Zero Point Energy Gravity Physics

Of UFOs, Star Gates, Time Travel and Parallel Brane Worlds

A Pedagogical Introduction

By
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Click on the equations to make them bigger.[1]

1. Newton's Classical Gravity Potential Theory in a Nutshell

The static near field[2] Green's function is

$$G\left(\vec{r}-\vec{r}\,'\right)\equiv\frac{-4\pi G}{\left|\vec{r}-\vec{r}\,'\right|} \tag{1.1}$$

where

$$\vec{\nabla}^2 G\left(\vec{r}-\vec{r}\,'\right)=-4\pi G\delta^3\left(\vec{r}-\vec{r}\,'\right) \tag{1.2}$$

The universal[3] attractive static gravitational potential energy $U\left(\vec{r}\right)$ per unit test particle of mass m at the field point with displacement 3-vector $\vec{r}$ [4] for source mass density $\rho\left(\vec{r}\,'\right)$ at source point $\vec{r}\,'$ is[5]

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[1] Like in Lewis Carroll's "Alice in Wonderland". ☺ Only in htm not pdf versions using MathType5. It may not work in MAC OS. Go to http://stardrive.org/math4/

[2] The dispersion relation (AKA "mass shell") $\omega\equiv 2\pi\nu=c\left|\vec{k}\right|$ for far field gravity waves is violated in the near field for frequency ν Hertz and wave 3-vector $\vec{k}\equiv\vec{p}/\hbar$. The entire $\omega-\vec{k}$ 4-space contributes to dynamic near fields, unlike the case of far field radiation. The near field is a macro-quantum coherent state of "virtual quanta" of the boson field. All Bose-Einstein condensates (BEC) are macro-quantum coherent, but not vice versa.

[3] Universality incorporates the Galilean principle of equivalence called the weak principle of equivalence in Einstein's general theory of relativity (GR). That is, all bodies fall with the same acceleration in the same place in a gravitational field.

[4] Relative to an arbitrary origin of coordinates in a global Galilean frame of reference.

$$U(\vec{r}) = \iiint G(\vec{r} - \vec{r}\,')\rho(\vec{r}\,')d^3r' = -4\pi G \iiint \frac{\rho(\vec{r}\,')}{|\vec{r} - \vec{r}\,'|} d^3r' \tag{1.3}$$

The Newtonian gravitational local Poisson equation precursor to Einstein's 1915 geometrodynamic field equation is

$$\vec{\nabla}_r^2 U(\vec{r}) = \iiint \left[\vec{\nabla}_r^2 G(\vec{r} - \vec{r}\,')\right]\rho(\vec{r}\,')d^3r' = -4\pi G \iiint \delta^3(\vec{r} - \vec{r}\,')\rho(\vec{r}\,')d^3r' = -4\pi G\rho(\vec{r}) \tag{1.4}$$

The universal force per unit test particle[6] mass field, is therefore,

$$\vec{f}_g(\vec{r}) \equiv -\vec{\nabla}U(\vec{r}) = -4\pi G \iiint \frac{\rho(\vec{r}\,')(\vec{r} - \vec{r}\,')}{|\vec{r} - \vec{r}\,'|^3} d^3r' \tag{1.5}$$

In the special case of an isolated point mass source

$$\rho(\vec{r}\,') \to M\delta^3(\vec{r}\,') \tag{1.6}$$

$$\vec{f}_g(\vec{r}) \to = -4\pi G \iiint \frac{M\delta^3(\vec{r}\,')(\vec{r} - \vec{r}\,')}{|\vec{r} - \vec{r}\,'|^3} d^3r' = -4\pi G \frac{M\vec{r}}{|\vec{r}|^3} \tag{1.7}$$

Note from equation (1.7) for a point source mass M, that taking the radial derivative gives a minus sign that is cancelled in the minus sign of the negative gradient. With this convention, one needs the – sign in the static Green's function to get an attractive force back to the source for a positive mass density.

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[5] Note that the dimensions of both sides of equation (1.3) are speed squared. The dimensions of Newton's G are 1/(mass density) x (time)^2. This is useful to commit to memory.

[6] The test particle approximation ignores direct back-reaction by the test particle on whatever is influencing it. In Bohm's realist quantum theory, the inability to clone a photon comes from treating the hidden variable as a test particle. That is, the qubit pilot field moves the hidden variable particle without the particle directly distorting the pilot field. That is the orthodox statistics of quantum theory with the linear evolution of the density matrix depends on this approximation of action without reaction. See p. 30 & Ch 14 of "The Undivided Universe" by David Bohm and Basil Hiley (Routledge, 1993) and Asher Peres "How the No-Cloning Theorem Got its Name", http://xxx.lanl.gov/abs/quant-ph/0205076

2. Einstein's General Theory of Relativity in the Galilean-Newtonian Limit

The local non-gravitational classical field[7] stress energy tensor $T_{\mu\nu}$ has the form of a general relativistic fluid

$$T_{\mu\nu} = g_{\mu\sigma} g_{\nu\varsigma} \left(\rho + \frac{p}{c^2} \right) \frac{dx^\sigma}{ds} \frac{dx^\varsigma}{ds} - p g_{\mu\nu} \tag{2.1}$$

Where ρ is the mass density and p is the pressure.[8] The trace[9] of this second rank tensor is an absolute objectively real scalar invariant, i.e. the same measurable real number for all observers in arbitrary motion relative to each other all measuring the same properties of the same events.

$$T \equiv g^{\mu\nu} T_{\mu\nu} = T^\mu_\mu = c^2 \rho - 3p \tag{2.2}$$

A key qualitative physical difference between Einstein's early 20th Century covering geometrodynamic theory of Newton's late 17th Century theory of gravity is that pressure is a local source of gravity in addition to mass density. The equation of state connects pressure to mass density. Einstein's local field equation, with zero cosmological Λ local field, can be written as

$$R_{\mu\nu} = -\frac{8\pi G}{c^4} \left(T_{\mu\nu} - \frac{1}{2} g_{\mu\nu} T \right) \tag{2.3}$$

The dominant term in the Newtonian limit is the time-time term i.e.

$$R_{00} = -\frac{8\pi G}{c^4} \left(T_{00} - \frac{1}{2} g_{00} T \right) \tag{2.4}$$

Where $g_{00} \to 1$, therefore

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[7] The Yilmaz theory, with a nonvanishing local pure classical vacuum gravity field stress-energy tensor, found implicitly in Hal Puthoff's "PV" theory, is rejected as a violation of the Einstein equivalence principle (EEP) as explained in detail by Misner, Thorne & Wheeler in "Gravitation". For this reason alone, as well as several others equally fatal, Puthoff's PV gravity claims are completely without any scientific foundation in my opinion. For the record, my remarks here should *not* be over-extrapolated and misconstrued as a blanket condemnation of Puthoff's scientific work in other more practical engineering physics fields.

[8] Pressure is defined as the diagonal elements of the 3-dim space-space stress tensor piece of the 4-dim total local stress energy tensor of non-gravitational field, here assumed isotropic for simplicity.

[9] Sum of the 4 diagonal elements.

$$R_{00} \to -\frac{8\pi G}{c^4}\left(c^2\rho - \frac{1}{2}\left(c^2\rho - 3p\right)\right) = -\frac{4\pi G}{c^4}\left(c^2\rho + 3p\right) \approx \frac{1}{c^2}\vec{\nabla}^2 U \tag{2.5}$$

Therefore, Einstein's generalization of Newton's Poisson equation in the weak field limiting approximation of large principal radii of curvature compared to the scale of the system is

$$\vec{\nabla}^2 U = -4\pi G\left(\rho + \frac{3p}{c^2}\right) \tag{2.6}$$

A positive active source density $\rho + 3p/c^2$ giving an overall minus sign on the RHS of equation (2.6) is a universally attractive gravitating source region, similarly, an overall plus sign is a universally repelling anti-gravitating source region. Note that a dipole of opposite signs of active source density will self-accelerate as in "propellantless propulsion", or Paul Hill's "acceleration field".[10] This was first pointed out by Hermann Bondi in the 1950's when he was Chief Scientist of the British Ministry of Defense. I heard his lecture on this at Cornell when I was an undergraduate physics major in Hans Bethe's senior honors seminar in 1960. I was also studying tensor calculus with Wolfgang Rindler at the time and was Paul Olum's grader in the Cornell Math Department for engineering calculus. The full significance of Bondi's remark was not understood until today more than 40 years later.

All classical equations of state have a strictly positive active source density, i.e.,

$$\rho_{classical} + \frac{3p_{classical}}{c^2} > 0 \tag{2.7}$$

Indeed, this is a crucial assumption in the Penrose-Hawking classical spacetime singularity theorems based on global topology independent of details of the local geometrodynamical field equation and the classical action it comes from. Hal Puthoff is not cognizant of this when he claims that his ill-posed classical PV theory has no black holes. Quantum physics changes this. Indeed, Heisenberg's uncertainty principle combined with Einstein's local principle of equivalence (EEP) implies[11] the following universal zero point energy equation of state for the vacua of all micro-quantum fields both boson and fermion

$$\rho_{vac} = -\frac{p_{vac}}{c^2} \tag{2.8}$$

Therefore, in general, the active micro-quantum vacuum field source density is

[10] "Unconventional Flying Objects" by Paul Hill who was a solid sober USG aeronautical engineer circa post WWII at time of Roswell. His book is the best technical engineering book on UFOs, indeed the only one that is not crackpot.

[11] Eq. (1.88) p. 26 John Peacock, "Cosmological Physics", Cambridge Press ,(the Cal Tech text book).

$$\rho_{vac} + \frac{3p_{vac}}{c^2} = -2\rho_{vac} \tag{2.9}$$

Field	Sign of ρ_{vac}	Vacuum gravity
Boson	Positive	Repulsive
Fermion	Negative	Attractive

The micro-quantum vacuum Poisson equation is then

$$\vec{\nabla}^2 U_{vac} = +8\pi G\rho_{vac} \tag{2.10}$$

The local stress-energy tensor of this quantum vacuum in terms of the local cosmological $\Lambda(x)$ is

$$t_{\mu\nu(vac)} = \frac{\Lambda c^4}{8\pi G} g_{\mu\nu} \tag{2.11}$$

Therefore,

$$t_{00vac} \equiv \rho_{vac} c^2 = \frac{\Lambda c^4}{8\pi G} g_{00} = \frac{\Lambda c^4}{8\pi G} \tag{2.12}$$

Substitute (2.12) into (2.10)

$$\vec{\nabla}^2 U_{vac} = c^2 \Lambda \tag{2.13}$$

This is our key equation in the weak field limit, which illustrates the key new insight on how advanced super-technology will work.

$\Lambda > 0$ vacuum regions correspond to Kip Thorne's anti-gravitating "exotic matter" needed to make Star Gates and Time Machines. At the cosmological scale they explain the observed acceleration of our visible universe. Similarly $\Lambda < 0$ vacuum regions correspond to the "dark matter" that is at least ~ 80% of the total effective gravitating mass of our universe. A photon leaving a $\Lambda > 0$ region detected in a region will be blue shifted. Similarly a photon leaving a $\Lambda < 0$ region detected in a region will be red shifted. Hawking's equations for the holographic universe are modified as well.[12]

[12] Alleged alternating red and blue shifts from UFOs have been written about, e.g. Eric Davis's 2001 MUFON paper http://198.63.56.18/pdf/davis_mufon2001.pdf

3. Hawking's Holographic Universe Equations

From: Jack Sarfatti [sarfatti@pacbell.net]
Sent: Tuesday, June 11, 2002 11:37 AM
To: sarfatti@well.com; Jack Sarfatti
Cc: ItalianPhysicsCenter
Subject: Hawking's Nutty Universe: UFO Beauties from The Future?

From "The Universe in a Nutshell" Ch V

"So if a beautiful alien in a flying saucer invites you into her time machine. Step with care."

No, that's not from Nick Herbert's "Quantum Tantrum"
http://members.cruzio.com/~quanta/

It's not from

http://stardrive.org/cartoon/coffee.html

It's on p. 144 of Hawking's new book.

Also one finds:

"It's tricky to speculate openly about time travel. One risks either an outcry at the waste of public money… or a demand that the research be classified for military purposes. …There are only a few of us foolhardy enough to work on a subject that is so politically incorrect in physics circles. We disguise the fact by using technical terms that are code for time travel (p. 133) … we have no reliable evidence of visitors from the future. I'm discounting the conspiracy theory that UFOs are from the future and that the government knows and is covering up. Its record of cover-ups is not that good (p. 142)…. You might wonder if this chapter is part of a government cover-up on time travel. You might be right. (p. 153)"

Thus, Hawking sets the stage perfectly for my book "Destiny Matrix"

http://stardrive.org/Jack/cover.jpg

See also "The Star Gate Conspiracy" by Picknett & Prince.

http://www.templarlodge.com/

http://www.cassiopaea.org/perseus/bearden.htm

Previously Jack wrote:

Hawking gives two basic formulae for the world hologram entropy S and temperature T associated with classical curved spacetime that is effectively 3D rather than 4D (Ref: "The Universe in a Nutshell").

$$S = \frac{Akc^3}{4\hbar G} = \frac{A}{4L_p^2}k \tag{3.1}$$

For our holographic universe pp 64-65 Hawking and

$$T = \frac{\hbar c^3}{8\pi kGM} = \frac{\hbar c}{4\pi k\frac{2GM}{c^2}} = \frac{\hbar c}{4\pi kR_s} = \frac{1}{4\pi k}\left(\frac{\hbar}{Mc}\right)\frac{c^4}{G} \tag{3.2}$$

where for a nonrotating black hole

$$A \to 4\pi\left(\frac{2GM}{c^2}\right)^2 \tag{3.3}$$

k = Boltzmann's "imaginary time" quantum of entropy (disorder) ~ 1.4x10^{-16} ergs per degree Kelvin

$\hbar$ = Planck's "real time" quantum of classical mechanical action or periodic quantum phase ~ 10^{-27} erg-seconds

c = speed of far field transverse polarized electromagnetic waves (real photons on light cone "mass shell") ~ 3x10^{10} cm per second

G = Newton's constant of gravity ~ 6.7 10^{-8} cm^3 per second^2 per gram = 6.7x10^{-8} per mass density-second^2

L_p^2 is the quantum of area ~ 10^{-66} cm^2. It is one quantum gravity c-bit of Shannon information of the World Hologram.

$R_s \equiv 2GM/c^2$ is the classical gravity radius for the event horizon[13] of a non-rotating black hole of mass M

$\hbar/Mc$ is the quantum "Compton wavelength" of the mass M. If you probe a region inside this distance you create real particles and anti-particles of mass M.

[13] Where time stops for external observer.

c^4/G is the superstring tension also called the reciprocal of the "spacetime stiffness factor" because Einstein's local geometrodynamical field equation is

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = -\frac{G}{c^4} T_{\mu\nu} \tag{3.4}$$

The cosmological "constant" Λ (not really constant) has dimensions of 1/Area.

Up until recently[14] observation set a limit

$$|\Lambda| < 3\times 10^{-56} cm^{-2} \sim \frac{3}{\left(10^{28} cm\right)^2} \sim 3\left(\frac{H}{c}\right)^2 \tag{3.5}$$

Where H is the Hubble constant. Therefore $1/\Lambda$ is the World Hologram "area" $A_{universe} \sim 10^{122}$ bits.

The Wigner phase space density W(x,p) http://stardrive.org/math2/Wigner.htm at "wavelet" scale factor p can have sub-Planckian structure as shown by W. Zurek in Nature, Aug 2001.

Think of adding resistances in a parallel circuit

$$\frac{1}{A} = \frac{1}{4\pi}\left(\frac{c^2}{2GM}\right)^2 + \Lambda \tag{3.6}$$

or

$$A(\Lambda) = \frac{1}{\left(\frac{c^2}{8\pi GM}\right)^2 + \Lambda} = \frac{\left(\frac{8\pi GM}{c^2}\right)^2}{1 + \left(\frac{8\pi GM}{c^2}\right)^2 \Lambda} \equiv \frac{A_{Hawking}}{1 + A_{Hawking}\Lambda} \tag{3.7}$$

Dark matter is /\ < 0 corresponds to macro-quantum weird gravitating vacuum where the normal fluid Wigner phase space density is negative from giant superfluid macro-quantum interference in the virtual fermion-antifermion bound state local order parameter of spontaneous broken symmetry from false 100% normal fluid high entropy micro-quantum random vacuum to two fluid macro-quantum lower entropy true vacuum.

Hawking's anti-gravitating "vacuum energy" is /\ > 0, e.g. "the effect of vacuum energy is the opposite of that of matter ... vacuum energy causes the expansion to accelerate" p. 96.

[14] Before accelerating universe data.

Note the sign dependence. Anti-gravitating /\ > 0 decreases the effective mass $M_{effective}$ and it also decreases the effective holographic entropy. Gravitating /\ < 0 dark energy does just the opposite.

$$\left(\frac{c^2}{2GM_{effective}}\right)^2 \equiv \left(\frac{c^2}{2GM}\right)^2 + 4\pi\Lambda \tag{3.8}$$

Therefore

$$M_{effective}(\Lambda) = \frac{M}{\sqrt{1+4\pi\left(\frac{2GM}{c^2}\right)^2\Lambda}} = \frac{M}{\sqrt{1+A_{Hawking}\Lambda}} \tag{3.9}$$

Is the quintessent Λ field correction to the effective mass.

Similarly for holographic Hawking entropy and absolute temperature of the horizons and holographic areas in general.

$$S(M,\Lambda) = \frac{S_{Hawking}(M)}{1+4\pi\left(\frac{2GM}{c^2}\right)^2\Lambda} = \frac{S_{Hawking}(M)}{1+A_{Hawking}\Lambda} \tag{3.10}$$

$$T(M,\Lambda) = \frac{\hbar c^3}{8\pi k GM_{effective}} = T_{Hawking}(M)\sqrt{1+A_{Hawking}\Lambda} \tag{3.11}$$

These are my quintessent /\ field corrections, or renormalizations, for quantum gravity thermodynamics started by Bekenstein and further developed by Hawking & Co

/\ > 0 decreases black hole entropy and increases black hole temperature.

/\ < 0 increases black hole entropy and decreases black hole temperature.

This generalizes to ordinary curved spacetime regions in the sense of the "world hologram" idea of Lenny Susskind[15] et-al.

[15] I worked with Lenny Susskind at Cornell in 1963 where we were both grad students. I had brought "space kid" Johnny Glogower to Cornell with Phil Morrison's help. All three of us worked on the quantum phase-time operator problem that I had started Lenny on. The problem was first suggested to me by George Parrent, a student of Emil Wolf's, when I worked at Tech/Ops in Burlington, Mass between Brandeis and going back to Cornell. The problem is mentioned in my Nuovo Cimento paper on correlations in black body radiation that I wrote at Tech/Ops. Lenny went ahead, at Peter Carruthers' suggestion, and published a paper in Physics in the same volume the famous Bell inequality paper, without putting my name on it. I

BTW check my algebra above in case I made stupid errors. ;-)

This is the first time I have seen these relationships cosmic triggered by reading Hawking's popular book.

There are two senses of "hologram" in Hawking's book. The first one is above in which information on three-dimensional space is coded on the two-dimensional bounding surface. The second meaning is that of a four-dimensional boundary of a five-dimensional space. I am not clear on how these two ideas connect.

"Information about the quantum states in a region of spacetime may be somehow coded on the boundary of the region which has two dimensions less. This is like the way that a hologram carries a three-dimensional image on a two-dimensional surface. If quantum gravity incorporates the holographic principle, it may mean that we can keep track of what is inside black holes…. If we can't do that, we won't be able to predict the future as fully as we thought."

The second meaning is:

"we may live on a 3-brane – a four dimensional (three space plus one time) surface that is the boundary of a five-dimensional region, with the remaining dimensions curled up very small. The state of the world on a brane encodes what is happening in the five-dimensional region." – Hawking p. 64 "The Universe in a Nutshell".

I somewhat disagree with Hawking's statement on p. 124 where Hawking says that faster than light communication by quantum nonlocality is "ridiculous". True, it cannot happen in orthodox quantum theory and Tony Valentini shows why in a way that shows a loop hole.

http://users.ox.ac.uk/~quee0776/valentiniabs.html

http://www.fourmilab.ch/rpkp/valentini.html

http://www.edge.org/3rd_culture/bios/valentini.html

http://www.edge.org/discourse/information.html

Hawking keeps talking about the need for negative energy density. We do not really need it when the quintessent field $\Lambda > 0$ in the macro-quantum vacuum in limited regions. Light diverges there just like Hawking needs.

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was at Ford Philco Aeronutronics in Newport Beach, CA at the time with Fred W. Cummings who later became my Ph.D. dissertation advisor at UCR (August, 1969) though all my class work was done at UCSD in La Jolla. Indeed, Fred liked to come down to La Jolla to work at the Scripps Oceanographic Institute on the ocean.

The world hologram idea requires a coherent phase field. This is indeed my macro-quantum vacuum coherent complex numbered order parameter $\Psi(x)$.

$$\begin{aligned}\Psi(x) &\equiv \sqrt{\frac{1}{L_p^3}\left(1-L_p^2\Lambda(x)\right)}\sum_P e^{i\left[\arg\Psi(x)-\frac{2e}{\hbar c}\int_P^x A_\mu(x')dx'^\mu\right]} \\ &= \sqrt{\frac{1}{L_p^3}\left(1-L_p^2\Lambda(x)\right)}e^{i\arg\Psi(x)}\sum_P e^{-i\frac{2e}{\hbar c}\int_P^x A_\mu(x')dx'^\mu} \\ &\equiv \sqrt{\rho_s(x)}e^{i\arg\Psi(x)}\end{aligned} \tag{3.12}$$

The sum $\sum_P$ is over all Feynman paths P in the false globally flat vacuum "Flat World"[16] that terminate at event x. Define, the non-integrable renormalization factor[17]

$$\sum_P e^{-i\frac{2e}{\hbar c}\int_P^x A_\mu(x')dx'^\mu} \equiv \left|Z(x)\right|e^{i\arg Z(x)} \tag{3.13}$$

$$\begin{aligned}\rho_s(x) &\equiv \frac{1}{L_p^3}\left(1-L_p^2\Lambda(x)\right)\left|\sum_P e^{i-\frac{2e}{\hbar c}\int_P^x A_\mu(x')dx'^\mu}\right|^2 \\ &= \frac{1}{L_p^3}\left(1-L_p^2\Lambda(x)\right)\left|Z(x)\right|^2 \\ &\equiv \rho(x)-\rho_n(x)\end{aligned} \tag{3.14}$$

$$\begin{aligned}\rho(x) &\equiv \frac{\left|Z(x)\right|^2}{L_p^3} \\ \rho_n(x) &\equiv \frac{\Lambda(x)\left|Z(x)\right|^2}{L_p}\end{aligned} \tag{3.15}$$

$Z(x)$ is the electromagnetic control renormalization factor for the macro-quantum vacuum of Curve World that comes from the spontaneous breakdown of the global symmetry of micro-quantum Flat World. This is analogous to my 1966 UKAERE paper with Marshall Stoneham on the "Goldstone Theorem and the Jahn-Teller Effect". Note the Bohm-Aharonov-Josephson phase integral in the coherent sum over both *future* and past Feynman *destinies* and histories, respectively ending on event x in the "here-now".

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[16] Flat World has the Fermi surface without bound state pairing of the virtual electron-positron pairs to a lower more stable energy. It is 100% "Dirac sea".

[17] $\left|Z(x)\right|$ can be absorbed into the Planck scale $L_p \to L_p^*(x)$ making is larger and variable. The phase $\arg Z$ has singularities (e.g. vortex lines) representing non-integrable hysteresis memories from both past *and future* (e.g. Yakir Aharonov et-al "Destiny and History quantum state vectors").

$$\rho(x) \equiv \frac{|Z(x)|^2}{L_p^3} \equiv \frac{1}{L_p^{*3}(x)}$$
$$\rho_n(x) \equiv \frac{\Lambda(x)|Z(x)|^2}{L_p} \equiv \frac{\Lambda^*(x)}{L_p^*(x)} \tag{3.16}$$
$$L_p^*(x) \equiv \frac{L_p}{|Z(x)|^{2/3}}$$
$$\Lambda^*(x) \equiv \Lambda(x)|Z(x)|^{4/3}$$

For now I only include the electromagnetic field and the virtual electron-positron pairs that Bose-Einstein condense into the same cell in phase space of volume ~ h^3 in the center of mass coordinate. The relative coordinates are integrated out. I then form the *virtual superfluid* Wigner phase space density[18] of the macro-quantum vacuum substrate of the classical Einstein world from this nonrandom *zero entropy* coherent order parameter[19]

$$W_s(x,p) \equiv \left(\frac{1}{h}\right)^4 \int e^{ipy/h} \Psi^* \left(x - \frac{y}{2}\right) \Psi\left(x + \frac{y}{2}\right) d^4 y \tag{3.17}$$

There is also a corresponding virtual incoherent random "zero-point fluctuation" normal fluid component that carries all the entropy. The virtual superfluid component of the physical vacuum's Wigner phase space density has zero entropy which explains the mystery of the arrow of time.

$$W_{ZPF}(x,p) \equiv \left(\frac{1}{h}\right)^4 \int e^{ipy/\hbar} \rho_{ZPF}\left(x - \frac{y}{2}, x + \frac{y}{2}\right) d^4 y \tag{3.18}$$

Negative regions of the Wigner phase space density of the "normal fluid" random virtual zero point fluctuations are the gravitating dark matter regions of $\Lambda^*(x) < 0$.

$$W_s(x,p) + W_{ZPF}(x,p) = \frac{1}{\hbar^4} \tag{3.19}$$

We are free to choose complementary window 4-cell widths $\Delta^4 x, \Delta^4 p$ with x, p as center points in a wavelet analysis. The window cell sizes $\Delta^4 x$ in ordinary curved spacetime

[18] The Wigner phase space density can go negative. Indeed, the vacuum superfluid Wigner density is negative in huge regions of "dark matter" in the universe.

[19] "Sub-Planck structure in phase space and its relevance for quantum decoherence", W. H. Zurek, Nature, 412, p. 712, 16 August, 2001.

emerging from the long-range macro-quantum phase coherence must be small compared to the four local principal radii of curvature in a neighborhood of x.

$$\begin{aligned}
&\rho_s\left(x,p\,|\,\Delta_p^4\right)\equiv\rho_s\left(x,p;x,p\,|\,\Delta_p^4\right)\equiv W_s\left(x,p\right)\Delta_p^4\\
&\rho_n\left(x,p\,|\,\Delta_p^4\right)\equiv W_n\left(x,p\right)\Delta_p^4\\
&\Psi\left(x,p\,|\,\Delta_p^4\right)\equiv\sqrt{\rho_s\left(x,p\,|\,\Delta_p^4\right)}e^{i\Theta\left(x,p|\Delta_p^4\right)}\\
&\rho_s\left(x,p;x'p'\,|\,\Delta_p^4\right)\equiv W_s\left(x,p\right)\Delta_p^4 e^{i\left[\Theta\left(x,p|\Delta_p^4\right)-\Theta\left(x',p'|\Delta_p^4\right)\right]}\\
&\Theta\left(x,p\,|\,\Delta_p^4\right)\equiv\arg\Psi\left(x,p\,|\,\Delta_p^4\right)-\arg Z\left(x,p\,|\,\Delta_p^4\right)
\end{aligned}\tag{3.20}$$

$$\begin{aligned}
&\rho\left(x,p\,|\,\Delta_p^4\right)\equiv\frac{\left|Z\left(x,p\,|\,\Delta_p^4\right)\right|^2}{L_p^3}\\
&\rho_n\left(x,p\,|\,\Delta_p^4\right)\equiv\frac{\Lambda\left(x,p\,|\,\Delta_p^4\right)\left|Z\left(x,p\,|\,\Delta_p^4\right)\right|^2}{L_p}\\
&\rho_s\left(x,p\,|\,\Delta_p^4\right)\equiv\rho\left(x,p\,|\,\Delta_p^4\right)-\rho_n\left(x,p\,|\,\Delta_p^4\right)
\end{aligned}\tag{3.21}$$

$$\begin{aligned}
&\rho\left(x,p\,|\,\Delta_p^4\right)\equiv\frac{\left|Z\left(x,p\,|\,\Delta_p^4\right)\right|^2}{L_p^3}\equiv\frac{1}{L_p^{*3}\left(x,p\,|\,\Delta_p^4\right)}\\
&\rho_n\left(x,p\,|\,\Delta_p^4\right)\equiv\frac{\Lambda\left(x,p\,|\,\Delta_p^4\right)\left|Z\left(x,p\,|\,\Delta_p^4\right)\right|^2}{L_p}\equiv\frac{\Lambda^*\left(x,p\,|\,\Delta_p^4\right)}{L_p^*\left(x,p\,|\,\Delta_p^4\right)}\\
&L_p^*\left(x,p\,|\,\Delta_p^4\right)\equiv\frac{L_p}{\left|Z\left(x,p\,|\,\Delta_p^4\right)\right|^{2/3}}\\
&\Lambda^*\left(x,p\,|\,\Delta_p^4\right)\equiv\Lambda\left(x,p\,|\,\Delta_p^4\right)\left|Z\left(x,p\,|\,\Delta_p^4\right)\right|^{4/3}
\end{aligned}\tag{3.22}$$

Einstein's *scale-dependent* classical curved spacetime metric tensor is

$$g_{\mu\nu}\left(x,p\,|\,\Delta_p^4\right)\equiv\frac{1}{2}\left\{\partial_\mu,\partial_\nu\right\}\left[L_P^{*2}\left(x,p\,|\,\Delta_p^4\right)\Theta\left(x,p\,|\,\Delta_p^4\right)\right]\tag{3.23}$$

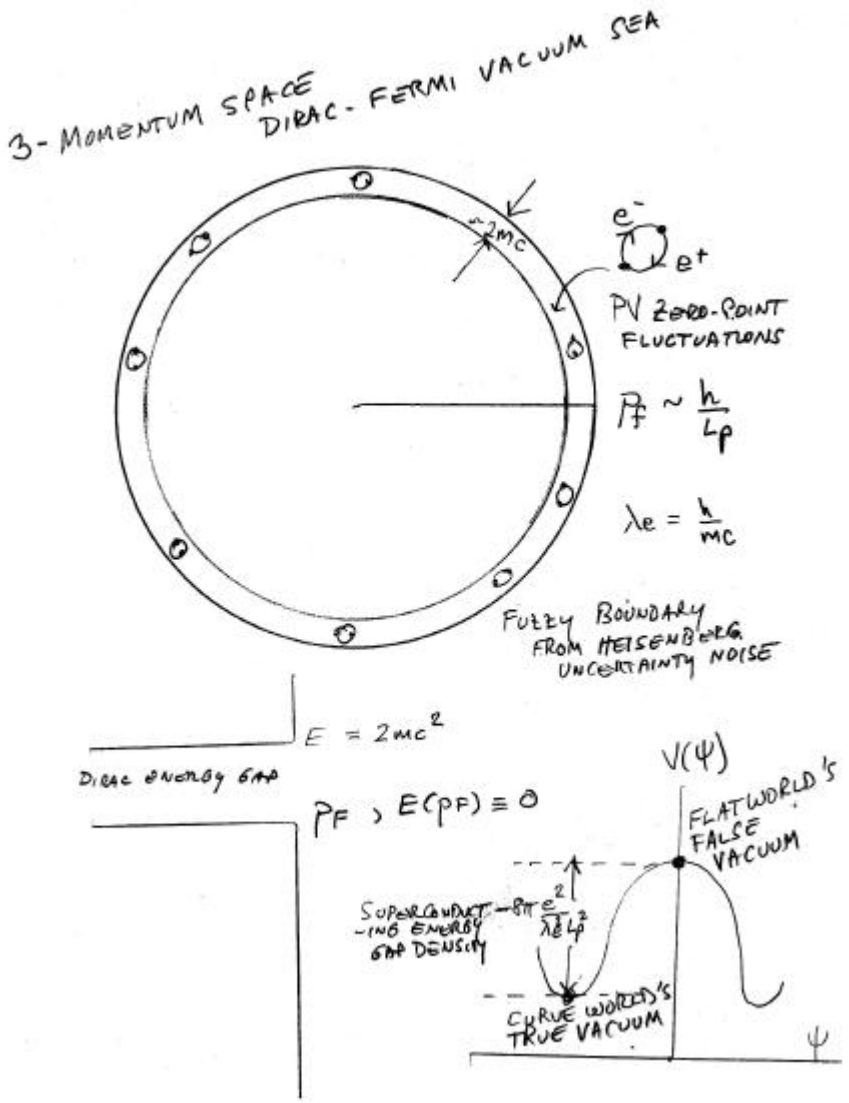
Where $\{\ ,\ \}$ is the anti-commutator. Note that I have derived $L_p^*\left(x, p \mid \Delta_p^4\right)$ of Abdus Salam's "f-strong-short range gravity" model[20] from the 1970's that was the precursor for modern ideas of strong gravity from extra hyperspace dimensions.

"Large extra dimensions are an exciting new development ... They would imply that we live in a brane world, a four-dimensional surface or brane in a higher dimensional spacetime. Matter and nongravitational forces like the electric force would be confined to the brane ... On the other hand, gravity in the form of curved space would permeate the whole bulk of the higher dimensional spacetime .... Because gravity would spread out in the extra dimensions, it would fall off more rapidly with distance than one would expect ... If this more rapid falloff of the gravitational force extended to astronomical distances, we would have noticed its effect on the orbits of the planets ... they would be unstable... However, this would not happen if the extra dimensions ended on another brane not that far away from the brane on which we live. Then for distances greater than the separation of the branes, gravity would not be able to spread out freely but would be confined to the brane, like the electrical forces, and fall off at the right rate for planetary orbits."

- Stephen Hawking, Ch. 7

[20] I worked with Abdus Salam at ICTP in Trieste, Italy in 1973 on these ideas. See my papers in "Collective Phenomena" edited by Herbert Frohlich and my UCR Ph.D. dissertation advisor, Fred W. Cummings, (Gordon & Breach ?) in that period. Also my 1966 paper with Marshall Stoneham of Harwell UKAERE on spontaneous broken symmetry in solid state "Jahn-Teller Effect" in Proceedings of the Physical Society of London cited in American Institute of Physics "Resource Letter on Symmetry in Physics".

4. The Macro-Quantum Vacuum



The false micro-quantum vacuum of "Flat World" is from gauge source and force fields. There is no gravity as yet which is, as Andre Sakharov first suggested, an emergent macro-quantum collective mode - indeed Einstein's 1915 "geometrodynamic" local field theory of gravity is a "signal modulation" of the stable long range coherent phase of a virtual Bose-Einstein condensate of a huge number of gauge source fermion-antifermion pairs whose centers of mass macroscopically occupy the same "mother wavelet" bound state. Special relativity works globally in the false vacuum of Flat World.

Think of the false vacuum of Flat World as a ball, i.e. a Fermi sphere in momentum space, of virtual electrons closely packed into negative energy states, i.e. the "Dirac Sea"

as required by the Pauli exclusion principle. There are also virtual photons but they play a minor role for now. To make life simpler in this broken (symmetry) toy model of the world, let's suppose there is only quantum electrodynamics. We can worry about the complications of weak and strong forces later. The edge of this Fermi sphere is not sharp because of Heisenberg's uncertainty principle. Indeed the edge is fuzzed out with locally uncontrollably random quantum noise by a thickness of momentum ~ 2mc below the threshold for real electron-positron pair creation, where m is the rest mass of the electron. The edge of the Fermi sphere has momentum pf ~ h/Lp, where $Lp^2 \sim hG/c^3 \sim 10^{-66}$ cm^2 ~ 1 Bekenstein-Hawking bit of entropy. Therefore, what we have is a fuzzy noisy spherical shell of phase space volume ~ $4\pi(h/Lp)^2(2mc)V = 4\pi h^2(c^3/hG)(2mc)V = 4\pi h(c^3/G)(2mc)V = 8\pi hm(c^4/G)V$. There is an addition spin factor 2S + 1 = 2. So the phase space volume of the fuzzy Heisenberg edge of the Fermi-Dirac sea is ~ $16\pi hm(c^4/G)V$. Note that c^4/G is the super string tension of 10^{19} Gev per 10^{-33} cm (AKA reciprocal spacetime stiffness factor). Each "single-particle"[21] cell of phase space has volume h^3 therefore the false vacuum density of Planck action cells of phase space is $16\pi(mc/h)(c^3/hG)$ per unit ordinary space volume. The attractive Coulomb bound state energy of the virtual electron-positron (hole) pair is ~ $-e^2/(h/2mc)$. Therefore, the total "superconducting" energy density gap is:

Superconducting macro quantum vacuum "BCS" energy gap density

~ - $8\pi(mc/h)^2(c^3/hG)e^2$

= - $8\pi e^2$/(Compton wave length of electron)^2(Planck area)

= - 8π(fine structure constant)mc^2/(Compton wavelength)(Planck area)

$$\frac{d\Delta_{vac}}{dV} = -\frac{8\pi\alpha mc^2}{\lambda_e L_p^2} = -\frac{8\pi e^2}{\lambda_e^2 L_p^2} \sim -10^{73}\frac{Gev}{cm^3} \sim -10^{-45}\frac{m_p c^2}{L_p^3}$$
$$\alpha \equiv \frac{e^2}{\hbar c} \sim \frac{1}{137}$$
$$\lambda_e \equiv \frac{\hbar}{mc} \sim 10^{-11} cm \qquad (4.1)$$
$$mc^2 \sim \frac{1}{2} Mev$$
$$L_p^2 \sim 10^{-66} cm^2$$

Note that the ratio [(Planck area)/(fine structure constant)]$^{1/2}$ i.e. $L_p/\sqrt{\alpha}$ is the Kaluza-Klein hyperspace compactification scale. Note that the superconducting vacuum energy gap density whilst enormous by everyday standards is still ultra tiny ~ 10^{-45} relative to the quantum gravity Planck energy density. In my new theory here there is never any direct

[21] The center of mass of a bound pair, real or virtual, acts like a single particle.

quantization of the classical gravity field, which is an emergent collective macro-quantum mode out of this spontaneous broken symmetry of the gauge force and source fields in the false unstable micro-quantum vacuum of global special relativity. Thus, I complete what Andre Sakharov started in Moscow in 1967. The theory here can be called the "PV theory of gravity" where "PV" stands for "Polarized Vacuum" – not what Hal Puthoff has called "PV gravity"[22] which is purely a metaphor in a classical phenomenology with no quantum physics in it.

How interesting!

Since everything must be scale-dependent, I make a leap of faith for now that I have not completely justified mathematically, but one can see precognitively[23], i.e., intuitively, where this is all heading. We now see where the "wavelet"[24] macro-quantum order parameter $\Psi(x,p)$ comes from. The phase of $\Psi(x,p)$ gives Einstein's classical Curve World geometrodynamic "wavelet" field $g_{\mu\nu}(x,p)$ along the lines shown by Hagen Kleinert of the Free University of Berlin. The amplitude of $\Psi(x,p)$ give the *renormalized* quintessent "wavelet" $\Lambda^*(x,p)$ field that explains, I say:

1. Why the universe accelerates i.e., $\Lambda^*(x, p \to \hbar/10^{28}\, cm) > 0$
2. What dark matter is i.e., $\Lambda^*(x,p) < 0$
3. How to make Star Gate time travel machines to past, future and parallel brane worlds like the Universe Next Door[25] of Jacques Vallee's "Magonia" where the UFOs allegedly come from? $\Lambda^*(x,p) > 0$
4. How to make weightless warp drive. (Clue: near field version of Ray Chiao's "gravity radio"[26]?)

$$G^{;\nu}_{\mu\nu}(x,p) = -\frac{\partial \Lambda^*(x,p)}{\partial x^\nu} g_{\mu\nu}(x,p) = T^{;\nu}_{\mu\nu|truevac}(x,p) \neq 0 \qquad (4.2)$$

5. Why the arrow of time, i.e. low entropy early universe.

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[22] http://arxiv.org/abs/gr-qc/9909037

[23] As in the Puthoff-Targ CIA-funded Remote-Viewing Stanford Research Institute experiments in 1973 when I first met them with Astronaut Edgar Mitchell, Brendan O' Regan and more of the others. See Martin Gardner's "Magic and Paraphysics" in "Science, Good, Bad and Bogus".

[24] There are still a lot of formal details to work out in the replacement of globally flat Fourier integrals by adaptive scale-dependent windowed wavelet transforms required in classical curved spacetime with the breakdown of global flatness of special relativity. So this is a "program" for continued R&D.

[25] A brane parallel universe would have to be less than ~ 2 millimeters away from us in hyperspace according to current measurements. This number is changing with better experiments, e.g. Ch 7 Hawking, Aug 2000 Scientific American "The Universe's Unseen Dimensions".

[26] http://xxx.lanl.gov/abs/gr-qc/0204012.

$$S_{truevac}\left(t=0\right)=\frac{\rho_n}{\rho_s+\rho_n}S_{falsevac}=L_p^2\Lambda^* S_{falsevac} \qquad (4.3)$$
$$S_{early-universe}\left(t=0\right)<<S_{older-universe}\left(t\right)$$

This is the real PV (Polarized Vacuum) theory of gravity not the False Idol, that still born thing, that Hal Puthoff has been Hawking.

Don't be put off by skim milk masquerading as cream! ☺[27]

5. UFO Star Gate Time Travel Warp Drive Physics

Exact supersymmetry is invoked to keep the sum of all zero point energy densities of all fields zero. However supersymmetry is broken so it is not clear if the argument works. The argument would go something like this. Take a toy universe with only electrons and photons. The boson photon has spin 1. Therefore, it has 3 independent spin polarizations tripling the number of field oscillators in a given quantized region of the lattice field oscillator phase space.[28] Each field oscillator has a cell area h in phase space. Each cell holds 2S + 1 field oscillators of a given type where the spin of the field is S. The photon's supersymmetry fermion partner is the spin ½ "photino" with two spin components. There is also the electron field with two more fermion spin components. Finally, the electron has a spin 0 partner the electrino with only one boson spin component. Therefore, each cell in phase space has four fermion spin components of gravitating negative zero point energy and four boson spin components of anti-gravitating zero point energy. This gives an ordinary $\Lambda=0$ non-gravitating vacuum. However, if we can control this balance we have something stupendous! This is the End of The Beginning of Our Conquest of Super Cosmos as we transform to "The Masters of Hyperspace".[29]

To be continued.

[27] "Things are seldom what they seem." HMS Pinafore, Gilbert and Sullivan.

[28] Given a cell in field oscillator phase space, the cell can either be empty of a real fermion or have one real fermion of a given type in it. That's the Pauli exclusion principle. The same cell can have any number of real bosons of a given type in it. However, the real quanta do not determine micro-quantum vacuum structure until they get very dense.

[29] Coined by Michio Kaku in "Hyperspace".

Index