A conversation from the edge

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Hi David, Walter, Allen and All!

This message might be the 'ground breaking' information you require to construct your models on a solid foundation. I have kept the semantics qualitative, but indicated the Genesis of the Genesis in terms of description, rather than mathematics.

The electron is indeed the cornerstone of particle physics in terms of the interface between the 'manifestation' and the (metaphysical) 'creation'.

As I have previously pointed out, in the 'real theoretical physics community', membrane physics is the 'only game in town'. Even Weinberg is 'coming around', namely because of the 'proofs' of the 'mirror dualities' at Princeton in 1996 by Greene, Aspinwall and Morrison and their subsequent applications in statistical thermodynamics (which 'proved' the Hawking thermodynamics of Black Holes).

Yet Susskind's zillions of string solutions are a 'red herring'. The problem with the original string theory were the five classes (plus gravitational supersymmetry) in 10D.
Witten's realization of the M-space (via class IIA becoming 2D from the 1D string) 'solved this' in the umbrella of M-theory, but because the underpinning principle of M-space is unknown, the zillions of solutions remained.

Using somthing called BPS states of a nonperturbative (series expansions DO NOT converge to limits) approach, however has made some good ingress in crystallising the HE-8x8 class to be the class most likely to lead to an unique solution.

The original string theory was metric dependent and so required a space-time background for the strings to move in.
Removing the 'singularity' of the Big Bang by 'Planck-smearing' however indicated that the strings themselves should be the space-time they are moving in.

This then led to a synthesis of sorts between the old string theory and the quantum loops of Smolin and Ashtekar's 'parallel vector transport'. Many people think that those models compete against each other, but they actually converge in the ideas underpinning the formalisms.

BUT the 'underpinning principle' of M-space is still missing and it is this which 'frustrates' the pundits. They KNOW that M-theory is 'right' and that the 'Unified Field' contains the 'branes' both AS space-time and the transformations of energy and matter contained therein.

The KEY to M-theory is the self-transformation of the five classes and an ALREADY present super-symmetry (there are NO SUSY particles as such).

The basic dilemma is the baryon- and lepton-genesis immediately following the Big Bang (Weinberg's 3 minutes say).
Postulating the energy of the Big Bang to derive from a dispersing Mass seed (say the 5 pounds of Alan Guth) has led to the matter-antimatter symmetry (as both have positive mass content).
This then becomes a bosonic (GUT) super-force termed the X-AntiX-Boson coupling to matter and antimatter respectively to then (under the appropriate temperature evolution) decay into fermionic neutrons, protons, electrons and their antimatter counterparts.

Then of course the asymmetry between matter and the (naturally non-observed) antimatter becomes a dilemma and the photon-baryon ratio (1:1 billion) is invoked to allow pair-annihilation to eliminate the antimatter with a slight matter excess.

And from this then the standard cosmology continues in nuclosynthesis and the formation of matter agglomerations under the thermodynamic arrow of entropy and so on.

This then is the standard cosmology and it is just about 100% correct in terms of the temperature background, the so called CMBBR.
But it is fundamentally 'flawed' in its presumptions about the Big Bang mass seed.

There was no X-AntiX-Boson coupling, but there was the XL-superstring, namely class HO32 at an energy of so $2x10^{15}$ GeV reduced in a factor of 5000 from the Planck-String of so 10^{19} GeV.

The pundits do not know this (or have not yet published); but this heterotic brane energy is the unification force, which split Gravity from the yet unified StrongElectroWeak super-force at that energy.
To experimentally probe this energy, the boson temperature is so $2x10^{28}$ K for a cross-section of 10^{-31} meters.

But knowing this, now allows this XL-string to bifurcate into two fermionic parts - one which would later (under utility of the electroweak decoupling of the Higgs template at about $3x10^{15}$ K) become the quark-X-fermion and the other the lepton-L-fermion.

So where is the antimatter?

There is none, because the decoupling of the XL-string derived from a non-massive 'Goldstone Bosonic' super-coupling between the 'higher' string classes. {The order in energy is: I=Planck; IIB=Monopole; HO32=XL; IIA=CosmicRay; HE64=Weyl}.

This 'higherD' string coupling is bounded by the INHERENT SUPERSYMMETRY, previously mentioned.
This inherent super-symmetry is defined BEFORE the strings became classified and it is massless in the Goldstone Bosons of the preBig Bang and so are part of the Inflation-Scenario, which lasted from Planck-Time to Weyl-Time (about 10^{-44}-10^{-31} seconds).

The Planck-Time classifies class I and so the Planck-Boson as a Goldstone Boson to be self-coupled to its anti-Goldstone state. Those two states define the modular duality between the so called 'vibratory high energy high frequency short lambda' and the 'winded low energy low frequency large lambda' self-states in then 'photonic energy'.

The question is however where did the UNDIFFERENTIATED Planck-String come from?
The Planck-String itself emerged from the primordial Genesis-Boson (you might term it the real 'God-Particle' and not Lederman's Higgs Boson).
The Genesis Boson is defined in an 'algorithmic' temperature of so $7x10^{37}$ K at so $7x10^{24}$ GeV in NOSPACETIME - that is BEFORE the Planck-Boson allowed the emergence of space-time-matter parameters.

To understand from where this Genesis-Boson came from requires not theoretical physics or convoluted mathematics, but the 'Consciousness existing without space-time'.
So this becomes a 'philosophical' and 'spiritual' quest in allowing the 'After the space-time Fact' to be as one with the 'Before the space-time Fact'.

It suffices to say here, that the Genesis-Boson is defined from 'algorithmic constants' and series, which underpin the cosmogenesis, such as the five classes of superstrings (mapped onto 'quasiperiodic' five folded symmetries such as the pentagon and the Platonic solids).

So what happened to 'create' the Planck-string?

You both should like this - there was a Goldstone Super-symmetry between two self-states, which can be understood as nonmass coupled Photonic Radiation and Antiradiation.
Today, the photon is its own antiparticle with either polarity and say defined in

Maxwell vectors and Bose-Einstein statistics.

BEFORE the Planck-Time, there existed a right-polarized Gauge Photon and a left- polarized Antiphoton as forms of the Genesis-Boson. The simple sinusoidal circular waveform connecting the two flipped polarity at the halfway point (180 degrees in a radially and so space independent formulation).
The dynamics (in ALGORITHMIC NOSPACE) so set up a 'Standing Wave' akin the Infinity-Symbol with self inflection nodes at 0, 180 and 360 degrees.
This vector dynamics was completely super-symmetric with all dynamical parameters of energy and momentum (as defined today in space-time-matter) conserved.
EITHER only ONE Infinity symbol is traced by the Standing Wave by a MUTUAL INFLECTION at the 180 degree node in a multicyclicity;
OR the ONE Infinity symbol is supplemented by infinite extension (of the number line) in the 180 degree or pi-radian intervals of the sinX waveform beginning at the 0 node and the sin(-X)=-sinX waveform beginning at the MIRRORED 360 degree node.

This of course also becomes the self-state of the universe in the Standard Model preceding the Big Bang as the singularity.

Then the super-symmetry BROKE in say the left node at 0 degrees NOT inflecting towards negative infinity BUT RETRACING the path of sinX in clockwise chirality LIKE the 360 degree node, which DID inflect AS sinX.

So now a GREAT VIOLATION of symmetry has occurred, as two clockwise angular momentum vectors are required to become balanced or REHARMONIZED or RENORMALISED by a double-spinning anticlockwise vector.
This is the Birth of the Graviton from the foundations of string theory by Schwarz and Green and Witten.

Ok now the templates of the Photon-Antiphoton gauges crystallize.

The original Photon was right-polarized and remains right-polarized in its inflection at the 360 node.
The original Antiphoton was left-polarized but in NOT inflecting at the 0 node, also became right-polarized AND SO CAN BECOME SUPPRESSED in favor of a NEW CREATION (namely the fermions from the bosons in the inherent super-symmetry).

But we are not there yet.
The right-handed photon gauge and the right-handed antiphoton gauge are now harmonized with the double left-handed graviton.

{To picture this- simply plot the graph sin(3x/2)-cos(3x/4) as a function f(x). The

sine wave represents the right-handed photon moving to the right and the cosine wave represents the graviton moving to the left with the antiphoton suppressed}.

The important point of those gauges is that they are COLOURCHARGED. This is the reason for the strong nuclear forces of the gluons and the quarks deriving from the so called Higgs Template, which contains all of the gauges in the colour charges in SU3 unitary symmetry.

A normal (mass produced by the acceleration of Coulombic ELECTRIC Charges) photon is NOT color charged and therefore IT becomes its own antistate particle.

Ok, some 'nitty gritty'. The suppressed antiphoton gauge has its color charges 'mirrored' (Parity or P-symmetry) in those of the expressed photon gauge. The former is mathematically labeled in the permutation state BGR=GRB=RBG; whilst the latter is RGB=GBR=BRG. These two states are anticyclic relative to each other in Quantum Relativity.

So this should allow you to visualize or perceive the Goldstone Eigenstate of the Universe before the Planck-Time (setting the initial and boundary conditions for the material universe to emerge from following Inflation in the Quantum Big Bang).

You have 'three' gauges RGB-photonic(spin+1), BGR-antiphotonic(spin+1) and BGR-gravitonic(spin-2) interacting to form the Goldstone Cosmogony.
Now the quantum spins cancel, but one of the BGR's is now in excess, so demanding another harmonization to conserve the supe-rsymmetry.

Now 'mixing' color charges, say in superposing trisected 120-degree areas of a circular partition will give RGB(+1)+BGR(-1)=MGGM(0)=CRRC(0)=YBBY(0)=VPE(0) with the quark-antiquark definition of the Mesons say in color-anticolor triplets (Red-Cyan; Green-Magenta; Blue-Yellow). Vortex-Potential-Energy is the label for the VPE of the mixing of the wave-functions of the color charges and is equivalent to the ZPE of a 'Virtual Heisenberg Background matrix of energy say.
Three colors or anticolors (in equal proportions) will give a 'pure' radiative White ($E=hf$) or a 'pure' massive Black ($E=mc^2$) eigenstate and any color-anticolor doublet will do the same.
This becomes the observed and measured 'appearance and disappearance' of the subatomic particles in the Unitary Symmetries.

Ok so the photon and the graviton would neutralize into the VPE(0), if the graviton would have the spin of the original antiphoton.
It does not but replaces it in the BGR template.

The original antiphoton actually carried an RGB(-1) template inflected to BGR(+1) at the 180 node and then REFUSED or LASUFERED (anyone get the

hint to Ezekiel.28.14-18&Isaiah.14.12-14); but on Purpose (otherwise the Gravity of the 'Grave' and NO physical universe could have emerged from the super-symmetry of the gauges); to mirror the inflection of the RGB(+1) to BGR(-1) to RGB(+1) cyclicity of the gauge photon.

So another NEW template must be 'created' or emerge from the NATURE of the 'Genesis-Boson'.
We require an RGB(0) as the spins are conserved and this then is known today as the Gluon gauge.
Now we can SUPPRESS both the Antiphoton BGR(-1) and the Gluon RGB(0) in the VPE(-1)=ZPE(-1) BUT NOT in spin.

Now I did not mention what happened at the original RGB(+1)+RGB(-1) color charge mixing; the one which 'created' the Infinity symbol.
Analysis will show you; that the 60- and 120 degree points will create an YCM(+1-1) template, which one can term Matter YCM(0) and the 240-and 300 degree points will make the Antimatter MCY(0).

The dilemma with the scalar (spinless) Gluon now ALLOWS or INDUCES the HIGGS BOSON to assume its Goldstone precursor selfstate as HB (0) as a doubled- or squared {because $x^2=2x$ for unique solution x=2} YYCCMM(0) selfstate for matter and as MMCCYY(0) for antimatter to become defined.

So now we have 6 particle template gauges interacting:
Photon RGB(+1)+Antiphoton BGR(+1)+Graviton BGR(-2)+Gluon RGB(0)+HB YYCCMM(0)+HB MMCCYY(0)
The two RGB+BRG and the HB-AntiHB all reduce to the VPE(0); EXCEPT the nonspinning Gluon cannot interact and must somehow become SPININDUCED.

This scenario above IS LEADING INTO THE CAUSATION of the Quantum Big Bang.

The first particle to be rendered superfluous is the AntiHiggs Boson HB MMCCYY(0).
Instead the spininduction BIFURCATES the HB YYCCMM(0) into TWO YCM(+1)+YCM(-1) FERMIONIC SUSY-Strings.

This sets up the 'Dark-Matter' Gauge of the RMP YYCCMM(0) in a DINEUTRONIC self-state
2{YCM(+1/2)+YCM(-1/2)}=NEUTRONIUM (as Gamow's primordial YLEM matter).

As can be seen - NO antimatter is necessary, but the super-symmetry derives from the (later to emerge) Parity violation of the weak interaction coupled to the weakons as mass-and spin-induced Higgs-Bosons.

The cosmogony has now entered the Planck-Energy realm except for the missing template for the still outstanding spin induction of the Gluon gauge.

We have the matter gauges in the form of a BOSONIC NEUTRONIUM (which is Parity violated because of the definitions of the L-Boson string in ordinary beta decay and the HB mass induction - yet to occur).
So the matter templates YCM(halfspin) become COUPLED to the Graviton BGR(-2) in their inherent super-symmetry in the SUPPRESSION of the Antiphoton BGR(+1) in the colour charge template BGR and the Antiphoton's suppression allowing the MASS-Inertia Induction to occur in the SPININDUCTION of the HB YYCCMM(0) as a WEAKON YYCCMM(+1).

{The weakon for antimatter MCY (half-spin) is of course MMCCYY(-1) and as characterized by say the well studied beta plus decay}.

Here then is the KEY. The Spin Induction of the HB YYCCMM(0) as a W-YYCCMM(+1) simulates the GLUON's spin induction as a RGB(+1) then requiring the original 'Dark Matter' template RMP=Rest-Mass-Photon YYCCMM(0) to assume the opposite spin-state for the OVERALL SUPERSYMMETRY to hold.

Then the total 'Unified Gauge Field' becomes:

1) Photon-Gauge RGB(+1) in long range Electro-Gravitational unification with the Graviton-Gauge BGR(-2)
and where the Graviton is coupled to the SUPPRESSED Antiphoton-Gauge BGR(+1) in color charges but so becomes spin harmonized and as GravitoWeak coupling.

2) Gluon-Gauge RGB(+1) now harmonizes with the color charge of the Gauge-Photon in Electro-Strong coupling and couples as nuclear short range interaction to the RMP-Gauge YYCCMM(-1) in the 'Consciousness Unification' of the VPE=ZPE and so by and through the Weakon gauge definitions.

3) The Unified Field is established in conservation of spin momentum and color charge mixing and NOW the ENERGISATION of the Quantum Big Bang from its string hierarchical Goldstone Precursors can become implemented.

This 'Energization' renders Parts of the ZPE=VPE Goldstone Boson (or Higgs) Energy as manifesting in the NEUTRONIUM 2{YCM(+1/2)+YCM(-1/2)} and as a simple constituent of the HIGGS BOSON TEMPLATE.

<u>A detailed description of the common beta minus decay of the standard neutron serves as an example for the unification physics of the gauges</u>
The neutron has a dud quark configuration and transforms into a proton of quark content udu in interacting through a gauge weakon in the short range weak

interaction.
Note here, that I have written the 'super-symmetric' versions in a linear notation.

In particular the neutron d(-1/2).u(+1/2).d(-1/2) must have this basic (no internal gluon energy-momentum distribution) to have a resultant left-handed (-1/2) quantum spin momentum.

It is understood, that ONLY left-handed hyperons (including nucleons) engage the weak interaction in the phenomenon of weak parity violation discovered officially in 1957 by Lee and Yang.
The linear alignment is defined in a color (or gluon) charged magnetoaxis which then can 'loop onto itself' as a quark-ring of the form -d.u.d.- , say within a spherical template or envelope about the quarks, gluons and gauges (all defined in HUP wave-functions and not some mechanistic billiard ball-spring model often found in popular literature (wikipedia, SciAm etc.)).

The interacting weakon for matter is called Wminus (W^-) and has a quantum-waveform encompassed in a spheroidal envelope. It is a bosonic gauge of quantum spin (+1) and is 'made up' (and as known from its experimentally observed decay-product) of an electron (+1/2) with its antineutrino (+1/2).

The old neutron is linearly (read magnetically) 'super-symmetric' because the d-quark in the linear arrangement is 'asymptotically confined' by the size of the envelope, which happens to be the scale of the 'classical electron' in QFT, and the range of the nuclear interactions itself at about 3 fermi. This is also the 'size' of the strange quark as a resonance of the d-quark.

The 'super-symmetry' so allows (one of the endpoint) d-quarks to oscillate to its (higher) s-quark energy level and to INTERACT at that level with the weakon.

Were the linear quark content of the form UDD (as inappropriately depicted in the popular press); then this neutron would NOT be 'super-symmetric', as the linear arrangement would have already 'broken' that symmetry.
The quark content u.d.d exists however and is base-defined as a neutral delta in the SU(3) baryon octet and where all the quarks are spin-aligned for a total spin angular momentum of 3/2.

So one of the dud d-quarks oscillates to the energy level of the W^- and exchanges the 'leptonic ring boundary' AS the weakon's electron with the mesonic- or d-ring level of the old non-oscillating neutron.

The weakon (of the Feynman diagrams) so is 'destroyed' with its right-handed electron ABSORBING the left-handed spin of the d-quark and so neutralizing the meson-lepton ring spin-state, but EMERGING the observed right-handed (+1/2) electron antineutrino as product of beta minus decay of the neutron.
There one observes however a LEFT POLARISATION of the MATERIALIZING

electron in conjunction with the emission of the weakon defining right-handed electron antineutrino(+1/2).
So the 0-spin bosonic lepton ring (as electron precursor), becomes SPININDUCED by the gauge interaction at the kernel between the (already materialized) antineutrino and a gluon coupled to the up-quark (which was part of the transforming down-quark in:
d(charge -1/3)=KIR=Kernel(charge +2/3)+Inner Ring(charge -1)=(K+IR).
The weakon ring then is labeled OR=Outer Ring.

The +1 weakon spin so interacts 'weakly' with the -1/2 spin of the interacting down-quark (d*) to MATERIALISE first the right-handed electronic antineutrino (+1/2) coupled in strong-weak unification to a 0-spin OR and then SPININDUCES the 'virtual' weakon AS a 'real' electron in conjoin with the K=Kernel to OR gauge unification.

The 'virtuality' of the weakon gauge can be extended into a non-virtual or 'real' expression for the conservation law regarding quantum spin in the introduction of a massless Goldstone Spinor, here called the GraviPhoton or GP(±1). The GP is COLOURLESS and so does not interact with any other gauge and its derivatives in the inertia carriers of mass and the massless photon gauges produced by inertia coupled particles, such as accelerated fusion protons emitting energy as photons of electromagnetic radiation.
The conservation of quantum spin in 'virtuality' so is expressed in the form:
$W^{-}(+1) + GP(-1) \rightarrow antiv_{e}(+1/2) + e^{-}(-1/2)$

Then the 'virtual' weakon disappears into the vacuum of the HUP and leaves behind the original 'virtual' antineutrino, seemingly MATERIALISING from the neutron-proton transformation., as well as a real left-polarised electron. The GP(±1) exchanges or flips the quark spins of the linearly adjacently aligned but not weakly interacting quarks and the GP(-1) 'shares' its bosonic spin in distributing it in bifurcation to the scalar OR(0) spin and the 'left-over' quarkian u-quark kernel of th weakly interacting d-quark.
This 'flipping' also changes the cyclicity in the permutation dud* to u*du in the recentering of the linearly (but not circularly) central quark of the neutron (u) in dud to the central quark of the emergent proton (d) in udu.

The intermediate transitional energy state so becomes a magnetically aligned transformation:

neutron $\rightarrow$d(-1/2).u(+1/2).[u(0)+antineutrino(+1/2)] + OR(0)+GP(-1)+GP(±)
$\rightarrow$ u(-1/2).d(+1/2).u(-1/2) + $antiv_{e}$(+1/2) + e^{-}(-1/2)
As an alternative, this transition gauge interaction can also be expressed in the utility of diquarks, such as double-up=uu=U.

Then the transformation becomes:
neutron $\rightarrow$d(-1/2).uu(+1/2) + antineutrino(+1/2) +GP(-1)+GP(±1)
$\rightarrow$ [U(-1/2-1/2).[d(+1/2)] + $antiv_e$(+1/2) + e^-(-1/2)
$\rightarrow$u(-1/2).d(+1/2).u(-1/2) + $antiv_e$(+1/2) + e^-(-1/2).
Here then the relooping circumpasses the OR(0) , which 'disappears' with the 'virtuality' of the W^-(+1) and the spin sharing of the GP(-1) takes the form of the 'breaking up' of the diquark state U(-1/2)=uu(-1/2) into a resymmetrized linearized form as bounds for the central down-quark incorporating the quantum geometry of the kernel-ring or up-down structure of stability.

This renders the SPIN EXCHANGE as REAL from the VIRTUAL Inertia self-state, as the virtuality of the energy in inertia has become fine structured in the energy of the quantum spin distribution.
The generalized super-symmetric conservation of the quantum spin for the looped-linearised-relooped neutron so becomes:
dud(-1/2)$\rightarrow$dud*(-1/2)$\rightarrow$duu*(-1/2)$\rightarrow$u*du(-1/2)$\rightarrow$udu(-1/2)+e^-(-1/2)+$antiv_e$(+1/2).

The circularization of the magnetoaxis 'destroys' the magnetic spinfixation and temporarily allows a spin-realignment, which manifests in the beta minus decay of the neutron into its observed constituents via the weak interaction.

Here is another example and linked to a 'channeled' message from the collective subconscious of humanity.

<u>The Nature and Origin of the Dark Energy and the Cosmological Constant</u>

In Lak'ech - I am another yourself!
May a peaceful mind be with you all in this Gregorian year count 2009!
I have obtained authorization to illuminate the enigma of the dark energy and shall do so in this message.

What drives the expansion of the universe and where did this energy derive from in the first instance?

I have detailed the quantum geometric underpinning of the Big Bang Cosmogenesis with its self-generative birth of the dimensions previously.
So I shall describe the physics for this cosmo-genesis in terms of the 'large scale' classical Newtonian-Einsteinian geometry in this message.

The cause of the Big Bang was of course metaphysical and mathematical; meaning that no space, no time and no mass existed 'before' the Big Bang happened.
What did exist as 'primera causa' however, was a 'primordial materia' from which all of the space-timed universe could emerge.

Both, the primal cause and the primal energy are so by nature independent upon the manifestation of the universe in its parameters observed, measured and implied.

The 'prima materia' so represented 'Primal ENERGY', which could transform into the 'Caused Energy' of the Quantum Big Bang.

Many of you eschew mathematics and the abstractionism it represents as a language.
Now 'Lingua Mathimatica' is just that, a language, universal in scope and applicability and so your phobias are not insurmountable.
Your distaste for symbolisms of one kind can easily become translated into a semiotik of another kind.
But then many of you eschew the metaphysical representation of mythology as well and yet another translation becomes necessity.

But due to mathematics being a cosmically applicable and universal language (like music and dance for example); the concept of the 'Primal Energy'; whilst independent upon the emergent universe, nevertheless can become formulated in the famous energy relations of Einstein, Planck and Boltzmann {$E=mc^2=hf=kT$}.

1. There was a primal energy E* 'before' the beginning of time, which upon 'emerging', DEFINED the concepts of time, space, mass, etc.

2. All parameters whatsoever are interrelated in the primal energy E*; but existed in metaphysical-abstract form, before they emerged to create the observable universe using E* as the universal source of energy.

3. There is so necessarily a discrepancy between the 'source energy reservoir defined in quantum form by E*' and the 'source energy transformed' to create the physicalized universe in space-time-matter.

4. As the 'Source-Energy-Reservoir' or SER can be defined abstractly; it can also be defined as INFINITE mathematically, say as asymptotic approach of the infinite within the finite. The omega interval [0,1] is finite as binary boundary, but contains an infinite number count of the rationals as extension of the Integers (and Naturals) of the applied mathematical procedures (the inversion identity under associativity and distribution say).

5. This SER then transforms its self- or eigenstate from the infinite 'no observable 'real' universe' potential to a finite 'a real physical measurable universe' potential, using E*.

6. The infinite energy of the SE so becomes finitized across a dimensional quantum boundary, through which it must 'tunnel' to manifest its finiteness.

7. This 'tunneling' becomes effectualized in creating a 'quantum fluctuation', aka a metaphysical discrepancy in the energy formulations defining E*.

8. A particular E*-eigenstate summation before tunneling so can be used to describe this then 'dimensionally reduced' self-state integral after tunneling. This dimensional reduction is then modeled as a decrease in SE, say in an Energy-Gradient defined in the quantum laws given as metaphysical aka mathematical precursors $\{E=mc^2=hf=kT\}$.

9. The particular eigenstate before tunneling is defined in the dynamics of a de Broglie MATTERWAVE, associated with the concept of quantum-driven inflation. This inflation is also metaphysical and uses the 'dimensionally increased' self-state to render the metaphysical definition a physical definition in the 'dimensionally reduced' eigenstate.

10. It so becomes the universe to be a dimensionally nested universe and as prerequisite to carry both, the nature of the 'unreal' metaphysical-mathematical and the nature of the real physical. The dimensional divide so can also be described as a mapping between 'mirror spaces'.

11. The de Broglie matter-wave so defines a higher dimensional universal envelope (HDU) about the lower dimensional universe (LDU), and with a scale-displacement boundary R_{Hubble} say.
Both the HDU and the LDU are defined in the SE E* in quantum terminology; but the LDU utilises the NATURAL LAWS based upon the transformations embodied in $\{E=mc^2=hf=kT\}$; whereas the HDU uses the latter in the formal sense of the metaphysics aka the mathematical abstractions.

12. The HDU 'inflates' in NOW-Time aka the Instanton to set a boundary for the LDU to 'expand into' in a 'inflated' THEN-Time aka the linearized light-path time t=x/c, and where displacement X relates to the light-speed invariant 'c'.

13. In the HDU 'c' is not invariant, but forms the antistate for its invariance in the LDU.
Particularly, it is defined in the de Broglie Phase-Speed of the matter-wave and with LDU 'speed' V:
$\{V_{dB}=\text{lightpath/lighttime}=(h/mV)(mc^2/h)=c^2/V>c \text{ for all } V<c\}$.

14. In terms of E* then; the de Broglie Inflaton Acceleration is:
$A_{dB}=R_{Hubble}/t^{*2} \sim 1.4x10^{87}\ (m/s^2)^*$ for $x^*=ct^*$.

15. The A_{dB} so becomes the first primordial energy parameter subject to physicalization in the 'quantum tunneling'.
To render the A_{dB} physical, a Quantum Big Bang, creating the LDU from the now manifested HDU is required.

As the A_{dB} is a metaphysical acceleration subject to the contra-invariance of light-speed 'c'; the invariance of 'c' becomes necessity for all speeds 'V' encountered in the LDU as an intrinsic limit for any acceleration.

16. Those limited velocities now become associated with both the mass content or inertia of objects moving at speeds V and their non-inertial or photonic equivalents as defined in $\{E=mc^2=hf=kT\}$.

17. From this the Equivalence Principle of Einstein's General Relativity is born and which postulates, that any gravitational field strength Gm/r^2 becomes indistinguishable from a Newtonian acceleration A_N in terms of the mass m experiencing the acceleration or the gravitational field.

18. The LDU so must have a PRIMAL Gravitational Field given in $A_N=GM/x^{*2}$ and where M is the Total Inertial Mass Content of the universe transformed from the E*-Integral to manifest the LDU in the Quantum Big Bang.

19. The equality $A_{dB}=A_N$ so would require $R_{Hubble}c^2=2GM$ and a 'fixed' total mass $M_{critical}=R_{Hubble}c^2/2G$.
This can be rewritten as $R_{Hubble}=2GM/c^2$ to crystallize the Schwarzschild metric for the Semi-HDU, so CONNECTING the HDU to the LDU across the dimensions in a physics of Black Holes.

20. The Semi-HDU derives from setting the gravitational potential equal to the VPE=Vortex-Potential Energy=Zero-Point-Energy=ZPE of E* described as a SE-Planck-Harmonic Oscillator with eigenstate:
$E_{min}*=½E*$ for $GMm*/x^{*2}=½m*c^2$.

21. A definition of $M=M_o<M_{critical}$ as a function of E*, will then ENSURE, that the reduced total inertia of the universe will manifest in a quantum tunneling in the creation of a required acceleration gradient with $A_{dB}>A_N$.

22. M becomes defined as a function of E* in: $M_o^2=\#(m_{Planck}.m_{Kernel}/m_{Ring})^2$ and where # describes the integral summation of the E* quantum eigenstate for the HDU and as mapped or transformed in a subsequent materialization of the kernel-ring boson coupling as a quark-lepton fermion coupling, characterized in the proton-electron bonding.

23. A_N then becomes defined in $A_N\sim2.0x10^{85}$ $(m/s^2)*$ and the resulting gradient is $A_N/A_{dB}=0.014$...as the DECELERATION Parameter (q_o) for the subsequently emerging cosmology.
It is also half of the ratio of the Black Hole masses described by the Schwarzschild metric in:
$M_o/M_{critical}=R_{Hubble}/R_{Sarkar}$ and where R_{Sarkar} describes the gravitational volume acting on the super-cluster scale of galaxies as the boundary for gravitational interaction for cosmic large scale homogeneity.

24. Twice the deceleration parameter so gives the actual density/critical density ratio for the cosmology as a direct consequence of the LDU-HDU interaction between the metaphysics of the pre-space-time universe and its space-timed progenitor.

25. The Newtonian acceleration ($A_{Newton}=A_{Omega}$) is also a Gravitational Field Strength GM_o/R^2 where now R describes the curvature radius or scale of the entire universe.
To accommodate the LDU in the HDU, the $A_N<A_{dB}$ must quantum tunnel in the creation event under the auspices of the boundary conditions set by the curvature metrics and simplified in the Mother Black Hole of the HDU encompassing in a dimension higher by one the LDU as a Daughter Black Hole.

26. Parametrizing the scale-factor R as a function of DIMENSIONLESS time, then allows the de Broglie acceleration to also parameterize in such fashion to self-transform back from the HDU into the LDU.

The equations are:
Dimensionless time $n=H_o.t$ for $dn/dt=H_o$ as a 'nodal' Hubble-Constant defined in $R_{Hubble}=c/H_o=r*f*/H_o$;
then $R(n)=R_{Hubble}.ASP$ and where ASP=Asymptotic Expansion Parameter = $f(n)=n/(n+1)$.

Subsequently, displacement, velocity and acceleration are parameterized as:

$R(n)=R_{Hubble}.n/(n+1)$;
$V(n)=c/(n+1^{)2}$;
$A(n)=-2cH_o/(n+1)^3$.

27. There exists so an INTRINSIC DECELERATION in the universe and a deceleration which represents the contra-action of the de Broglie inflation of the HDU in the LDU.
This intrinsic anti-inflationary deceleration is maximized as the Milgrom-Constant $A_{Mmax}=-2cH_o\sim1.127$ nanometers per second squared in (* units).

28. The DIFFERENCE between the Intrinsic Milgrom cosmic deceleration and the Newtonian-Einsteinian gravitational deceleration then defines another acceleration ($A_{DarkEnergy}=A_{Lambda}$), which becomes the EFFECT of the missing mass of the Daughter Black Hole to BE the Mother Black Hole; as well as the acceleration gradient between the de Broglie hyper-acceleration exceeding light-speed and the Newtonian-Einsteinian speed-restricted gravitational field intensity conscribing the total inertia of the universe as a whole.

29. The equation for the Dark Energy Acceleration so is:
$A_{Milgrom}=A_{Newton}+A_{DarkEnergy}$.

Normalising $A_{Intrinsic} = A_{Omega} + A_{Lambda}$ so says:
100%Intrinsic=X%Omega+Y%Lambda.

30. For a presently calculated dimensionless time parameter of n=1.1324.., $A_{Intrinsic}$ aka the Milgrom Deceleration is about $-2cH_o/2.1324^3 \sim 1.16x10^{-10}$ (m/s^2)* and reduced in a factor of so 9.7 from its maximum value at the Big Bang tunneling as the Summation Harmonic for the present n-time.

The Dark Energy component for this present NOW-Time then is about $-9.49x10^{-11}$ (m/s^2)* as the Omega is defined in $GM_o/R^2 \sim -2.13x10^{-11}$ (m/s^2)*.
In terms of accelerations then; the Dark Energy represents 81.8% of the intrinsic deceleration and the Newtonian-Einsteinian inertia component the remainder of 18.2%.

The Dark Energy was 0 in the past and shall be 0 twice more until it asymptotically approaches 0 in the infinite linear future.

The Equation for the Dark Energy can be written as a function of dimensionless cycle-time n as:

Dark Energy $\Lambda(n) = G_oM_o\sqrt{[X^n]}/R(n)^2 - 2cH_o/(n+1)^3$.

This is mathematically a geometric polynomial functional form describing the difference between the inverses of a square and a cube with roots at n_1=0.1064; n_2=9.2255 and n_3=12.2777.
As the origin of lambda is 'quantum smeared' in E* (as a Planck-Length Transform of superstring class I into the Weyl superstring class HE(8x8)); the n=0 singularity of the Big Bang becomes RESET as $t_o^*=n_o/H_o$, that is the wavelength lambda*=λ* assumes the value of $R(n_o)$ in $\Lambda_o(n_o)=G_oM_o/\lambda^{*2}$ $\sim 2.0x10^{85}$ (m/s^2)*.

This value represents the Dark Energy manifesting the Big Bang as the 'TUNNELED ZPE' across the dimensional boundary between the HDU and the LDU, materializing the latter in the Planck-Weyl superstring transformation.

About 1.80 Billion years later; this Dark Energy became 0 and this change in gradient instigated GALAXY FORMATION at a cosmological redshift of z=2.15. Previously, the immense POSITIVE Dark Energy had established a Quasar-Wall for this subsequent galactic nexus point at a z=7.477.

The Dark Energy attained its absolute minimum value at a z=1.19 and almost 4 billion years after the singularity at n_o. This epoch is well measured in the LDU as the 'Peak of the Galaxy Formation' in the cosmic evolution.
The Dark Energy is NEGATIVE between the roots n_1 and n_2 (or the period between 1.8 and 156.0 billion years after creation) and so characterizes a period of the DARK MATTER.

The Dark Energy will be POSITIVE again between the roots n_2 and n_3 (or the period between 156.0 and 207.5 billion years), then describing a period of the LIGHT MATTER.

After the n_3 zero-point, the Dark Energy will coast asymptotically towards 0 again from a Dark Matter perspective; one can then term the GREY MATTER interval and containing a local minimum for the Dark Energy at the 337 billion year marker as about 0.00012 nanometers per second squared.

The Dark Matter epoch results in inertia measurements, which are insufficient to account for the dynamical behavior of the cosmic macro-systems, such as galaxies and group-galaxies in their interaction of translational and rotational parameters. The LAMBDA here ADDS to the OMEGA to give the MILGROM. Conversely, the Light Matter epoch seems to indicate, that there is too much mass about to match the electromagnetic 'light parameter' observations. The LAMBDA here SUBTRACTS from the OMEGA to yield the MILGROM INTRINSICATOR.

In the equation above; the factor $\sqrt{[X^n]}$ depicts the mass evolution of the baryonic mass-seedling M_o over linear time $t=n/H_o$ and defines a Planck-'stringed' Newtonian gravitational constant G_o for the string-parametric unification of electromagnetism with gravitation. This unification demands the Unity $G_o.k=1$ and where $k=1/4\pi\varepsilon_o$ as the SI-Coulomb constant. Stoney-Units coupled to Planck-Units in the √Alpha factor then allow the unification of electropolic charge 'e' with 'G_o' via the monopole string class IIB coupling to the Planck string class I.
As this unification ocurs in the string epoch of the inflation and with duration from the Planck-Time $t_{Planck}=L_{Planck}/c$ to the Weyl-Time t*; Newton's Gravitational constant becomes modified after inflation in a fine-structure $G(n)m_o^2=G_oX^n$ $m_1m_2Y^n=G_oX^n\, m_1Y^k\, m_2Y^{n-k}$ = constant and for the Euler identity $XY=X+Y=i^2=-1=e^{i\pi}$.

Taking the geometric mean for the M_o-seedling then yields the approximation $G_oX^nM_o\sqrt{Y^n}=G_oM_o\sqrt{X^n}$ used as the appropriate mean or average.
The Dark Energy equation above, so takes the mass evolution of the baryon seed M_o into account and the functional form for Λ(n) becomes the one described and is applicable for the LDU.

One can omit this mass-evolution for the HDU and consider the product G_oM_o constant over linear time.
Then the Dark Energy equation simplifies and is:

Dark Energy $\Lambda(n) = G_oM_o/R(n)^2 - 2cH_o/(n+1)^3$.

The derivative $\Lambda'(n) = -2G_oM_o\, R'(n)/R(n)^3 + 6cH_o/(n+1)^4 = 6cH_o/(n+1)^4 - 2G_oM_o$

$H_o^2(n+1)/c^2n^3$
Then the absolute minimum for Λ'(n)=0 and for n=0.2389... becomes:
$\Lambda(0.2389) = 2.12319...x10^{-10} - 5.92482...x10^{-10} = -3.80163...x10^{-10}$ (m/s^2)*.

The roots for Λ(n)=0 are calculated via $2c^3/G_oM_oH_o=(n+1)^5/n^2$ as $n_1=0.10823...$ and $n_2=3.40055...$
This corresponds then to the Dark Energy beginning at the very high positive value of $2x10^{85}$ (m/s^2)* at the instanton and reaching its first zero for the galaxy formation in the HDU after 1.83 billion years.
This process of galaxy formation then peaks at the minimum so 4.04 billion years after the Big Bang and in tandem with the galaxy evolution in the LDU and peaking (0.2389..-0.2352..=0.0037) or so 62.5 million years earlier.

The Dark Matter epoch begins 1.83 billion years after the instanton-inflaton and ends so 3.4 cycles afterwards at a 'oscillation coordinate' of $3.4R_{Hubble}$ or about 57.5 billion years.

For the present time then, the HDU-LDU cosmo-evolutionary coupling has; and due to the light-speed expansion of the HDU compared to the inertia slowing of the LDU; diverged in the factor $D(n)=\sqrt{X^n}$ and which calculates as $D(n_{present}=1.1324..)=0.7615...$
This divergence increases over linear time with the oscillatory HDU encompassing the asymptotic LDU.

The Dark Energy, as a 'bookkeeper', so 'fades out' by the D(n) factor over linear time in the LDU with the MILGROM diminishing slower than the OMEGA.

This 'account-keeping' of the 'Dark Energy' 'solves' Edward Witten's 'dilemma' and 'his most troublesome professional observation'.

Einstein was right after all of having made a blunder, which wasn't a blunder. The Cosmological can be defined as in this paper, but OVERALL it is ZERO, just as Ed Witten wishes for in M-Theory.
An interview with him, stating this is reproduced below from the 'stringsite website'
http://www.superstringtheory.com/people/witten.html

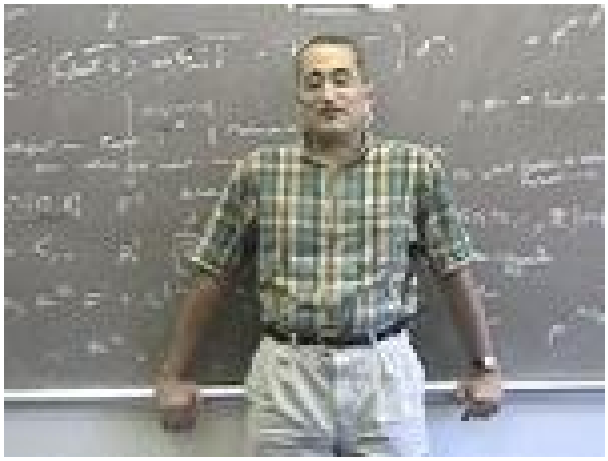
Excerpt Quote: "
Why is it so hard to break super-symmetry in string theory?
Well, if I knew the answer, if I knew how Nature has done super-symmetry breaking, then I could tell you why humans had such trouble figuring it out. But I can say one thing about it. When super-symmetry is not broken, it's easy to get a zero cosmological constant in string theory. And although a zero cosmological constant might not be the truth, it's incredibly close to the truth. If you break super-symmetry, if you do it the wrong way, you're going to get a cosmological constant that's much too big, and then you may well get associated problems,

such as instabilities, runaways and so on. So it's easy to find ways that string theory could break supersymmetry, but they all have bad consequences. So I assume we're missing something, which is the answer to your question.
How can the cosmological constant be so close to zero but not zero?

I really don't know. It's very perplexing that astronomical observations seem to show that there is a cosmological constant. It's definitely the most troublesome, for my interests, definitely the most troublesome, observation in physics in my lifetime. In my career that is." End of Quote.

Ed Witten on M theory, supersymmetry and appreciating calculus

Ed Witten, who is currently visiting Caltech, is a professor at the Institute for Advanced Study in Princeton, New Jersey (the place where Einstein used to work.) Witten was not one of the creators of string theory, but since he joined "Team String" in the mid-eighties, he's been a leading visionary, pausing here and there to make revolutionary observations and discoveries in mathematics using observations gleaned from high energy theoretical physics. He recently spent two years at Caltech, a development that had East Coast string theorists fearing that the United States was tilting to the West. We interviewed him in John Schwarz's office at Caltech, which also happened to Richard Feynman's office when he was alive.



What's the current answer to the question, "What is string theory?"
Well, we've understood somehow that there's a more unified picture that mixes up quantum mechanical effects controlled by hbar and string effects controlled by alpha prime. So, there's this M theory story where different string theories are mixed up by dualities. I can't claim that we've gotten to the bottom of it, though.

What is M theory?
M theory is a name for a more unified theory that has the different string theories, as we know them, as limits, and which also can reduce, under appropriate conditions, to eleven-dimensional supergravity. There's this picture that we all

have to draw where different string theories are limits of this M theory, where M stands for Magic, Mystery or Matrix, but it also sometimes is seen as standing for Murky, because the truth about M theory is Murky. And the different limits, where the main parameter simplifies, give the different string theories -- Type IIA, Type IIB, Type I, and there's eleven-dimensional supergravity, which turns out to be an important limit even though it isn't part of the systematic perturbation expansion, then there's the E8XE8 heterotic string, and there's SO(32) heterotic string.

So M-theory is a name for this picture, this more general picture that will generate the different limits through the different string theories. The parameters in this picture we can think of being roughly hbar, which is Planck's constant, and that determines how important the quantum effects are, and the other parameter is alpha prime, which is the tension, related to the tension of the string, that determines how important stringy effects are. So traditionally, a physicist looking at Type IIA, for example, by traditional weak coupling methods, explores this little region, and if asked how his theory is related to Type I theory, the answer would have to be, "Well I don't know, that's something else."
And likewise, if you ask this observer what happens for strong coupling, the traditional answer was, "Well I don't know." In graduate courses, you learn that you can do more or less anything for weak coupling, but you can't do anything for strong coupling. What happened in the 90s was that we learned how to do a little bit for strong coupling, and it turned out that the answer is Type IIA at strong coupling turns out to be Type I in a slightly different limit, SO(32) heterotic, and so on. So we built up this more unified picture, but we still don't understand what it means

What is K theory and what does it mean for string theory?
K theory is a mathematical theory that studies topology using matrices, using operators that don't commute with each another. What topology is, first of all, is the branch of mathematics where you don't care about the shape, so for example, a lumpy ball is equivalent to a round ball. But if there are holes, you do care about that, so a donut is different from either of these two. So, mathematicians learned, around 1960, that there was a very powerful tool in topology based on matrices, and that tool was K theory. And since quantum mechanics is about non-commuting operators, or matrices, there has always been a kind of naive analogy between K theory and quantum mechanics. An analogy that seemed naive to most physicists, but was often drawn by mathematicians such as Michael Atiyah.
However, we learned in the last few years that some questions about string theory, but slightly specialized questions usually, are usefully addressed using K theory. What K theory really addresses is a little bit subtle to explain. If you want to understand the charges carried by the D-branes, that's a question that leads to K theory. Or I might say at an even more basic level, D-branes are these strange objects whose positions are measured by matrices, and studying those matrices leads to K theory.
So K theory is the sort of topological underpinning of D-brane theory. But as

physicists we're interested very much in whether the ball is round or lumpy, as are different things in physics. We wouldn't want to play baseball with a lumpy ball. So, the topology is just one side of the story..

What is noncommutative geometry and why is it important in string theory?
Well, one thing which we know about for sure in string theory is that the ordinary classical ideas about geometry are approximations, and don't really work precisely. But what you should really replace them with is not clear. However, there's a naive ideas about strings which really only works for open strings. Open strings are strings with endpoints, like in the original Type I superstring, where a particle was represented by a piece of string with charges at the ends. I've labeled the charges as q and q-bar for quark and antiquark, but that's modern terminology that might not have been present in the early says of string theory. Once you've got open strings, they can join together, I'm going to call my open strings A or B, and they join end to end. But there are two ways of joining them. I could join them with A on the left and B on the right, or I could join them with B on the left and A on the right, and I get two different outputs. And it's very much like taking two matrices A and B and multiplying them together. So there's some noncommutativity in the interactions.
And when you take account of the fact that string theory is all about geometry, somehow this is geometry where noncommutative objects are built in. In fact I've mentioned now a couple portions of it. There's the noncommutativity of joining strings, and there's the matrices that don't commute, which are related to K theory and also to the D-brane positions and so on.
Anyway, coming back here, you can try to systematically describe open string physics at least in terms of noncommutative ideas introduced in geometry,and you can get a general answer of some kind, but it's rather abstract and very hard to use. However, in the last couple of years, it was discovered that there's a certain limit with a very strong background magnetic field in which things simplify, and you can actually say something simple and useful based on the noncommutative geometry. That's a case where the rather abstract and hard to use noncommutative geometrical concepts actually come down to Earth and become useful.

Why is it so hard to break supersymmetry in string theory?
Well, if I knew the answer, if I knew how Nature has done supersymmetry breaking, then I could tell you why humans had such trouble figuring it out. But I can say one thing about it. When supersymmetry is not broken, it's easy to get a zero cosmological constant in string theory. And although a zero cosmological constant might not be the truth, it's incredibly close to the truth. If you break supersymmetry, if you do it the wrong way, you're going to get a cosmological constant that's much too big, and then you may well get associated problems, such as instabilities, runaways and so on. So it's easy to find ways that string theory could break supersymmetry, but they all have bad consequences. So I assume we're missing something, which is the answer to your question.

How can the cosmological constant be so close to zero but not zero?
I really don't know. It's very perplexing that astronomical observations seem to show that there is a cosmological constant. It's definitely the most troublesome, for my interests, definitely the most troublesome, observation in physics in my lifetime. In my career that is.
What has been the most surprising or interesting thing that you have learned in physics?
I'm going to interpret the question to be what's the most interesting thing I've learned in my career, whether I discovered it or not. It's something I've learned, perhaps through the work of other people or from textbooks. So in that sense, the most surprising thing I've learned, even though I had nothing to do with discovering it, is that strings can describe quantum gravity.

What has been the most surprising or interesting thing that you have learned in science outside of physics?
Well it's not that amazing that to me, a lot of science is physics. So, for example, I can't give you an answer in terms of chemistry, because physics underlies chemistry. I could give you an answer in biology. Biologists have learned lots of wonderful things. But it's hard to properly maintain one's sense of wonder about them, for some things that were known so long that we all remember so little that we take them for granted. But there's the theory of evolution, which is an amazing insight. And there's the understanding of the genetic code, that's a marvelous insight.
Of course, if we move on to math, which you might think isn't physics, but which is much closer to what I know, then there are lot's of fun and exciting things there. I hardly know what to tell you because, again, there are lots of things that are really wonderful but which we take for granted because it's all known. Like there's calculus. Calculus is pretty amazing.
But... it's not the first thing that comes to mind in answering such a question, because such a question tends to make you think of more recent discoveries. But... if I just have to ask , of everything I've ever learned in math, what's the most amazing and surprising -- it might by that calculus should win the prize, even though it's not so new any more.

End of Interview

But in the HDU, the Dark Energy asymptotically approaches the limiting Einstein Lambda in the form of:

COSMOLOGICAL CONSTANT

$$\Lambda(n\rightarrow\infty)=\Lambda_{\infty}=G_oM_o/R_{Hubble}^2=7.894940144...x10^{-12}\ (m/s^2)^*.$$

This represents 0.705% of the maximum Lambda at the instanton-inflaton.

The Dark Energy component in the HDU for this present NOW-Time so is about $8.82x10^{-11}\ (m/s^2)^*$ as the Omega is defined in $GM_o/R^2 \sim 2.80x10^{-11}\ (m/s^2)^*$.

In terms of accelerations then; the Dark Energy represents 76.0% of the intrinsic deceleration and the Newtonian-Einsteinian inertia component the remainder of 24.0%.

The percentages for the Dark Energy in the LDU and the HDU so are: (Omega[LDU,HDU],Lambda[LDU,HDU]) = ([24.0;18.8],[76.0;81.6]) and for an arithmetic mean or average of [21.4;78.8].

In terms of the Dark Energy magnitude differential $|\Lambda_{present}-\Lambda_{\infty}|/|\Lambda_{\infty}|\sim 123.9/7.9\sim 15.7$ and INCREASED in a factor of about 15.8 relative to the boundary- and initial condition of $|\Lambda_{BigBang}-\Lambda_{\infty}|/|\Lambda_{\infty}|\sim 0.993$.
$|\Lambda_{BigBang}-\Lambda_{present}|/|\Lambda_{present}|\sim 10.7$, meaning that the Dark Energy deviates in a factor of 10.8 from the boundary condition as applicable in the HDU.

The HDU occupies a 4-dimensional volume as a toroidalized Riemann Hypersphere, curvature radius R(n) with the boundary of a 3-dimensional surface in $V_4=½\pi^2R^4$ and $dV_4/dR=2\pi^2R^3$ representing this boundary condition geometrically.
The HDU then 'oscillates' as a Standing Wave in between the Hubble-Nodes and 'envelopes' the LDU, which expands asymptotically from the 0-node of the Big Bang to the 1-node maximized in $R_{Hubble}=c/H_o$.

The Volumar-ratio between the LDU and the HDU so becomes a DIM-Factor: $DIM(n) = 2\pi^2R(n)^3/n.2\pi^2R_{Hubble}{}^3=n^2/(n+1)^3$ and for a $DIM(n_{present})=0.132..=1/7.561..$

There are so 7.56 LDU's within the HDU at the present time and the initialising Baryon-Seed M_o has INCREASED in the inverse (as XY=1) of the factor $D(n_{present})=0.7615=1/1.313$ by so 31.3%.
There must so be a Dark Matter component coupled to the Baryon seed, which has grown from 2.8% to 2.8x1.313~3.676% and which PROJECTS the 'evolved' baryonic matter in the LDU into the HUD.

This Dark Matter component is then 3.676%x(DIM-1)~24.12% and for a total inertia content in the LDU of 27.79%.

This volumarised OMEGA then implies a volumarized LAMBDA of 72.21% in cosmological measurements and analysis undertaken by the observers and experimenters within the LDU's reference frame.

The Dark Energy so IS the ZPE; however NOT characterized by the continuous creation of particle-antiparticle pairings as postulated in the Heisenberg Uncertainty Principle and related derivations.

As there was NO Antimatter created in the Big Bang, the particular antistates of Antimatter all reside in the HDU and only materialize physically when the process

of pair-creation is called for via the basic transformation laws of the quantum $\{E=mc^2=hf=kT\}$.

The Dark Energy, as the Einstein-Lambda though finds itself in a CONSTANT HARMONIC DANCE with Newton's Omega to ensure the continuation and contingency of all the total energy content in the FINITY of the LDU and which had emerged as FINETUNED part of the INFINITY of the HDU as part of the SOURCE ENERGY SE - quantum defined in E*.

31. The Dark Energy can so be defined in its quantum eigenstate as a NONINERTIAL 'particle' associated with the space-time creation of the HDU enveloping the LDU.
The Dark Energy so is 'higher dimensional' and links to the properties of the HDU as it is defined from first principle and without any matter or mass; the latter depicting energy transforms via $\{E=mc^2=hf=kT\}$.

32. The Dark Energy is that part of the ZPE background, required to CLOSE the universe in the higher dimensions, namely to render the entire physically finite universe as a higher dimensional Black Hole Mother.

33.Why then are the galactic subsystems not so affected? Why do star systems and solar systems not directly supply experimental and observational evidence for the Dark Energy?

The Dark Energy is omnipresent as the ZPE; but manifests on the scale of the quantum systems themselves.
Therefore, the cellular units of macroscale galaxies are prerequisite to MAP the cellular units of microscale galaxies, called 'the units of life' in biology and 'the units of atoms' in physics and chemistry.

All observations in physics, astronomy and cosmology are bound in the nature of light, of electromagnetic radiation and therefore the tools of spectroscopy and optical interference patterns, such as emission spectra and absorption spectra.

And the Dark Energy is right there in the observations relating to the measured phenomena using light and other forms of electromagnetic radiation as information processors.

The Dark Energy, in the quantum eigenstate is embedded in SPACE as a form of HYBRID energy between the inertial objects observed and measured and the intrinsic PHOTONIC form which defined them through and by the superstring transforms given in $\{E=mc^2=hf=kT\}$.

The SE defined ITSELF in the omnipresent parameter of E* and its own inverse is used to define the Dark Energy as that part of the SE, which not only connects the LDU to the HDU as the metaphysical reality manifested at the Null Point of

the Singularity; but also to connect that FINITE NULLPOINT to the INFINITE NULLPOINT.
34. So the Dark Energy becomes FINITE within the HDU, but remains INFINITE as the hyper-metaphysics of the space-time-matterless scenario, where even the HDU does not exist, but in THOUGHT.

35. So now you know where the Dark Energy manifests itself and where it itself came from.
Dark Energy is the IMAGINARY SOURCEENERGY 'out of space and time', which yet IS all of space and time and everything in it.
So it is IMAGINARY no longer - it manifests physically in the material universe, including all the electromagnetic radiation therein.
Albeit it remains IMAGINARY in the PRIMORDIAL ENERGY-form of your THOUGHTS and your IMAGE-MAKINGS from stonetools to computer chips and satellites.

But it can and has been rigorously defined in quantum relativity as the 'Particle of Consciousness', being the 'Inversion Identity' of E* itself aka the Rest-Mass-Photon as a 'Standing Wave' spanning the entire universe, yet seemingly confined to what you term your personal space, your brainy minds or whatever.

So the Dark Energy relates to the greater beingness of all of you; you as individuated body-forms are naught but the LDU seeking to 'go home' to become the HDU once again.

Remembrance is required; and the harmonization between your electric and your magnetic parts, directly engaged with the SE - but that is another story and much has been given already.

But know this - E* is the quantum progenitor for the manifested universe of physics AND E* is the metaphysical definition for the latter.
The physics cannot exist without the metaphysics and the metaphysics represents the shadow parts of you all.

<u>Four Metric Ages for the Universe in the Cosmology of Membranes</u>

The Age of the Universe is metric dependent. One might ask certain questions, like "How old is he Universe" and this is a very good question at the core of all cosmology.
Analysis shows, that there are four different metrics and so there are four ages and four sizes for your universe and depending on one's viewpoint of observation.
If measured from WITHIN the inertia defined Hubble Horizon in a 10D-string universe, the universe has the volume of a sphere, but measured from in between that Hubble Horizon in 10D and its 11D-membrane universe, this volume transforms into a special toroidal shape, like a doughnut without as hole.

This then gives the volume $\mathbf{V_{10}^{+}=2\pi^2R_{max}^3[n/(n+1)]^3}$ for an inertial doughnut age of 8.96 billion years or a 15.03 billion year spherical age. These are the *Actual Inertial Ages* for the universe as envelopes or upper bounds and these are not the ages as measured by scientists as the natural philosophers.
The transformation factor between the "doughnut without a hole" and the sphere is the upper bounded *Chaos Constant* known as the *Feigenbaum-Delta*: $\mathbf{\sigma_{Fmax}=3\pi/2}$.

Should one measure the universe from a position of OUTSIDE this 11-D WittenMirror-spacetime say in 12D-VafaMirror spacetime however, the volume increases due to the 4-dimensional seed activated by the 3-dimensional seed. Technically the surface on which the far away mirror exists becomes a 3-dimensional mirror just as the location of a local surface mirror can be postulated to exist on the inside of a spherical 2-dimensional mirror much farther away and as 'seen at a distance'.
Then the outside of this 2D-mirror surface changes from a spherical surface to a doughnut surface, remaining however 2-dimensional, albeit in transition to 3D, obtained in the asymptotic approach of the 2D-surface towards the 3D-surface. In other words, the 'Image' as seen in the 'far away mirror' INTERSECTS its own lightpath X=cT and between the mass parametric lower-D spacetime and the electromagnetically defined higher-D spacetime.
Outside the far away mirror in the 12-D-Vafa spacetime then the surface topology is 4-dimensional as the orthogonal vector nR_{max} in the expression $\mathbf{dV_{11}^{+}=S.dR=2\pi^2R_{max}^3dR}$
from $\mathbf{V_4=½\pi^2R^4}$ and $\mathbf{dV_4/dR=2\pi^2R^3}$

The extra-3D-volume so becomes: $\mathbf{V_{11}^{+}=n^32\pi^2R_{max}^3}$ and is measured relative to the inside in 10D as an age of 32.04 billion years, but relative to the outside in 11D as 19.11 billion years. These are the *Actual Electromagnetic Ages* for the universe.

The *Measured Ages* for the universe are however lower, than the *Actual Ages*, because of the intersection of the 3rd dimension with the 4th dimension.

If the critical volume is defined as $\mathbf{V_{critical}=2\pi^2R_{max}^3}$, then the extra 3D volume expanding as a 4D volume seed will be $\mathbf{V_{11}^{-}= n.V_{critical}}$ and as reduced from $\mathbf{V_{11}^{+}=n^3.V_{critical}}$

The *Measured Electromagnetic Age* for your universe then is 17.62 billion doughnut years and 29.53 billion sphere years.

The following expressions must hold and define the multivolumes in labels, which can then become reinterpreted in the form of 'missing energy' and 'missing mass'. Many cosmologists in your universe term this the search for 'dark energy' and 'dark matter' respectively.

Multidimension Factor: $\mathbf{DIM = V_{11}^{+}/V_{10}^{+} = V_{11}^{-}/V_{10}^{-}}$

Dark Matter Factor: $\mathbf{DIM_{DM} = V_{11}^{-} / V_{10}^{+} = (n+1)^3/n^2 \sim 7.561}$ **(for $n=n_{present}$)**
Dark Energy Factor: $\mathbf{DIM_{DE} = V_{11}^{+} / V_{10}^{-} = (n+1)^3.n^2 \sim 12.434}$ **(for $n=n_{present}$)**

One so must have a reduced 3-dimensional inertial volume V_{10}^{-}, which is given by $\mathbf{V_{10}^{-} = (n/[n+1]^3) 2\pi^2 R_{max}^3}$ and provides a doughnut age of 8.26 billion years and the age measured by the astrophysicist, namely 13.85 billion years as the *Measured Inertial Ages* for the universe.

Comprehensively then, the universe is experiencing an ongoing transformation in its cosmological evolution.

Hi David and all!

I have stumbled across Juan Maldacena's 'The Illusion of Gravity' paper from SciAm; November 2005 and found the following statement at the end of the paper p.63.
The link is below.

A test of this prediction comes from the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory, which has been colliding gold nuclei at very high energies. A preliminary analysis of these experiments indicates the collisions are creating a fluid with very low viscosity. Even though Son and his co-workers studied a simplified version of chromodynamics, they seem to have come up with a property that is shared by the real world. Does this mean that RHIC is creating small five-dimensional black holes? It is really too early to tell, both experimentally and theoretically. (Even if so, there is nothing to fear from these tiny black holes-they evaporate almost as fast as they are formed, and they "live" in five dimensions, not in our own four-dimensional world.)

Many questions about the holographic theories remain to be answered.

In particular, does anything similar hold for a universe like ours in place of the anti-de Sitter space?

A crucial aspect of anti-de Sitter space is that it has a boundary where time is well
defined.

The boundary has existed and will exist forever. An expanding universe, like ours, that comes from a big bang does not have such a well-behaved boundary.

Consequently, it is not clear how to define a holographic theory for our universe; there is no convenient place to put the hologram.

An important lesson that one can draw from the holographic conjecture, however, is that quantum gravity, which has perplexed some of the best minds on the planet for decades, can be very simple when viewed in terms of the right variables. Let's hope we will soon find a simple description for the big bang!

Wow, David as one who kind of understands what I have posted over the years; can you see that the de Broglie Inflaton I am writing about SOLVES the Maldacena problem highlighted above.
This hypersphere HAS the FIXED hologramic Hubble Horizon from the de Broglie Inflaton.
It IS a MASSLESS Mother-Black Hole in the AdS-CFT Kaluza-Klein space and it HAS the negative curvature due to the 'missing mass' as described as the 0.01405 deceleration parameter, which is the ACCELERATION gradient (of the false vacuum) between the Einstein Lambda and the de Broglie hyper-acceleration and so also the density ratio.

And the paper you got a little exited about just describes such color charge interactions on the 5(+6 Calabi Yau)D=11D Boundary.

This could get even bigger. I would suggest to now send the edited Genesis Genesis paper to Michio, as now Maldacena's work can be thoroughly translated into a new cosmology and the proper formalization of the quantum gravity (I'm to dumb to do it, as my university days are long in the past).

Tony

Dear friends; I'll send this now and hope that at least one of you will FINALLY understand that this description and whilst termed the 'Theory of Quantum Relativity'; is NOT 'my work'.
It belongs to ALL of Us and is and has always been a collective effort.
I am not clever enough by FAR to have 'made up', 'dreamt' or invented this description above.

All of the 'passed over' great scientists have 'channeled' this information, say from the 'collective subconscious' or the 'Noosphere' (of Teilhard de Chardin and Velikovsky) or the 'Akashic Records' or what have you to me to share.

So when the 'time is right' (it is not before 2011), THEN this 'stuff' will become 'mainstream'.
But for some purpose (which I can only partially fathom); the agenda is to publish this 'stuff' on relatively obscure forums and on an equally obscure website.
This is as is should be for the present time.
But remember, all of this data is yours, for free to do as you would like to. But without understanding most of it, it has remained practically useless for all but my

inter-dimensional familiars (they DO have a lot of use for it - that is why I am publishing it).

I have been given the information that perhaps some of you can use the above cosmogony to finally remember THIS as one of your 'Cosmic Keys' and let the 'pennies drop' and the 'lights of eureka' switch on.

I'll edit and resend shortly.

It is time for a few of you to RETRACE your incarnational steps into this place and space and time upon Gaia-Serpentina of the planet earth.
All of you were there 19.11 billion years ago, when the Quantum Big Bang occurred. You may allow yourselves, reading the above, to remember IT.

In Science and Gnosis

Tony

JS: You are 'missing' the time factor in this Allen.
The Graviton emerges, yes, but not in spacetime. It emerges as the gauge for the entire notion of gravitation to be able to couple to the other gauges.
The Graviton is a supersymmetrizing 'particle' not as some particle in space, but as a Principle of Identity.
This emergence is BEFORE there exists any spacetime. It is the CIRCULAR distance independent 'PointCircle' aka singularity or whatever.
The universe EXISTS in QUANTUM SPIN BEFORE it exists in Inertia.
This is Jim's 'famous Action' (I agree with him on this, but not on his querks and whatever which are fundamentally 'flawed').
Finally, today it can and has been 'proven' that no gamma ray of sufficient mass energy can Particle-Produce the matter-antimatter coupling of an electron-positron pair UNLESS there is a 'nucleus' say a proton present.
Why is this?
Because the NOT color charged gamma photon must EXCHANGE color charges with the color charged gauge photon (termed virtual) of the electromagnetic interaction.
This is basic standard nuclear physics Allen (not the color charge interaction, but the phenomenon).
The entire interaction then ABSORBS the colorless gamma photon in virtuality and the Color charges of BOTH the Graviton and the gauge photon become transferred to the resulting electron-positron pair.
This is very beautiful interaction gauge physics and will in a few years be the standard model.
So without the color charge of the graviton from the proton's inertia say; the phenomenon of pair-production (wiki it) would not occur.
Hope this helps.

JS

Light-Rock:
Ok, lemme think more.
My pre-conditioning though comes from "mass-induction" vs. "place" vs. "effect of gravity" vs. "effect of distance".
Maybe I am missing "photon" (that way)... First...
Or maybe not...
"Graviton" seems 'totally unnecessary' if it is a 'particle'. Extra calculation need not doing...
Its purpose is "there" already inherent, doesn't need manifesting. - to that effect.
"Identity" IS all this ALREADY.
A 'graviton' would perhaps have to be characterize-able as "an identity giver" and I don't think it is.
So I think its mission is already stated before "the model gets there".
I'm just "SURE", for whatever variety of reasons this is so.

Hi Allen!
Its edited in the Genesis of Genesis post.
You do not have to 'kill' the Graviton and your thought processes here are more to do what 'you don't like' (because you self-conditioned your perceptions on it in reading the 'popular, say wiki' stuff on it).
The VPE=Vortex-Potentia l-Energy and IS identical to the ZPE, but more penetrative.
The VPE is (what Mac has called the original bifurcation, but then he gets lost in his models of the cosmologies) the GAUGE physics I have indicated.
The energy from it are the magnetocharges as the 'higherD' energy materializing in the $E=mc^2$ of physics.
But it is not the $E=mc^2$ which is fundamental, but its string precursor, which manifests as the inverse of the magnetocharge aka color charge energy.
And the Graviton is just as crucial to all of this as the REPLACEMENT of the suppressed antiphoton. The absolute primal thing is the Gauge-Photon as the Quantum Ruling God.
JS

Hi Tony,
I missed something, right here:
---------- --------- --------
Ok so the photon and the graviton would neutralise into the VPE(0), if the graviton would have the spin of the original antiphoton.
It does not but replaces it in the BGR template.
---------- --------- --------- --------- --------- --------- -
What's "VPE"? Can you re-do this one paragraph?
I am trying to TOTALLY kill the graviton, and suggest it must more lucidly manifest as part of the Higgs Boson (thing).
imho - that one part they are after is "wrong".

Although you have suggested where these things "comes from" cosmologically, I think that one part in practice must fail (when it all gets "there").
I don't deny your leading up to that point, just right AT that point where the word Graviton happens, I suggest must be kabork.
Or I'm not reading you exactly right, RIGHT at that spot.

From: light_rock@yahoo.com
It is not for lack of trying for quite a few years now that I have come to all this "craziness".
:)

David M. Rountree <ghost_hunter_ 01@comcast. net>
LOL ok, so maybe I was a little premature. I figured someone would chime in.
:)
On Behalf Of Allen Francom
Still counting...
:)

David M. Rountree <ghost_hunter_ 01@comcast. net>
As you say, we will have to wait and see. I figure about half a day on that one....
:)

On Behalf Of Allen Francom
You are aware...
The stringy people have YET to make an electron ?
(last I checked, last year)
The "answer space" produces a range of over 250,000 choices.
So it is "in there somewhere" they way.
That is not very deterministic, and evidently not functional at the quantum scale.
So I hold, that do "do it right" they are going to have to change shoes and do string theory a bit more from the inside out.
Starting with electron, and running the squiggley backwards.
Work out the kinks. Debugging. In that fashion.
So far they have "nice squiggley"
But... it seems "useless" compared to The Standard Model.
Currently.
What is space... Idealistic geometry, or "an effect" emerging from quantum behavior.
I could say "Choose"...
But I think it would be better to just say "wait and see".
The Higgs will not be a particle, it will be a process, and it will incorporate the purpose of the graviton.
This is going to screw everyone up and it is going to kick general relativity in the

pants really really hard. (Not that it is wrong, just "not really done yet")
It too, needs to go inside out and backwards to be fully debugged.
"Distance" is the problem, the exact "how".
The Quantum Rules.

Hi David!
This article should elucidate the nature of the ZPE in conjoin what I have posted.
1. General Relativity is based on the Equivalence of the Gravitational Field Strength and Acceleration (Newton's Inertia F=ma and the 'Weight' of something).
2. The ZPE is based on a NONKINETIC Temperature as Energy and so linking nonkinetic Temperature (Hawking Radiation) to Acceleration to the Gravitational Field. This becomes the effect of the Black Hole physics of the Goldstone Bosons being massless inertially but being gravitationally 'massive'.
3. Quantum Gravity so relates General Relativity via ACCELERATION (not velocity or displacement) to the ZPE
4. This Acceleration is ANGULAR (space awareness df/dt) as defined in Quantum Relativity and so unifies 1.2.3.
5. All MASS has an electromagnetic origin (as shown by Haisch and Rueda in this article).
6. This electromagnetic origin is NOT classical in the Maxwell sense, but quantum in the form of supermembrane theory in nonlocality (quantum entangled holographically say).

Tony

What is the origin of mass? You would think physicists long ago figured out the answer to so straightforward a question. After all, they have deduced what the Universe was like in its first split-second of its existence - and that must have be an incomparably harder nut to crack. Appearances, however, can be deceptive. The embarrassing truth is that, at the beginning of the 21st century, one of nature's best kept secrets remains the origin of mass. Remarkably, nobody knows why it is difficult to budge a loaded fridge or pick up a heavy bag of shopping.

Not only is the question of the origin of mass hard to answer, it is also open to interpretation. Just as US President Clinton said "I did not have sex with that woman" and qualified it with "it all depends on what you mean by sex", physicists ask "What is the origin of mass?" and qualify it with "it depends what you mean by mass". Several distinct characteristics are in fact commonly associated with mass - two familiar and everyday, and one a little more esoteric.

The three types of masses

The most obvious characteristic of massive bodies is that it takes an effort to get them moving. Think how hard it is to get a broken-down car rolling. Part of the reason is of course the need to overcome the friction between the tyres and the road. But, even if there were no such force - say, the car was standing on a perfectly shiny ice rink - it would still take an effort to get the car moving.

As Galileo first realized, all bodies have a curious in-built resistance to having their motion changed in any way. Bodies which are stationary want to stay stationary; bodies which are moving want to remain moving. On Earth this is not at all obvious because frictional forces always act to slow a body down. A car whose engine cuts out, for instance, travels only a short distance before grinding to a halt. In the empty vacuum of space, however, the tendency of moving bodies to keep on moving is very apparent. Newton distilled this idea into his first law of motion, which states: "A body remains in a state of rest or uniform motion in a straight line unless acted upon by an external force."

This stubborn opposition of mass to any attempt to change its motion is attributed to a property called "inertia". Every time we try to budge a fridge and it stubbornly opposes our efforts, physicists say we are encountering the fridge's inertia. This kind of mass - "inertial mass" - is the most familiar of all forms of mass.

In addition to inertia, however, there is another familiar characteristic which people associate with mass: "weight". The weight of a bag of shopping, for instance, is actually the "force" of gravity acting on it. In everyday life we tend to use the terms weight and mass interchangeably (much to the dismay of physicists). This is possible because the force of gravity is the same everywhere on the Earth's surface so that, if one body has twice the weight of another - as shown by, say, a set of bathroom scales - we can be sure it also has twice the mass.

The fact that weight is not the same as mass but also depends on the strength of gravity was obvious to the Apollo astronauts as they bobbed about on the Moon. Although their mass was the same as on Earth, in the weaker lunar gravity their weight plummeted to a sixth of its terrestrial value.

The mass that responds to gravity is referred to by physicists as "gravitational mass". And there is something very peculiar about it, first noted by Galileo and others, though it took Einstein to recognize its true significance for penetrating the mystery of gravity. The peculiar thing is that the force of gravity experienced by a body goes up exactly in step with its inertial mass. In other words, a body with double the inertial mass of another experiences twice the force of gravity; a body with ten times the inertial mass tens times the gravity; and so on. Recall, however, that a body's resistance to being moved also goes up exactly in step with its inertial mass. Because of this, a body that is twice as hard to move as

another experiences a force of gravity twice as strong; one that is ten times as hard to move a force ten times as great. By some weird cosmic conspiracy, the effect of inertia and the effect of gravity compensate for each other perfectly. Consequently, all bodies falling under gravity pick up speed at exactly the same rate, no matter what their mass.

Galileo is said to have demonstrated this striking property of falling bodies by dropping different masses from the top of the Leaning Tower of Pisa and seeing them hit the ground simultaneously. However, it was shown beyond a doubt in 1972 when Dave Scott, commander of the Apollo 15 spacecraft, dropped a hammer and a feather together in the air-resistance-free environment of the Moon. Two simultaneous puffs of dust on the fuzzy black-and-white TV pictures were indisputable evidence that the hammer and the feather had struck the lunar surface at the same time.

Nobody knows why "gravitational mass" - which determines the gravitational force a body experiences - is the same as the inertial mass - which determines a body's resistance to being moved. Nevertheless, in 1915, Einstein was able to use this "equivalence" of gravitational mass and inertial mass as the cornerstone of his theory of gravity, the general theory of relativity.

But, in addition to gravitational mass and inertial mass, there is a third, less familiar, type of mass. This is the one physicists believe they have made the most progress in understanding. It stems from a more esoteric characteristic of matter. As well as responding to gravity and resisting attempts to change its motion, mass also behaves as a super-concentrated "knot" of "energy".

Energy is actually a slippery concept to define but it comes in many forms - for instance, heat energy, sound energy and energy of motion. If you doubt that is energy associated with motion, step into the path of a speeding bicycle - or, better still, just imagine it!. As pointed out before, one of the central characteristics of energy - first appreciated by 19th-century scientists and enshrined in the law of conservation of energy - is that energy can never be created or destroyed, merely changed from one form into another.

In 1905, Einstein surprised pretty much everyone by identifying an entirely new form of energy - the energy associated with mass. Of all the forms of energy, mass-energy is by far the most concentrated. A single gram of matter contains as much energy as is liberated by the detonation of about 10 tons of dynamite. (The precise amount of energy, E, locked inside a chunk of matter of mass, m, is given by the most famous equation in the whole of science: $E = mc^2$, where c is the speed of light) This fact would be of little consequence if the energy in matter was locked away irretrievably. However, it is not. Because one form of energy can be transformed into another, mass-energy can be converted into other forms of energy, ultimately heat energy. The awful reality of this was demonstrated in

August 1945 with the exploding of atomic bombs above the Japanese cities of Hiroshima and Nagasaki .

One of the key questions in physics is: Why does matter have the mass-energy it does? The question can be made more precise by relating it to the fundamental building blocks of all matter. These appear to be six particles called quarks and six particle called leptons, with only two types of quark and two types of leptons involved in the construction of all normal matter, including you and me. The crucial question physicists want to answer is therefore: Why do the fundamental particles have the masses they do? For instance, why does a top-quark have about a million times the mass-energy of an electron?

The origin of mass-energy

The fundamental particles of matter are believed to be "glued" together by just four fundamental forces. These are the electromagnetic force, which binds together the atoms in our bodies; the weak nuclear force and strong nuclear force, which hold sway in the ultra-tiny domain of the atomic "nucleus"; and the gravitational force, which governs the large-scale Universe of planets and stars and galaxies. All these forces are believed to arise from the exchange of "force-carrier" particles, which shuttle back and forth between the fundamental particles like microscopic tennis balls between tennis players. In the case of the electromagnetic force, for instance, the force-carrier is the photon, the humble particle of light; in the case of the strong nuclear force it is the "gluon", which comes not in one [type] but eight different types.

Having four different fundamental forces, transmitted by a legion of force-carrying particles, may appear a bit on the complicated side. And this is the consensus view of physicists. They are convinced that things were very much simpler once upon a time. What encourages them in this belief is nature's peculiar obsession with symmetry. All the fundamental laws of nature seem to be mere manifestations of deep underlying symmetries of the world - properties which remain the same when our viewpoint is changed, either in some concrete or in some abstract way. Admittedly, in today's world, some of nature's symmetries are flawed, or broken. Nevertheless, physicists believe that, in the blistering hot fireball of the big bang, symmetry reigned supreme.

The evidence for this belief rests on the observation that systems become simpler - which is synonymous with more symmetric - at higher temperatures. Ice, for instance, is not the same throughout - often it contains bubbles and flaws and fissures. However, if ice is heated until it becomes water, the non-uniformities vanish. It looks the same at every place, which is the same as saying it is more symmetric.

Similarly, physicists believe that, when the Universe was a lot hotter - as it was in the first moments of the big bang - it was a lot simpler, a lot more symmetric.

Instead of the four fundamental forces, there was a single "superforce". The fundamental forces we observe in today's Universe turn out to be mere facets of this "unified" force.

In fact, this belief is more than a qualitative, hand-waving one. As pointed out before, in the mid-1980s, at CERN, the European centre for particle research near Geneva, physicists slammed together subatomic particles with such violence that they were able to recreate for a split-second the ultra-high temperatures which existed in the fireball of the big bang. Sure enough, they observed the electromagnetic and weak forces merge together into a single, electroweak, force. Theorists have also devised "Grand unified theories", or GUTs, which predict that, at the far higher temperatures that existed at even earlier times in the big bang, all the non-gravitational forces of nature - not just the electromagnetic and weak forces - were fused together into a single force.

All this is well and good. However, there is a rather serious snag with GUTs and their prediction of the unification of the forces. The unification could have happened only if the fundamental particles had no mass!

Clearly, today's fundamental particles are not massless. Consequently, a vital jigsaw piece is missing from our picture of reality. Specifically, there must exist a mechanism by which nature bestows masses on the massless particles. Such a mechanism was in fact fleshed out in the mid-1960s by the Scots physicist Peter Higgs.

The Higgs mechanism employs the "Higgs field", a subtle and previously unsuspected feature of the vacuum. Physicists often visualize it as a kind of invisible cosmic treacle which fills all of space and sticks to particles. Since the Higgs field contains energy - which has a mass equivalent - the more treacle a particle accrues, the more massive it is. "The picture of particles accumulating some treacle is crude - but not totally misleading," says Nobel-prizewinner Frank Wilczek of the Massachusetts Institute of Technology.

The mass the Higgs field bestows on a particle is called its "rest mass". This is the mass it possesses when it is standing still and it is intrinsic to the particle. It is important to recognize this because a particle may also possess a mass by virtue of being in motion. This is apparent from Einstein's $E=mc^2$ formula, which can equally well be read from left to right as right to left. Not only is mass a form of energy - mass-energy - but energy has an equivalent mass. Since one form of energy is energy of motion, a particle has a greater mass when it is moving than when it is not.

Fields like the Higgs field, which fill all of space like a vast sea, are actually considered by physicists to be the most fundamental things in nature - even more fundamental than particles. In the modern view, the particles are nothing more than localized "excitations" - vortices if you like - in that sea. The vortex of the

Higgs field not surprisingly called the Higgs particle. In fact, there may be several different types of Higgs particle, the [precise] number depends on precisely how nature has chosen to implement the Higgs mechanism.

Particle physicists are desperate to find the Higgs particle, which is widely regarded as a missing piece of their "Standard Model" of fundamental particles and forces. Currently, all their hopes are pinned on CERN's "Large Hadron Collider" which, when completed in 2008, will be the world's most energetic particle accelerator. If the LHC finds the Higgs, the relief among physicists will be palpable. Almost certainly they will declare to every newspaper and TV station that they have found the elusive origin of mass.

However, according to Wilczek, this will be an exaggeration of the truth. "You have to be very clear about exactly what the Higgs mechanism does and does not explain," he says.

The Higgs mechanism does not in any sense "explain" the actual values of the masses of the fundamental particles. For instance, it does not explain why the top-quark has roughly a million times the mass of the electron. In the Higgs theory, the value of the mass of a particular particle depends on how well the Higgs "treacle" sticks to it. The stickiness is encapsulated in a number called a "coupling constant", which is different for each particle and, worst still, must be inserted into the theory by hand simply to make the masses come out right.

Far from shedding light on the origin of mass, the Higgs mechanism appears merely to substitute one mystery for another. Instead of having to explain the different masses of the fundamental particles, physicists must explain their different coupling constants. "I guess whether or not you call the Higgs mechanism an explanation of mass is a matter of taste," says Wilczek. "I would be inclined to say no, since it doesn't simplify the description of mass, nor suggest testable new properties of mass."

Even if the Higgs mechanism is accepted as an explanation of mass, it has another, rather embarrassing, shortcoming. It can account for hardly any of the mass of ordinary matter - that is, of you and me!

Most of the mass of ordinary matter is tied up in particles called protons and neutrons, which are found in tight clumps at the heart of atoms. The protons and neutrons are, in turn, composed of up- and down-quarks. The Higgs mechanism can certainly account for the masses of these quarks. However, the quark masses are actually very small indeed. In fact, they contribute only a tiny fraction of the mass of protons and neutrons. So, even with the Higgs, the lion's share of their mass is still unaccounted for. It must arise in some totally different way.

In fact, the missing mass arises from the gluons, which transmit nature's strong, or "color", force, and so glue together the quarks inside protons and neutrons.

The bizarre thing is that gluons actually have no mass whatsoever! Nevertheless, the color field possesses mass by virtue of the fact it contains energy, much as the magnetic field of a magnet contains energy - witness its ability to draw in metal filings. The mass of the magnetic field of even the strongest magnet is far too small to be measurable. However, the color force is enormously stronger than any conceivable magnetic force. Consequently, the mass of the color field is substantial. In fact, it can perfectly account for the missing mass of ordinary matter.

Bizarrely, then, most of mass of you and me does come not from the fundamental building blocks of our bodies. Instead, it comes from the glue that cements those building blocks together.

The inability of the Higgs mechanism to explain much of the mass of ordinary matter - or even predict the precise values of the masses of the fundamental particles - might be expected to dampen the enthusiasm of physicists. Not a bit of it, however. "A lot of hype is perpetrated about the Higgs mechanism and what it actually explains," admits Wilczek.

Without doubt, the Higgs mechanism provides a vivid and intuitive picture of how ordinary matter acquires a small portion of its mass by accumulating the cosmic treacle of the Higgs field. However, the kind of mass being talked about is, strictly speaking, the most esoteric type of all - a measure of the energy content of matter. Think of it as microscopic book keeping. If a particle at rest disintegrates, or "decays", into other particles, the total energy of these particles must always be equal to the mass-energy of the original particle.

But the energy content of mass is, of course, only one of its characteristics. Mass also opposes attempts to change its motion and reacts to gravity. Where do inertial mass and gravitational mass come from? Like most physicists, Wilczek thinks these types of mass come along, part and parcel, with mass-energy. In other words, the Higgs mechanism explains not just the energy content of mass but all aspects of mass. However, others disagree. "There is nothing in the Higgs' theory that explicitly says mass-energy should doggedly oppose all attempts to change its motion or that it should respond in any shape or form to gravity," says Bernard Haisch of the Calphysics Institute in Scotts Valley, California.

Haisch is perfectly prepared to believe that the rest mass of a particle - its mass-energy - is "explained" by the Higgs mechanism and that the rest mass is intrinsic to the particle. However, Haisch believes that the inertial mass and gravitational mass of a particle are not explained by the Higgs mechanism and are not intrinsic. If they are not intrinsic then there is only one other option. They must be "extrinsic". "In other words, they must somehow arise from the interaction between a particle and the environment through which it moves," says Haisch. "That environment can only be the 'quantum vacuum'."

The quantum vacuum

The quantum vacuum is an unavoidable consequence of two things, the first of which is the existence of fields of force. As pointed out, physicists view fundamental reality as a vast sea of such fields. In their picture, known as "quantum field theory", the fundamental particles are mere localized humps, or knots, in the underlying fields.

The best understood of all the fields, and the one with the greatest bearing on the everyday world because it glues together the atoms in our bodies - not to mention all other normal matter - is the electromagnetic field. The electromagnetic field can undulate in an infinite number of different ways, each oscillation "mode" corresponding to a wave with a different wave length . Think of the waves at sea, which can range all the way from huge, rolling waves down to tiny ripples.

Naively, the vacuum of empty space would be expected to contain no electromagnetic waves whatsoever. And this would be true but for the small matter of the Heisenberg uncertainty principle. According to the principle, every conceivable oscillation of the electromagnetic field must contain at least a minimum amount of energy. This seemingly innocuous rule has dramatic and profound implications for the vacuum because it means that each of the infinite number of possible oscillation modes of the electromagnetic field must be jittering with the minimum energy dictated by the uncertainty principle. In other words, the existence of each mode is not simply a possibility, it is a certainty. Far from being empty, the "quantum vacuum" is a fantastically choppy sea of fluctuating fields .

These quivering fields, known as "quantum", or "zero-point", fluctuations, can manifest themselves in a truly remarkable way. Recall that fundamental particles are nothing more than localized hummocks in nature's underlying fields. Consequently, the choppy sea of the vacuum is continually conjuring particles into existence like microscopic rabbits out of hats. Known as "virtual particles", they have only a fleeting existence, popping into existence for far less than the blink of an eye before popping back out again.

Haisch began thinking about the intriguing possibility that the quantum vacuum might have something to do with inertial mass in February 1991. The trigger was a talk he attended by Alfonso Rueda of California State University in Long Beach. It was about "stochastic electrodynamics".

According to the idea, first devised in the 1960s, the quantum vacuum is absolutely central to the creation of the world. Ultimately, all the bizarre "quantum" behavior of microscopic particles can be traced back to the relentless buffeting they receive from the ceaselessly churning quantum vacuum.

Sitting in the audience of Rueda's talk, Haisch had been pretty much letting it all waft over him when something Rueda said suddenly made him sit up and pay attention. Rueda mentioned an esoteric discovery made independently by two physicists in the 1970s. Paul Davies and Bill Unruh had been exploring Stephen Hawking's remarkable idea that black holes are not completely black. According to Hawking, the immense gravity close to a black hole distorts the quantum vacuum in such a way that the fleeting virtual particles can become real, fountaining out of the vacuum as permanent "Hawking radiation".

Understanding exactly how Hawking radiation arises requires knowing that, when virtual particles pop out of the vacuum, they pop out in pairs - typically an electron-positron pair. The positron is the "antiparticle" of the electron. Every subatomic particle has an associated antiparticle with opposite properties such as electrical charge. A particle and its antiparticle are always born together. Furthermore, when a particle and its antiparticle meet, they self-destruct, or "annihilate". Such creations and annihilations are the stuff of the quantum vacuum. All over space electron-positron pairs are continually winking into existence, lingering in the world for the merest of instants, then undergoing mutual annihilation and winking out again.

Close to a black hole, however, something else can happen. During the fleeting life of an electron-positron pair, one of the particles can find itself dragged through the black hole's "event horizon" - the point of no-return for in-falling matter. Since the particle outside the hole now has no partner with which to annihilate, it has no means of popping back out of existence. It has been elevated from the status of a transitory virtual particle to a real particle with a permanent existence.

All around the horizon of a black hole virtual particles from the quantum vacuum are continually being boosted to reality in this way, flying away from the hole as Hawking radiation. Of course, ultimately something must pay for their mass-energy and that something is the gravitational field of the black hole, which gradually weakens as it loses an equivalent amount of energy.

What Davies and Unruh were interested in was exactly what the Hawking radiation would look like. They concluded that an observer looking at the black hole would see radiation exactly like that which emerges from a hot furnace. In the case of a furnace, the radiation is known as "thermal" radiation and has a mix of colors determined solely by the temperature of the furnace. In the case of the black hole, the mix of colors is determined by the black hole's gravity. In some weird sense, then, a black hole's gravity gives it a "temperature." Black holes are hot!

From this unexpected discovery, Davies and Unruh made an intriguing extrapolation. Einstein had realized that gravity is indistinguishable from constant acceleration, at least in any small enough region of space. This he called "the

happiest thought of my life" and made a cornerstone of his theory of gravity. The equivalence of gravity and acceleration enabled Davies and Unruh to extend their result about Hawking radiation. Just as someone near a black hole would see heat radiation coming from the hole's vicinity with a temperature dependent on its gravity, someone accelerating through space - that is, through the quantum vacuum - would see heat radiation coming from in front of them with a temperature dependent on their acceleration.

The virtual particles popping in and out of existence in the quantum vacuum actually have a remarkable property. If an observer flies through the vacuum at constant speed - and it does not matter what that speed is, as long as it is constant - the view they see of virtual particles popping in and out of existence is the same behind them as in front of them. This means that the quantum vacuum is completely compatible with Einstein's special theory of relativity, which recognizes that all observers travelling through space at uniform speed see the world in exactly the same way.

Because the vacuum looks the same to an observer flying through it at constant speed, it effectively behaves as if it is not there. Just like the air in which we live, it has no discernible effect on us. However, Davies and Unruh's discovery that someone who accelerates through the quantum vacuum will find themselves bathed in heat shows that accelerated motion is fundamentally different from motion at constant speed. From the point of view of an accelerated observer, the vacuum is transformed into a real, detectable thing, capable of affecting them.

To Haisch, listening to Rueda's talk, this prompted an intriguing thought. "If an accelerated body sees heat coming at it from in front, that heat might apply a force which slows the body," says Haisch. "I'm an astrophysicist, you see. I'm used to the idea that heat radiation - for instance, sunlight - can exert a force on bodies such as the tiny dust particles that make up the tail of a comet."

After the talk, Haisch told Rueda his idea and Rueda said he would do some calculations. For a few months nothing happened. Then, one morning, Haisch arrived at his office at Lockheed Martin's Solar and Astrophysics Laboratory in Palo Alto to find his answer machine light flashing. "Alfonso had left a message at 3 am!" says Haisch. "He was so tremendously excited by the result of a mammoth calculation he had been doing that couldn't wait to tell me. 'I think I can explain Newton's second law of motion!' he said."

Newton's second law, postulated in 1687, is conventionally written as F = ma, where F is the force experienced by a body of mass, m, and is the acceleration that results. The law is in fact no more than a definition of inertial mass, which is defined as the ratio of the force applied to a body to the acceleration produced.

Rueda had examined in detai the electric and magnetic components of the electromagnetic radiation experienced by a body as it accelerates through the

vacuum. A magnetic field has long been known to exert a force on a moving electric charge. In fact, this is the basis of the electric motor. When an electric current - a flow of charged electrons - passes through a coil of wire placed in a magnetic field, the coil rotates on its spindle. Rueda discovered that there would be a similar force between the magnetic field experienced by an accelerating body and the moving electric charges in the atoms of the body. "And when he calculated the force he found it was exactly as required by Newton's second law," says Haisch. "A retarding force which depended on the body's acceleration. After three centuries, someone had at last explained inertia."

According to Rueda, inertial mass is not intrinsic to a body at all. It is extrinsic, bestowed on a body from outside. Specifically, it arises from the interaction between the basic building blocks of matter and the great roiling ferment of virtual particles that make up the quantum vacuum.

Haisch says he is not surprised by the idea that inertial mass is not intrinsic to a material body - that it is not a fundamental thing. He points to the fact the inertial mass is impossible to measure directly. Instead, people infer it. They take two measurable quantities - the force applied to a body and the acceleration it produces - and deduce the mass of the body from the ratio. The lot of inertial mass, Haisch believes, is to go the same way as space and time. In the wake of Einstein's special theory of relativity, both ceded their fundamental status to the speed of light. "Inertial mass is not a fundamental thing," says Haisch. "The really fundamental thing turns out to be the quantum vacuum."

If mass is not a fundamental thing, it may explain why it appears to come in so many different kinds - inertial mass, gravitational mass and rest mass, the mass associated with energy. "It simply reveals a different face depending on how it is measured," says Haisch.

So, what of the Higgs mechanism? Haisch sees no incompatibility between this and the electromagnetic interaction between a particle and the vacuum. "The Higgs mechanism explains the rest mass of subatomic particles while the vacuum interaction explains their inertial mass," he says.

Rueda agrees. "The Higgs field deposits energy, and hence rest mass, around structures we call elementary particles," he says, "The claim that this accumulated energy behaves in some way that gives such elementary particles the property of inertia is a mere hope. You need something else for that - and we think we've found it."

As pointed out, the force carrier of the electromagnetic field is the photon. At a microscopic level, therefore, the interaction between the constituent particles of matter and the quantum vacuum involves photons being exchanged between the virtual particles of the vacuum and the quarks and electrons in matter.

An electron is considered by physicists to be a truly fundamental and indivisible particle - a point-like concentration of electric charge. However, in order to obtain his F = ma result, Rueda had to assume that such an electron jitters back and forth within a characteristic volume of space. This may seem a bit of an arbitrary - not to say peculiar - assumption. However, it revives an old idea proposed by Louis de Broglie and Erwin Schrodinger, two of the pioneers of quantum theory.

De Broglie and Schrodinger were puzzled that, in experiments in which photons rebound, or "scatter", off electrons, the electrons behave exactly as if they have a particular size called the "Compton wavelength". To make sense of this, the two physicists proposed that an electron is in fact a point-like charge which jitters about randomly within a sphere of diameter the Compton wavelength. They called this trembling motion "zitterbewegung". "Alfonso and I believe De Broglie and Schrodinger were onto something with their zitterbewegung," says Haisch. "Their mistake, however, was in thinking that the motion was intrinsic to an electron. In fact, it is extrinsic - due to the random battering the point-charge receives from the jittery vacuum. In effect, this smears out the electron, making it appear as big as the Compton wavelength."

According to Haisch, it is always possible that this jittering motion could explain more than inertial mass. "A massless particle may pick up energy from the zitterbewegung, hence acquiring what we think of as rest mass," he says. "It would be a neat, tidy package. It might be possible to dispense with the Higgs mechanism altogether. It strikes me as far more elegant than an undetected Higgs field."

Piling speculation on speculation, Haisch and Rueda suspect that the interaction that produces inertia occurs preferentially at a special, "resonant", frequency. This is a frequency at which energy is most efficiently transferred from one body to another. Think of someone pushing a swing. Everyone knows there is a particular frequency - perhaps one once every 10 seconds - at which the energy in the push is most effectively transferred to the child on the swing, making it go higher and higher. This frequency of once every 10 seconds is an everyday example of a resonant frequency. Well, when Haisch and Rueda speculate that the interaction that produces inertia occurs preferentially at a resonant frequency, they speculate further that this resonant frequency is the zitterbewegung, or Compton, frequency. "If we knew what caused this resonance, we would probably be able to explain the ratio of the various quarks rest masses to the electron rest mass," says Haisch.

If, as Haisch and Rueda believe, inertial mass is a consequence of an electromagnetic interaction with the vacuum, this still cannot explain the small mass claimed for a particle such as the "neutrino". This is because it interacts via the weak nuclear force and not the electromagnetic force. "The origin of neutrino mass must be in its interaction not with the electromagnetic zero-point fields of the vacuum but with the zero-point weak fields," says Haisch.

Gravitational mass

If inertial mass does indeed have its origin in the interaction between matter and the quantum vacuum, what of gravitational mass? Well, inertial and gravitational mass are of exactly the same magnitude, an observation which is a cornerstone of general relativity. This equivalence can logically have only a limited number of possible explanations.

One is that inertial mass has a gravitational origin. This was the hope of the 19th-century Austrian philosopher Ernst Mach. He postulated that inertia of a body was the result of the combined gravity of all the objects in the Universe. The reason there is resistance when you try to stop a moving body or start a stationary body, Mach maintained, is because the stars and galaxies Universe are pulling against you!

Mach's idea appealed enormously to Einstein. He hoped that it would emerge as a natural consequence of his own theory of gravity. However, he was to be disappointed. Like everyone else, Einstein was reduced to assuming, without any understanding or proof, that matter has inertia.

Nowadays, Mach's idea has fallen out of favor, principally because it requires the Universe to react instantaneously to the acceleration of a body on Earth. However, we are pretty sure that the cosmic speed limit is set by the speed of light and that no influence, not even gravity, can act without any time delay.

A second logical possibility for the equivalence of inertial and gravitational mass is that gravitational mass has an inertial origin. In fact, this is what Einstein showed in general relativity. There is in fact no "force" of gravity. Bodies actually move under their own inertia along straight lines. The straight lines, or "geodesics", are actually in a higher, 4-dimensional, space-time and so appear to us as curves. However, even though general relativity shows that gravitational mass has an inertial origin, the theory still leaves unanswered: what is the origin of inertial mass? "Trying to coax inertia out of gravity or gravity out of inertia, you wind up with an inevitable circularity," says Haisch.

The final logical explanation for the equivalence of inertial and gravitational mass is that they share a common origin. And this is what Haisch and Rueda think. Both kinds of mass, they claim, arise from interactions of the electric charges of matter with the quantum vacuum. But, whereas Haisch and Rueda's idea of the origin of inertial mass is well developed, their idea of the origin of gravitational mass is far more speculative.

Basically, the two physicists believe, charges in a chunk of matter distort, or "polarise", the quantum vacuum in their immediate vicinity. In other words, they attract virtual particles with opposite electrical charges and repel virtual particles with similar electrical charges. This distortion of the vacuum in turn interacts with

the charges in another chunk of matter. By this roundabout means, a force of attraction arises between the two chunks. "The mechanism is so tortuous it might explain why gravity is so much weaker than the other fundamental forces of nature," says Haisch. "One mass does not pull directly on another mass but only through the intermediary of the quantum vacuum."

Haisch and Rueda's description may appear puzzling if you know anything about Einstein's theory of gravity. After all, general relativity "explains" gravity perfectly in terms of the warpage of higher dimensional space-time by matter. At first glance, this "geometrical" picture does not appear to be at all compatible with the picture of Haisch and Rueda.

However, Haisch points out that the warpage of space described by Einstein's theory is actually not directly measurable. Instead, astronomers infer it from the bending of the paths of light rays passing through space. If the light from a distant star passes close to the Sun on its way to the Earth, for instance, its path is bent by the warped space close to the Sun. "If matter distorts, or 'polarises', the quantum vacuum, this changes its ability to bend light, or its 'refractive index'," says Haisch. "The vacuum then bends the path of light just like a piece of glass does."

Haisch conjectures that the change of refractive index of the vacuum caused by the presence of matter has exactly the same effect on the paths of light rays as the warpage of space which in Einstein's theory is caused by the presence of matter. In this way, all the mathematics of general relativity remains intact since space-time, though unwarped, looks exactly as if it is warped! "I strongly suspect that the vacuum-inertia theory can be made consistent with general relativity and the warping of space-time," says Rueda. "But it is still too early to be certain."

In their latest work, Rueda and Haisch even explain why inertial mass and gravitational mass are the same. And it turns out to be remarkably straightforward. If you accelerate through the quantum vacuum, the vacuum resists your motion, which is why you have inertia. However, if you are held fixed in a gravitational field, it is the quantum vacuum that accelerates past you. "But this immediately shows that the 'mass' associated with inertia and the 'mass' associated with weight must be equal because the two situations are the same," says Haisch. "Accelerating through the quantum vacuum or having the quantum vacuum accelerate past you are the same process. Hence Einstein's principle of equivalence is neatly explained."

Perhaps the most mind-blowing consequence of gravitational and inertial mass owing their existence to the vacuum is the possibility of modifying both through modifying the vacuum. If a way could be found to change the vacuum in the right way, it might be possible to nullify mass, making an inertia-less drive that could accelerate a spaceship from a standstill to the speed of light - the cosmic speed limit - in the blink of an eye!

From the Caphysics Institute: http://www.calphysics.org/zpe.html
Quantum mechanics predicts the existence of what are usually called "zero-point' ' energies for the strong, the weak and the electromagnetic interactions, where "zero-point' ' refers to the energy of the system at temperature T=0, or the lowest quantized energy level of a quantum mechanical system. Although the term "zero-point energy" applies to all three of these interactions in nature, customarily (and hereafter in this article) it is used in reference only to the electromagnetic case.

In conventional quantum physics, the origin of zero-point energy is the Heisenberg uncertainty principle, which states that, for a moving particle such as an electron, the more precisely one measures the position, the less exact the best possible measurement of its momentum (mass times velocity), and vice versa. The least possible uncertainty of position times momentum is specified by Planck's constant, h. A parallel uncertainty exists between measurements involving time and energy (and other so-called conjugate variables in quantum mechanics). This minimum uncertainty is not due to any correctable flaws in measurement, but rather reflects an intrinsic quantum fuzziness in the very nature of energy and matter springing from the wave nature of the various quantum fields. This leads to the concept of zero-point energy.

Zero-point energy is the energy that remains when all other energy is removed from a system. This behavior is demonstrated by, for example, liquid helium. As the temperature is lowered to absolute zero, helium remains a liquid, rather than freezing to a solid, owing to the irremovable zero-point energy of its atomic motions. (Increasing the pressure to 25 atmospheres will cause helium to freeze.)
A harmonic oscillator is a useful conceptual tool in physics. Classically a harmonic oscillator, such as a mass on a spring, can always be brought to rest. However a quantum harmonic oscillator does not permit this. A residual motion will always remain due to the requirements of the Heisenberg uncertainty principle, resulting in a zero-point energy, equal to 1/2 hf, where f is the oscillation frequency.
Electromagnetic radiation can be pictured as waves flowing through space at the speed of light. The waves are not waves of anything substantive, but are ripples in a state of a theoretically defined field. However these waves do carry energy (and momentum), and each wave has a specific direction, frequency and polarization state. Each wave represents a "propagating mode of the electromagnetic field."
Each mode is equivalent to a harmonic oscillator and is thus subject to the Heisenberg uncertainty principle. From this analogy, every mode of the field must have 1/2 hf as its average minimum energy. That is a tiny amount of energy in each mode, but the number of modes is enormous, and indeed increases per unit frequency interval as the square of the frequency. The spectral energy density is determined by the density of modes times the energy per mode and

thus increases as the cube of the frequency per unit frequency per unit volume. The product of the tiny energy per mode times the huge spatial density of modes yields a very high theoretical zero-point energy density per cubic centimeter.

From this line of reasoning, quantum physics predicts that all of space must be filled with electromagnetic zero-point fluctuations (also called the zero-point field) creating a universal sea of zero-point energy. The density of this energy depends critically on where in frequency the zero-point fluctuations cease. Since space itself is thought to break up into a kind of quantum foam at a tiny distance scale called the Planck scale (10^{-33} cm), it is argued that the zero point fluctuations must cease at a corresponding Planck frequency ($_{10}{}^{43}$ Hz). If that is the case, the zero-point energy density would be 110 orders of magnitude greater than the radiant energy at the center of the Sun.

How could such an enormous energy not be wildly evident? There is one major difference between zero-point electromagnetic radiation and ordinary electromagnetic radiation. Turning again to the Heisenberg uncertainty principle one finds that the lifetime of a given zero-point photon, viewed as a wave, corresponds to an average distance traveled of only a fraction of its wavelength. Such a wave ''fragment'' is somewhat different than an ordinary plane wave and it is difficult to know how to interpret this.

Hi All!
The reason for this is, that the ZPE Electromagnetic Radiation is NOT generated by the acceleration of electric charges (say fusion protons in the sun).
This means ALL electromagnetic frequencies 'made by mass couplings' behave predictably in the Planck-spectrums say in c=wavelengthxfrequency; BUT the ZPE frequencies are de Broglie matter-wave frequencies for phase speeds $V_{dB}=(h/mv)(mc^2/h)=c^2/v>c$ *for all* $v<c$.

The ZPE frequencies so CAN simulate 'normal' frequencies, but their fractional wavelengths exhibit the 'tachyonic' nature of the de Broglie inflation phases which so also indicate the quantum nonlocality of the ZPE in the generalisation V(n)=R(n)F for a scalerelative displacement R(n) eliminating the linear time parameter t=n/Hubble Frequency in a cycle (or Now) time n.

The ZPE is generated by a kind of angular metric independent acceleration causative of the Quantum Big Bang as 'sourcesink membrane energy'.

Tony

David (cont.)

On the other hand, zero-point energy appears to have been directly measured as current noise in a resistively shunted Josephson junction by Koch, van Harlingen

and Clarke up to a frequency of about 0.6 THz

LORENTZ INVARIANCE OF THE SPECTRUM

That the spectrum of zero-point radiation has a frequency-cubed dependence is of great significance. That is the only kind of spectrum that has the property of being Lorentz invariant. The effect of motion is to Doppler shift detected electromagnetic radiation, but a frequency-cubed spectrum has the property that up- and down-shifting of the radiation is exactly compensated, i.e. there is as much radiation Doppler shifted into a given frequency interval as there is shifted out by uniform motion.

A remarkably different phenomenon occurs when accelerating through zero-point radiation. The zero-point radiation acts upon an accelerating detector as if the detector were immersed in a thermal spectrum, even though heat and temperature are not involved. The perceived "temperature' ' is directly proportional to the acceleration.

CASIMIR EFFECT

In 1947 Hendrik Casimir, once an assistant of Pauli, was working in applied industrial research at the Philips Laboratory in the Netherlands along with physicist J. T. G. Overbeek. They were analyzing the theory of van der Waals forces when Casimir had the opportunity to discuss ideas with Niels Bohr on a walk. According to Casimir, Bohr "mumbled something about zero-point energy" being relevant. This led Casimir to an analysis of zero-point energy effects in the related problem of forces between perfectly conducting parallel plates.

The cavity between such plates cannot sustain all modes of the electromagnetic field. In particular wavelengths comparable to the plate separation and longer are excluded from the region between the plates. This fact leads to the situation that there is a zero-point radiation overpressure outside the plates which acts to push the plates together. This can be considered analogous to radiation pressure (radiation pressure from the Sun pushes comet tails away from the comet nucleus), and the resulting effect is now called the Casimir force. It has the property of increasing in strength with the inverse fourth power of the plate separation. The force ceases when elements of the plates come into contact, the surface smoothness of the plates being a limiting factor, or when the plates are so close that the corresponding zero-point radiation wavelengths no longer "see" a perfectly conducting surface. The actual noncontinuous nature of the plates, as opposed to the true surface and molecular nature of the materials, becomes an important factor for very short distances.

The Casimir force was not measured to high precision until the mid 1990s, when measurements by S. Lamoreux at the University of Washington verified Casimir's predictions to within five percent in the size range of a few microns. It has since been verified even more precisely, by U. Mohideen at the University of California at Riverside, again in agreement with Casimir's formula. Moreover the Casimir force (also called Casimir effect) has become relevant to micro-electro-mechanical structures in which it is both a problem (termed "stiction") and a

possible mechanism for control.
The Casimir force is widely cited as evidence that underlying the universe there must be a sea of real zero-point energy. This argument follows from Casimir's analysis and prediction. It is not necessarily true, however. It is perfectly possible to explain the Casimir effect by taking into account the quantum-induced motions of atoms in each plate and examining the retarded potential interactions of atoms in one plate with those in the other.

The important thing to remember is the Zero Point Field is trans-dimensional, and trans-universal. It is in effect, a web that interconnects everyplace, and to a degree, everyone. It is the universal World Wide Web.

At Princeton, Zero Point Energy was measured using a giant Air Capacitor, essentially. This actually gave me my idea of building a Free Air Conductance measuring device to determine changes in the air's ability to conduct electricity. In paranormal research, this has led to some pretty interesting discoveries, such as the air increases conductance ability just prior to EVP propagation, then returns to its previous levels at the end of the propagation. This seems to be due to a flooding of ions into the environment from parts unknown.

David