Clifford Algebra

Note 5
TOMONAGA's Super Multi-time Theory

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1 <Schrödinger equation>

State vector ψ

Time t

Electromagnetic field A

Hamiltonian H

$$i\hbar \frac{\partial}{\partial t}\psi(t) = H\psi(t), \quad \psi(0) = \psi \qquad (1)$$

2 <Dirac's paraphrase of Schrödinger equation >

Coordinate $\boldsymbol{x}$

Momentum $\boldsymbol{p}$

Electron N in number

Electromagnetic field A

H^{-}_{em} Electromagnetic field Hamiltonian

$$[\, H^{-}_{em} + \sum_{n=1}^{N} H_n (\boldsymbol{x}_n, \boldsymbol{p}_n, A (\boldsymbol{x}_n)) + \frac{\hbar}{i} \frac{\partial}{\partial t} \,] \psi(t) = 0 \qquad (2)$$

3 <Representation by unitary transformation>

$$u(t) = \exp\{ \frac{i}{\hbar} H^{-}_{em} t \}$$

$$A (\boldsymbol{x}_n, t) = u(t) A (\boldsymbol{x}_n) u(t)^{-1}$$

$$\Phi(t) = u(t) \psi(t)$$

$$[\sum_{n=1}^{N} H_n (\boldsymbol{x}_n, \boldsymbol{p}_n, A (\boldsymbol{x}_n, t)) + \frac{\hbar}{i} \frac{\partial}{\partial t}] \Phi(t) = 0 \qquad (3)$$

4 < Dirac's multi-time theory- Time variant in number N >

$$[H_n (\boldsymbol{x}_n, \boldsymbol{p}_n, A (\boldsymbol{x}_n, t_n)) + \frac{\hbar}{i} \frac{\partial}{\partial t}] \Phi(x_1, t_1; \dots ; x_N, t_N) = 0 \qquad (4)$$

5 <Tomonaga's representation of electromagnetic field>

Unitary transformation

$$U (t) = \exp \{ \frac{i}{\hbar} (H_1 + H_2) t \}$$

Schrödinger equation

$$[H_1 + H_2 + H_{12} + \frac{\hbar}{i}\frac{\partial}{\partial t}]\,\psi(t) = 0$$

Independent time variant t_{xyz} at each point in space

$$[\,H_{12}(x, y, z, t_{xyz}) + \frac{\hbar}{i}\frac{\partial}{\partial t}\,]\;\; \Phi(t) = 0 \qquad (5)$$

6 < Tomonaga's super multi-time theory>

Super curved surface C

Point on C P

4-dimensional volume's transformation of C ∂C_P

Infinite small variation of state vector $\Phi[C] = \Phi[T_{xyz}]$ $\partial\Phi[C]$

$$[\,H_{12}(P) + \frac{\hbar}{i}\frac{\partial}{\partial t}\,]\,\Phi[C] = 0 \qquad (6)$$

[References]

<Past work on multi-time themes>

Aurora Theory / Dictoron, Time and Symmetry <Language Multi-Time Conjecture> / Tokyo October 6, 2006

Aurora Theory / Word, Phrase and Sentence <Language Multi-Time Conjecture 2> / Tokyo October 25, 2006

Aurora Theory / Distance and Time <Language Multi-Time Conjecture 3> 5th Time for KARCEVSKIJ / Tokyo October 28, 2006

Language and Spacetime / Time Flow in Word For KOBARI Akihiro and His Time / Tokyo May 3, 2007

<For more details>

Invitation by Theme-Time / Data Arranged at Tokyo January 6, 2008

Aurora Theory

Language and Spacetime

Tokyo January 25, 2008

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