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The λ/m-Hamiltonian in Hitoshi Kitada's Treatment of Quantum Relativistic Time

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This paper shall discuss the comparative treatment of parametrical time by Hitoshi Kitada of Tokyo University in the paper referenced below. A clear link to Quantum Relativity (QR) between Kitada's work and that of the demetricated superbrane parameters shall be established in the Energy Hamiltonian for the displacement/mass ratio. The QR links are denoted in italics throughout this paper.

As Kitada succeeds to establish the equivalence between classically geometric and quantum mechanical time; the demetricated quantum relativistic time as precursive scenario is crystallised.

<u>Reference:</u> Hitoshi Kitada; Department of Mathematical Sciences, University of Tokyo
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"Quantum Mechanical Clock and Classical Relativistic Clock"

Abstract: Quantum mechanical clock is introduced as a means measuring the parameter of quantum mechanical motion, and is seen to be equivalent to the relativistic classical clock.

Introduction: The operational definition for time in Special Relativity (SR) uses the lightpath travelled by invariant lightspeed 'c' say between two mirrors as a lightclock'.

Since the frame of reference is said to be inertial as the distance between the two mirrors, no accelerations are permitted and General Relativistic (GR) effects are ignored in considering the lightclock as idealised point-particles.

Kitada then points out, that the mirrors occupy a finite volume, subject to GR-warping. Subsequently, the 'light-clock' cannot measure correct time as indicated by the lightpath x=ct, as individuated 'mirror-points' could assume warped metrical tensor spaces by the equivalence principle of GR.

Kitada elaborates in saying that quantising the GR field equations should result in a covariant quantum theory under the diffeomorphism transforming a point on the space-time manifold to a point of the manifold harbouring any actual non-infinitesimal clocks.
Kitada then proposes to give an operational definition for clocks and time in the spirit

of Einstein's SR, but in the scenario of an Euclidean quantum space, where the quantum mechanical dynamics of individual particles is localised in the proper times of the particles' reference frames under coordinate transformations, yielding relativistic quantum-mechanical Hamiltonians, concurring with the experimental observations.

Kitada thus continues the attempt to develop a Theory of Electromagnetism in harmony with both inertially referenced SR and gravitationally based GR. Kitada proceeds to consider quantum mechanics in association with SR for a particle in 3 dimensions (R^3) and then outlines its extension to the N-particle scenario.

I. One particle case with mass m

Hitoshi Kitada considers one particle in an universe expressed as a vector bundle $X \times R^6$, with X the curved and differential Riemann base space, holding for classical relativistic mechanics. R^6 becomes then the phase space associated with each point x in X.

This is adequate in view of QR considering the transformation of the Planck Boson as supermembrane class I through the other five classes to manifest as the heterotic supermembrane HE(8x8) in the Weyl-Geodesic as the boundary or 'event horizon' for the GR metrics of Riemannian multidimensional space.

The demetrication of the Weyl-Geodesic then macroquantises this superstring class and considers its eigenstate as holographically imaged as the hologramic universe in total. Considering R^6 as a Calabi-Yau toroidal phase-space (say for rotational and vibrational degrees of freedom) of Kitada allows subsequent synthesis.

The particle then is defined in its own local frame of proper time 't' and follows Schroedinger's Equation and is observed in the classical space outside the local system, moving with velocity 'v'.

The local dynamics, Kitada describes as the random motion or 'Zitterbewegung' associated with the Zero-Point-Oscillator E=hf/2; f the frequency for energy E and Planck's Constant h. {Detailed definitions are provided in the Kitada references/publications given at the end of this paper}.

Kitada then defines the internal localised quantum mechanical velocity to be 'u'. *Subsequently, by the 'sharing' of dimensions of the Minkowski 4-vector, the Pythagoraen metric* sets

Kitada's Axiom 1: $[u]^2+[v]^2=c^2$, with c the velocity of light in a vacuum.

The magnitude of momentum inside the local system is observed constant independent of 'v' for
Kitada's Axiom 2: $m^2[u]^2=(m_o)^2c^2$, with m the observed mass moving with

velocity v relative to the observer and m_o is the inertial/rest-mass.

The unification of quantum mechanics and SR then proceeds in considering the invariance of c to apply to both the internal local space, considered quantum mechanical by Kitada and the classical observer space under application of the two axioms, which Kitada then seeks to justify.

Kitada's Hamiltonian for the localised particle in quantum mechanics then becomes:

$H=-(h/2\pi)^{\wedge}{}_2/(2m).(\Delta_x)=(1/2m).(h/2\pi i)^{\wedge}{}_2(d/dx)^{\wedge}{}_2=P^{\wedge}{}_2/(2m)$

for Momentum Operator $P=(h/2\pi i)(d/dx)$ and the (d/dx) partial differentials as usually defined, say for 3D spatial coordinates $x=(x_1,x_2,x_3)$.

Kitada's time-evolution for a clock defined in $\exp[-2\pi i.tH/h]$ and local time t then describes a solution for Schroedinger's Equation $(h/2\pi i).\{d\phi(t)/dt\}+H.\phi(t)=0$ in $\phi(t)=\exp[-2\pi i.tH/h].\phi(t)$.

The quantum mechanical velocity [u]=P/m in the two axioms then rewrites those as:

Axiom 1: $\{P/m]^{\wedge}{}_2+[v]^{\wedge}{}_2=c^{\wedge}{}_2$
Axiom 2: $[P]^{\wedge}{}_2=(m_o)^{\wedge}{}_2.c^{\wedge}{}_2$

Fourier Transform applied to differential operator P in momentum space f(p) becomes:

$F\{f(p)\}=(h)^{\wedge}\text{-}{}_{3/2}\,I\exp[(-2\pi i.px/h).f(x)dx$ for p in $R^{\wedge}{}_3$ for $px=(p_1x_1,p_2x_2,p_3x_3)$ for the Hamiltonian

$H=(1/2m)F_{\wedge-1}.p^{\wedge}{}_2F$ and solution $\phi(t)=\phi(t,x)=F_{\wedge-1}.\exp[-i\pi t.p^{\wedge}{}_2/mh].F\phi(0)$.

{F is a unitary operator from Hilbert space $L^{\wedge}{}_2(R^{\wedge}{}_3)$ specifying Lebesgue measurable complex functions f(x) on $R^{\wedge}{}_3$ for the integral $I[f(x)]^{\wedge}{}_2.dx$ < infinity; inner product $(f,g)=I f(x)g^*(x)dx$ and norm []f[]=Sqrt(f,f) and $g^*(x)$ the complex conjugate fpr g(x).}

Hitoshi Kitada then constructs the Hamiltonian spectral representation using the 2-sphere as the topological mapping from $R^{\wedge}{}_3$; that is subspace $L^{\wedge}{}_2(R^{\wedge}{}_3)$<->$L^{\wedge}{}_2(S^{\wedge}{}_2)$ and using $F(\lambda)$ with $\lambda>0$.

$F(\lambda)f(\omega)=(2\lambda)^{\wedge}{}_{1/4}(Ff)(\text{Sqrt}(2\lambda)\omega)$, with ω in $S^{\wedge}{}_2$, mapped from $R^{\wedge}{}_3$ and $[\omega]$-1.

{Definitional details: H.Kitada, "QuantumMechanics", http://kims.ms.u-tokyo.ac.jp/bin/qm.dvi}.

This establishes the Hamiltonian Fourier transform as $F(\lambda)H.f(\omega)=\{\lambda/m\}F(\lambda)f(\omega)$, which identifies the Hamiltonian H as the multiplier $\{\lambda/m\}$ when transformed via $F(\lambda)$ into spectral representative space between unitary operators H* onto H with $H^*=L\text{^}2\{(0,\text{infinity}),L\text{^}2(S\text{^}2),d\lambda\}$ for the norm of the integral $I[]F(\lambda)f[]\text{^}2\ d\lambda=[]f[]\text{^}2$ from (0,infinity) over $L\text{^}2(S\text{^}2)$ as $L\text{^}2(R\text{^}3)$.

Originally, $H=P\text{^}2/2m$ in 3D momentum-space which so maps $\lambda<\!\!-\!\!>P\text{^}2/2$ as the corresponde for the local velocity u=P/m, satifying $u\text{^}2=P\text{^}2/m\text{^}2 <\!\!-\!\!> 2\lambda/m\text{^}2$ and rewriting the Kitada axioms as:

Axiom 1: $2\lambda/m\text{^}2+[v]\text{^}2=c\text{^}2$
Axiom 2: $2\lambda=(m_o)\text{^}2.c\text{^}2$

The physics now describes the Energy Hamiltonian $\{\lambda/m\}=(m_o.c)\text{^}2/(2m)$ in the observation space for the particle under consideration.

Axioms 1 and 2 now give $(m_oc)\text{^}2=(mc)\text{^}2-(mv)\text{^}2$, which can be rewritten as $m=m_o/\text{Sqrt}[1-(v/c)\text{^}2]$ in the expression for inertial mass as a function of velocity v in SR.

The local system moving with velocity v has a period $P(v)=1/f=\{hm/\lambda\}=2hm/(m_oc)\text{^}2$ and specifying the local system's clock as $\exp[-2\pi it\lambda/hm]$ with minimum period at v=0, given as $P(0)=2h/(m_oc\text{^}2)$.

The Zero-Point-Oscillator in QR is used to derive the deceleration parameter for the demetricated cosmogenesis in Mass-Seedling (M_o/m_c) for the Schwarzschild Solution $R_S=2GM/c\text{^}2$ transforming to the nodal boundary of the Hubble-Frequency $H_o=c/R_{max}=dn/dt$ with $T(n)=n(n+1)$ from the generalised wavefunction $B(n)=B_o.\exp[-Alpha.T(n)]$ and $B_o=(2e/hA)$.

The identities(*): $c=\lambda_{ps}.f_{ps}=R_{max}.H_o$ and $XY=X+Y=\exp[i\pi]=-1=i\text{^}2$ are used as defining parameters in QR, where the Schwarzschild metric becomes $R_{max}.c\text{^}2=2G\rho_c.V_{max}$ for a critical density ρ_c for Euclidean classical flatness given in 3D as $\rho_c=3H_o\text{^}2/8\pi G$, using the boundary conditions above and a spherical 3D 2-sphere.

The Zero-Point-Oscillator represented by the transformed superbrane (from the Planck-Scale) then
sets the gravitational potential of the Mass-Seedling as $hf_{ps}/2=m_{ps}c\text{^}2/2=GMm_{ps}/r_{ps}$ where $r_{ps}=\lambda_{ps}/2\pi$
and the Weyl-Geodesic or wormhole radius and $M=M_{critical}$ for zero curvature corresponding to $\rho_c=M_{Critical}/V_{max}$.

The ratio $M_o/M_{critical}$ then defines the Ricci-Tensor in GR in the gravitational Omega=deceleration parameter 2qo (and the Sarkar architecture of 236.5 million *lightyears as the ratio between the superbrane hyperacceleration and the de Broglie phase inflation as the quantum tunnelling of the temperature gradient at time-instantenuity).*

In the derivations m_c represents a primordial nucleon seed obtained in equating the gravitational fine-structure as $2\pi G_o.m_c$^2/hc=Alpha^18 via the supersymmetry given in the identities (*).

Hitoshi Kitada's P(0)=2h/(m_oc^2), written as the frequency $f_o=m_o$c^2/2h so identifies the Zero-Point-Oscillation of the heterotic supermembrane $E_{ps}E_{ss}$ (class HE(8x8), defined as $E_{ps(0)}=m_{ps}$c^2/2 and where m_{ps}=2.2222..x10^-20 kg as transformed Planck-Mass precisely.*

Kitada terms the timeinstanton or inverse wormhole frequency the 'Least Period of Time' or LPT as the minimum cycle or Period Proper for the local quantum mechanical system.

One of Kitada's references discussing this further is the 'flavour-oscillation-clock' of Ahluwalia et al and Peter Beamish's 'Rhythm Based Time' or RBT (see references).

This retains the Time-Dilation formulation of SR, as the period P(v) for the clock of the local system moves with velocity v relative to the observer and is longer than P(0) as the ratio P(v)/P(0) per cycle and equals γ=1/Sqrt[1-(v/c)^2} as required by Special Relativity. The quantum mechanical clock so becomes slow by the inverse of the gamma (γ)-factor which sets it identical to the relativistic classical clock and unifies quantum mechanics and classical mechanics in SR.

Applying the LPT to the Planck-Scale with Planck-Length l_P=Sqrt(Gh/2πc^3)=c.Planck-Time(t_P) and Planck-Mass m_P=Sqrt(hc/2πG) then gives P(0)=2h/Sqrt(hc^5/2πG)=2(2π)t_P=4π.t_P.

Quantum Relativity transforms the Planck-Scale to the macroquantised Weyl-Scale, from where the metricated field equations of GR are applicable.

The Weyl-Scale represents the FineStructure of Heisenberg's Uncertainty Principle in those parameters and is given as h/4π=$\lambda_{ps}/8\pi R_e$.c^3 and where R_e=Alpha.$R_{Compton}$=10^10.λ_{ps}/360. This forms the quantum mechanical linkage between the nucleon (as protonic diameter R_e) and the superbrane parameters of the metrication limit for GR, where the tidal warping of the Weyl-Tensor must dewarp to allow the linearisation of the radius vector denoted by λ in the Kitada paper just discussed.

The Heisenberg Finestructure crystallises the factor c^3 as 'inverse action' parameter and this leads to the core of the QR boundary definitions.

The Planck-Length-Oscillation is defined in QR as the Planck-Length multiplied by *the Squareroot of Alpha and also as the Hamiltonian {e/(mc^2)} per unified (monopolic) mass; qualitatively identical to Kitada's analysis in momentum-space.*

Now superbrane class IIB is also known as the 'Magnetic Monopole Boson' analogous to the Planck-Boson of superbrane class I, the latter setting the Planck-Scale, which transforms through the classes to the Weyl-limit, satifying the Weyl-Nullification Hypothesis of Roger Penrose (Oxford).

Unifying the electromagnetic finestructure with the gravitational one in equating the mensuration units for the proportionality constants $k=1/4\pi\varepsilon_o$ *in (m.J/C^2) with G in (m^3/kg.s^2) for the modular duality between them as the unity kG=1, gives Charge^2=Volume^2/Time^4 =Area.c^4 or the Planck-Length-Oscillation PLO=Sqrt(Area)=Charge/c^2 which is the fundamental multiplier {e/c^2}=Sqrt(Alpha)=Sqrt(e^2/2*ε_o*hc)=Sqrt(60π.e^2/h) in QR.*

The Maxwell-Constant for electric permittivity and magnetic permeability $\varepsilon_o\mu_o$*=1/c^2 also assumes its unitary form for unitary resistance in their ratio leading directly to the Action-Law of Action=Charge^2 in setting the QR definition for the Electromagnetic Finestructure as independent of lightspeed c and permittivity* ε_o*. The Action-Law manifests in superconductivity via the Quantum Hall Effect, the Josephson Effect (with the coefficient defining the* B_o *in the cosmic wavefunction B(n)) and the Electric Conductance Quantum.*

Thus μ_o/ε_o*=Henry/Farad=(Js^2/mC^2).(mJ/C^2)=Action^2/Charge^4 or the multiplier {h/e^2}^2*

This ratio also sets (Voltage/Current)^2=Resistance^2 for the superconductivity.

I may here point out, that the supermembrane $E_{ps}E_{ss}$ *uses modular duality between vibratory (*$_{ps}$*=primary sourcesink) and winded (*$_{ss}$*=secondary sinksource) eigenstates for operational distance definitions and rather naturally crystallises the leading action term in Kitada's Hamiltonian. In particular* $E_{ps}.E_{ss}$*=h^2 and* $E_{ps}/E_{ss}=f_{ps}$*^2=1/*f_{ss}*^2=9x10^60 as universal sourcesink quantum entropy counter and upper bound for the df/dt operator.*

Using those QR definitions, we now rewrite mass m=E/c^2=hf/c^2=hc/λ.c^2=h/λc for a de Broglie matter wavelength λ and momentum p=mc=h/λ. in the massless limit for velocity v=c.

*But the absolute limit for the Heisenbergian Uncertainty principle is the momentum for the PLO and hence the minimum displacement is given by the PLO=e/c^2, transforming the mass m=h/λc=hc^2/ec=hc/e=ee*c/e=e*c by the generalised Action-Law.*

The Energy Hamiltonian for this superbrane definition for mass m so becomes the mass-equivalent for the Monopole Boson as the {ec}c^2=ec^3 , calculating as *precisely 2.7x10^16 GigaElectronVolt (GeV) (as the Cosmic Ray and Gamma Burster Maximum as superstring class IIB and the proposed GUT-Unification limit).*

Now the detailed analysis of the initiatory boundary conditions in QR show that the E_{ps} SourceSink Energy Quantum can be written as being precisely equal to the inverse of magnetocharge e in:*

$E_{ps}=hf_{ps}=m_{ps}c^{\wedge}2=kT_{ps}=Sqrt\{2\pi G_o.m_e{}^{\wedge}2/(4Alpha.hc.e^{\wedge}2)\}=/m_e/\{2e.m_P.Sqrt(Alpha)\}=1/e^*$, where m_e is the effective electronmass (containing a magneto-charged component as electromagnetic mass $m_e{}^*=2\mu_o e^{\wedge}2/3R_e.e^*$) and k is the Boltzmann Constant with Planck-Mass m_P and initiatory Gravitational Constant G_o for the proportionality unification.

We can now write the generalised F-Space Hamiltonian as 1/e via $2e.R_e=e^*L_P.Sqrt(Alpha)$,m leading to the F-Space mapping of magnetocharge e* onto Coulombic charge e via the de Broglie phases for the matter wavelength in: $e^*=2R_e.c^{\wedge}2$ <--> $e=PLO.c^{\wedge}2=Sqrt(Alpha).l_P.c^{\wedge}2$.*

Since $2R_ec^{\wedge}2$ defines the MagnetoCharge e, h can be written as $\lambda_{ps}/e^*c=E_{ps}/f_{ps}$, which is of course Kitada's Hamiltonian AS the Heisenberg Finestructure with mass m=e*c and $\{\lambda_{ps}/e^*c=1/e^*f_{ps}=t_{ps}/e^*\}$ representing mass m as unified inverse sourcesink current $I^*=e^*f_{ps}$.*

The F-Space is the vector bundle $XxR^{\wedge}9$ comprising 3 additional degrees of freedom to the ones of the Kitada $R^{\wedge}6$ space in the translational LineSpace $X/R^{\wedge}3$, the rotational HyperSpace $X/R^{\wedge}6$, the vibrational QuantumSpace $X/R^{\wedge}9$ and the quantisational (or holographically mapped) OmniSpace $X/R^{\wedge}12=X/R^{\wedge}3$.
Those 'higher dimensions' are thus all congruent with $R^{\wedge}3$ but manifest in phasal transformation as multivalued Riemannian Hyperspheres (Poincare's 3-Sphere).

The relevance of Kitada's work to the extended scenario of the superbranes and related endeavours in the unification between gravitational and electromagnetic parameters within QR in the discussed paper is herewith tentatively established.

II. N-particle case with masses mj (j=1,2,3,...N)

Kitada considers the case of a local system L of N particles, which are scattered sufficciently for asymptotic behaviour and a solution in the system's time $t=t_L$, as t increases to infinity. As given in the Kitada references:

$\exp[-2\pi i.t_LH_L/h)f\sim\exp[-2\pi i.t_Lh_b/h]g_0*\exp[-2\pi i.t_LH_1/h]g_1*...*\exp[-2\pi i.t_LH_k/h]g_k$, and where
$h_b=T_b+I_b(x_b,0)$ and k>=1.

The Hamiltonians H_s (s=1,2,...,k) are self adjoint in scattered clusters for the spectral representation (and its theorem for unfree Hamiltonians) to express the appropriate

Hilbert space as the Hamiltonian for the s-cluster in $\{\lambda_s/M_s\}$.

Hitoshi Kitada's analysis then proceeds analogously to the one particle state.

Kitada References:

1. H.Kitada, "Theory of local times"; http://xxx.lanl.gov/abs/astro-ph/9309051
http://kims.ms.u-tokyo.ac.jp/bin/time_divI.dvi,ps,pdf

2. H.Kitada, "Quantum Mechanics and Relativity - Their Unification by Local Time"; http://xxx.lanl.gov/abs/gr-qc/9612043

3. Dr. Peter Beamish at CETA Research; http://www.oceancontact.com

4. D.V. Ahluwalia, "On a new non-geometric element in gravity", Gen.Rel.Grav.29, No.12 (1997),1491-1501.

5. D.V. Ahluwalia and C.BUrgard, "Interplay of gravitation and linear superposition of different mass eigenvalues", Phys.Rev.D 57 (1998), 4724-4727.

6. H.Kitada, "Quantum Mechanics", at http://kims.ms.u-tokyo.ac.jp/bin/qm.dvi