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FINITE AND DISCRETE RELATIVISTIC QUANTUM MECHANICS*

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Conventional theories take the structure of relativistic quantum mechanics as given. The two empirical constants c and $\hbar$ are connected to the arbitrary historical standards of mass, length and time by various, hopefully self-consistent, means. A third fundamental constant such as $e^2, m_e, m_p, M_{Planck}$ has to be taken from experiment before theoretical "predictions" can be attempted.

Our theory [H.P.Noyes and D.O.McGoveran, *Physics Essays* **2**, 76 (1989)] is based on the principles of finiteness, discreteness, finite computability, absolute non-uniqueness, and strict construction. We *construct* (rather than postulate) the limiting velocity and discrete events, and then *derive* the Lorentz transformations and the non-commutativity of position and velocity.

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Our basic algorithm uses the *combinatorial hierarchy* to calculate scattering probabilities and hence coupling constants and mass ratios such as (in first approximation):

$$e^2/\hbar c \simeq 1/137; \quad Gm_p^2/\hbar c = [m_p/M_{Planck}]^2 \simeq 1/1.7 \times 10^{38}$$

$$G_F m_p^2/\hbar c \simeq 1/256^2\sqrt{2} = 1.07896... \times 10^{-5}; \quad sin^2\theta_{Weak} \simeq \tfrac{1}{4}; \quad m_{u\simeq d}(0) \simeq \tfrac{1}{3}m_p$$

$$m_p/m_e \simeq \frac{137\pi}{\frac{3}{14}\left(1+\frac{2}{7}+\frac{4}{49}\right)\frac{4}{5}} = 1836.151497...; \quad m_\pi/m_e \simeq 274m_e$$

Since we have already identified the role of $\hbar$ and c in the theory we can take a third dimensional parameter such as $e^2, m_e, m_p, M_{Planck}$ from experiment and calculate a first approximation for the other three. From then on our iterative improvement of the theory is, in principle, much the same as for any other fundamental theory. For instance, the high dimension Kaluza-Klein theories coupled to a large number of Yang-Mills fields, compactified, in effect take the Planck mass $[\hbar c/G]^{\frac{1}{2}}$ as the third dimensional parameter. Weinberg [*Phys. Lett.* **B 125**, 265 (1983); P.Candelas and S. Weinberg, *Nucl.Phys.* **B 237**, 393 (1984).] calculates a first approximation to the coupling constants in this way. Our first approximations are much better than those achieved by more conventional methods.