation of "pseudo-tensors" as a useful *computational device*, but the maths is always an *approximation tool* only. We note Ervin Goldfain identified; "A close connection exists between the recently advanced concept of Fuzzy Dark Matter and Cantor Dust, a dimensional condensate created from the minimal fractal structure of spacetime near or above the Fermi scale."

[https://www.researchgate.net/publication/329698623\\_Diffusion\\_Limited\\_Aggregation\\_and\\_the\\_Spiderweb\\_Distribution\\_of\\_Dark\\_Matter\\_on\\_Galactic\\_Scales](https://www.researchgate.net/publication/329698623_Diffusion_Limited_Aggregation_and_the_Spiderweb_Distribution_of_Dark_Matter_on_Galactic_Scales)

**'Higgs Condensate'.** We've found Franck Wilczek previously coined the name for a slightly different concept; "*many Higgs particles, uniformly distributed through space, build up the Higgs condensate, which we sense as emptiness or pure vacuum. (Although individual Higgs particles are highly unstable, a uniform distribution of them is stabilized through their mutual interactions. Visible Higgs particles are disturbances above that uniform background.)*

**Mathematics.** "*There are, at present, fundamental problems in theoretical physics...(which)...will require a more drastic revision of our fundamental concepts than any that have gone before. ...these changes will be...beyond the power of human intelligence to get... by...mathematical terms. (and we must try to find and) ...interpret...in terms of physical entities.*" Paul Dirac. (PRS 1931 A133,60);

The discrete field model (DFM) suggests slightly less drastic revisions, and also suggests an initial physical architecture on which to base modified mathematics. It also does indeed test intelligence and in particular physical dynamic visualisation skills.

Dirac also proposed the 'ether' should be 're-introduced', but not one modulating light speed, so as our 'Higgs Condensate' of smaller scale particles. "...a new picture of the ether that will conform to our present idea of quantum theory." SciAm, May 1963, (45).

**Previous Theory** identified.

**George Stokes** 'dragged Ether' theory was conceptually similar, but assumed 'aether', as a modulator of EM propagation speed. Stokes also didn't find the 'boundary' transition zones Einstein later identified as crucial, and observer inertial frame confusion in spinning glass disc experiments wrongly discredited his concept.

**Edward H Dowdy**, ex NASA scientist 'Extinction shift' theory is are conceptually consistent with our model. Dowdy's 1990's model similarly identified the same mechanism modulating local c but his gravity derivation was quite different.

**Robert Dicke**, prior to finding more, including 'dark', matter in space than assumed in a good approximation; "added a scalar field to SR tensor field; using the small perturbation term  $h_{\mu\nu}$ , arbitrary constant  $G_0$  for Newtonian gravity and the Minkowski metric tensor  $\eta_{\mu\nu}$  giving;

$$h_{\mu\nu}(x) = \eta_{\mu\nu}(G_0, x) - E(x)G_0\eta_{\mu\nu}$$

Time of evolution of interaction due to non zero motion and time =  $6.3 \times 10^{-24}$ s at c for the classic electron radius. Actual rotation of optical axis due to asymmetry of charge also dependent on particle density, velocity, and harmonics, equivalent to Fresnel's 'n', only obtainable experimentally.

**Spaces.** 3D physical bounded spaces in motion render 'space-time' and 'wire frame' Cartesian systems inadequate modeling tools. Yet we agree Minkowski; "*Everywhere there is substance*". (1906).

- <sup>i</sup> Jackson, P.A. The Intelligent Bit. 2013. FQXi Competition Essay. May 2013. Acad.Edu. 3629453 v2  
<http://fqxi.org/community/forum/topic/1775>
- <sup>ii</sup> Zadeh, L. Fuzzy Sets. INFORMATION AND CONTROL 8, 1965, pp338--353.
- <sup>iii</sup> Jackson, P. Ridiculous Simplicity fqXi 2018. DOI: 10.13140/RG.2.2.15008.89609  
<https://fqxi.org/community/forum/topic/3012>
- <sup>iv</sup> Bell, J.S. 'Speakable and Unspeakable in Quantum Mechanics'. Camb. Press, 1987. p 171-175 & p.27.
- <sup>v</sup> Dirac. P. The Relation between Mathematics and Physics Lecture delivered on presentation of the JAMES SCOTT prize, Feb. 6, Proceedings of the Royal Soc (Edinburgh) Vol. 59, 1938-39, Part II pp. 122-129
- <sup>vi</sup> Minkowski, J. S. Jackson, P. A. Sub-matter Higgs Condensate in Discrete Bounded Fields. Theo. Phys, Vol 4. No.2, June 2019. [www.isaacpub.org/images/PaperPDF/TP\\_100087\\_2019070910523565700.pdf](http://www.isaacpub.org/images/PaperPDF/TP_100087_2019070910523565700.pdf)
- <sup>vii</sup> Shumlak, U. Aberle C. Hakim A. Loverich J. 2-Fluid Plasma Simulation Algorithm. EPS/APS Comp. Phys.Div. Conf. 2004. [https://www.researchgate.net/publication/253755786\\_Plasma\\_Simulation\\_Algorithm\\_for\\_the\\_Two-Fluid\\_Plasma\\_Model](https://www.researchgate.net/publication/253755786_Plasma_Simulation_Algorithm_for_the_Two-Fluid_Plasma_Model)
- <sup>viii</sup> Einstein Albert, "Relativity The Special and General Theory", Notes to the Fifteenth Edition. (Appdx V). 1954
- <sup>ix</sup> Jackson. P. A., Minkowski. J. S. Resolution of Kantor and Babcock-Bergman Emission Theory Anomalies. Hadronic Journal. Issue No. 5. Vol. 35. October 2012 pp.527-556 <http://arxiv.org/abs/1307.7163>
- <sup>x</sup> Nixey, R.K. Kinetics & the Conserved Photon Particle Assumption. 2012. fqXi. Essay.  
<https://fqxi.org/community/forum/topic/1448>
- <sup>xi</sup> Jackson P. A. 2013. Optical Breakdown limit as a Mechanism for the Lorentz Transformation; Academia.Edu. 3715747 v1. May 2013. <http://vixra.org/abs/1306.0071>
- <sup>xii</sup> Lopez-Corredoira, M. Perucho, M. Kinetic power of quasars and statistical excess of MOJAVE superluminal motions. A&A 544, A56 (2012) <https://arxiv.org/abs/1206.6282>
- <sup>xiii</sup> Mathpages. 'Kinetic Reverse Refraction'. KRR  
<http://www.mathpages.com/rr/s2-08/2-08.htm> 2.8 Refraction At A Plane Boundary Between Moving Media
- <sup>xiv</sup> Pushkarev A.B., et al., VLBA observations of a rare multiple quasar imaging event caused by refraction in the interstellar medium Astronomy and Astrophysics 555 (2013) A80. <http://arxiv.org/abs/1305.6005>
- <sup>xv</sup> Kaplan, H.G., 2005. The IAU Resolutions on Astronomical Reference Systems, Time Scales, and Earth Rotation Models. USNO. Circ. No. 179. [http://aa.usno.navy.mil/publications/docs/Circular\\_179.pdf](http://aa.usno.navy.mil/publications/docs/Circular_179.pdf)
- <sup>xvi</sup> Jackson, P.A. 2012, Much Ado About Nothing. V2 FQXi Essay. Acad.Edu. 3715764 v1 Aug 2012.  
<http://fqxi.org/community/forum/topic/1330>
- <sup>xvii</sup> Nixey. R. Jackson. P. Inertial Frame Error Discovery, Stellar Aberration and Paradox Free SR Via Huygens Principle. July 2010. <http://vixra.org/abs/1007.0022>
- <sup>xviii</sup> Tauber. J. ESA Planck Mission Head. Press Statement. 2013.  
<http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=51551>
- <sup>xix</sup> Parra, F.I., Barnes, M., Catto, P.J. Sources of intrinsic rotation in the low flow ordering RPCtr. Th.Phys. Ox. CCFE. N.Fusion 2011. <http://arxiv.org/pdf/1102.4613.pdf>
- <sup>xx</sup> Lei Huang., Roman V. Shcherbakov., Faraday conversion and rotation in uniformly magnetized relativistic plasmas Monthly Notices of the Royal Astronomical Society Volume 416, Issue 4, Oct. 2011.  
<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2966.2011.19207.x/full>
- <sup>xxi</sup> Jackson, P.A. Minkowski, J.S. A Cyclic model of Galaxy Evolution, with Bars. HJ. Vol.36 No 6. 2013 pp.633-676. [www.academia.edu/6655261/A\\_CYCLIC\\_MODEL\\_OF\\_GALAXY\\_EVOLUTION\\_WITH\\_BARS](http://www.academia.edu/6655261/A_CYCLIC_MODEL_OF_GALAXY_EVOLUTION_WITH_BARS)
- <sup>xxii</sup> Rees, M., Cosmic Jets., 1985. NASA. Goddard Space Flight Center 19th International Cosmic Ray Conference. Vol. 9 17 p (SEE N86-31483 22-93) <http://adsabs.harvard.edu/full/1985ICRC....9....1R>
- <sup>xxiii</sup> Mersini Haughton, L. Backreaction of Hawking Radiation on a Gravitationally Collapsing Star I: Black Holes? PLB30496 Phys Lett B, 16 September 2014 [arxiv.org/abs/arXiv:1406.1525](http://arxiv.org/abs/arXiv:1406.1525)
- <sup>xxiv</sup> Time Dependent Redshift. You Tube VIDEO. PJ. [http://youtu.be/KPsCp\\_S4cUs](http://youtu.be/KPsCp_S4cUs) (3.3.2015)
- <sup>xxv</sup> Jackson. P.A. 2015 FQXi Essay Contest; The Red/Green Sock Trick. Can Mathematics Demystify Nature?  
<http://fqxi.org/community/forum/category/31424?sort=community>
- <sup>xxvi</sup> Jackson. P. Classical Quantum Consciousness. fqxi. Jan. 2017. <https://fqxi.org/community/forum/topic/2755>
- <sup>xxvii</sup> Trail. D.A. A Fundamental Misunderstanding. fqXi. 2018. <https://fqxi.org/community/forum/topic/3014>
- <sup>xxviii</sup> Jackson P. A. 100 sec. Video; Classic QM. & non-integer spin 2017. <https://youtu.be/WKTXNvbkhhl>
- <sup>xxix</sup> Dirac. P. A., Quantized singularities in the electromagnetic field, PRS, 1931, A133, 1-60
- <sup>xxx</sup> Baltag. A, Smets. S. (2010) Quantum Logic as Dynamic Logic. Synthese 179 (2) p. 285-306.  
[https://www.academia.edu/20705589/Quantum\\_Logic\\_as\\_a\\_Dynamic\\_Logic](https://www.academia.edu/20705589/Quantum_Logic_as_a_Dynamic_Logic)