



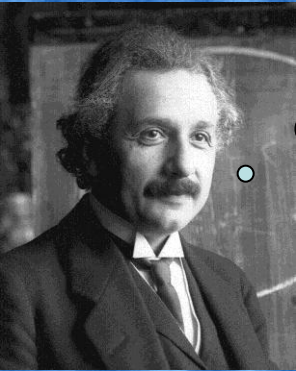
The Physics of Vacuum 2

A Solution of the First Einstein's Problem

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Uvitor, Bangkok,
Thailand
May 30, 2009**

Well-known about fundamentals

The current form of QM (Quantum Mechanics) **cannot be a starting point** for the further development of physics



Albert Einstein

QM, it's a discipline full of enigmas and paradoxes, which **we do not completely understand** but can employ



Murray Gell-Mann

Perhaps what we mainly need is same subtle change in perspective – **something that we all have missed...**

The right conclusion is that the basic equations of quantum electrodynamics **are wrong**. They require some extremely serious changes – minor changes give nothing

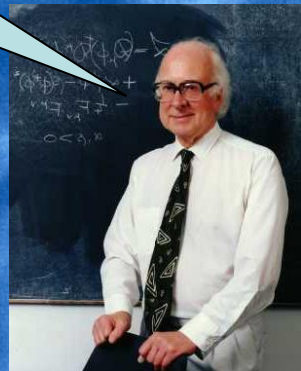
Rest mass of elementary particles **is a relative quantity**



Rodger Penrose



Paul Dirac

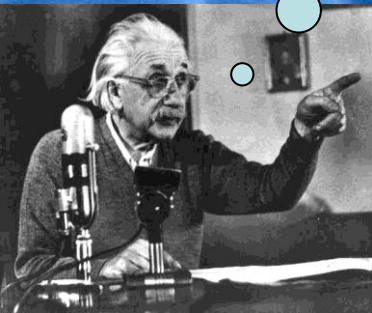


Peter Higgs

Clifford- Einstein Program - Geometrization of Physics

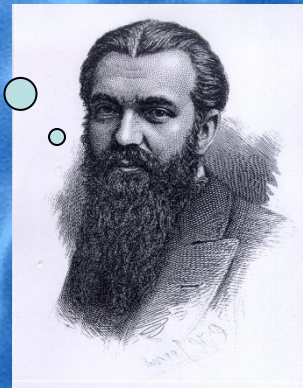
I believe, that the equations of gravitation for **empty space** are the only rationally justified case of field theory. This leads to an attempt to generalize the gravitational theory for empty space and obtain a key to a **more advanced quantum theory**.

Albert Einstein



$$R_{ik} = 0$$

Nothing occurs in the World except changing of the space **curvature**.



William Clifford
(1845-1879)

Rotation of matter gives a rise **to torsion** of the space.



Elie Cartan (1869-1951)

Nothing occurs in the World except changing of the space curvature created by **torsion** of the space.



Gennady Shipov

Preliminary reflections

$$F = F_N + F_C = G \frac{mM}{r^2} + \frac{Ze^2}{r^2},$$

$$U_N = -\frac{mMG}{r} < 0, \quad \varphi_N = \frac{U_N}{m} < 0$$

$$U_C = \frac{Ze}{r} > 0, \quad \varphi_C = \frac{U_C}{-e} < 0$$

$$M \gg m$$

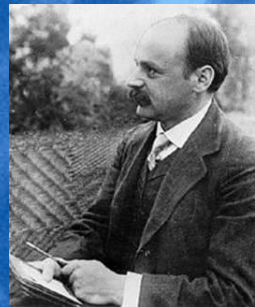
$$r$$

The total force of attraction between nucleus ($Z=1,2,\dots$) and an electron

Newton potential

Coulomb potential

$$R_{ik} = 0$$



Karl Schwarzschild (1873-1916)

$$r_g = -2r\varphi_N/c^2 = 2MG/c^2$$

$$r_e = -2re\varphi_C/mc^2 = 2Ze^2/mc^2$$

Gravitation radius

Electromagnetic radius

$$g_{00} = [1 - (r_g + r_e)/r]$$

Junior of the Moscow State University (1963)

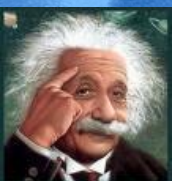


Solution of the first Einstein's problem (1972)

Good idea!

When $r_e \gg r_g$, we have

$$ds^2 = \left(1 - \frac{r_e}{r}\right) c^2 dt^2 - \left(1 - \frac{r_e}{r}\right)^{-1} dr^2 - r^2(d\theta^2 + \sin^2 \theta d\varphi^2)$$



$$R_{ik} = 0$$

Geometrization of the Coulomb potential

The beginning of a search for an answer

1968

electron

Stationary orbit – inertial motion connected with QM

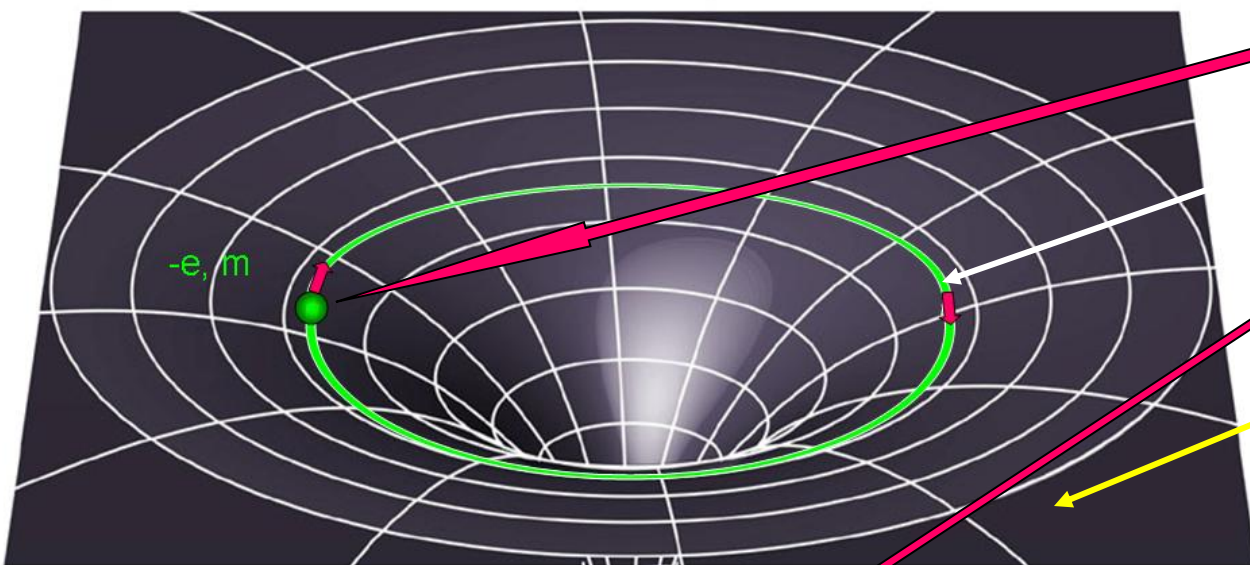
nucleus H_2

The space of events is curved by Coulomb potential of the H_2 nucleus

$$r_e = \frac{2e^2}{mc^2} = 2\alpha \frac{\hbar}{mc}, \quad \alpha = \frac{e^2}{\hbar c}$$

Oh...it's subtle indeed!

$$g_{ik} = \eta_{ik} + \frac{e}{m} a_{ik}$$



Potential energy

$$U_c = mc^2 (g_{00} - 1)/2 = e^2/r$$

$$r_e = 5.6 \times 10^{-15} \text{ m}$$

$+e, M$
 $M \gg m$

Parametric Riemannian geometry $g=g(k,x)$, where $k=-e/m$ - parameter

Result № 1: New Potentials of the Vacuum Electrodynamics (VE)

Super-potentials as a solution of the VE

Any solution of the equations $R_{ik} = 0$ the Vacuum Electrodynamics interprets as a potential energy of interaction

$$U = T - L = -mc \left[\left(\eta_{ik} \frac{dx^i}{dt} \frac{dx^k}{dt} \right)^{1/2} - \left(g_{ik} \frac{dx^i}{dt} \frac{dx^k}{dt} \right)^{1/2} \right]$$

Agree, I felt it intuitively

Rutherford discovered a new short-range interaction force

1911 Ernst Rutherford performed a number of the experiments on a scattering of α particles on nuclei and established a new type of force that can't be described by Coulomb potential. **The new short-range interaction force was called the Nuclear force**

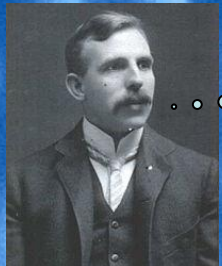
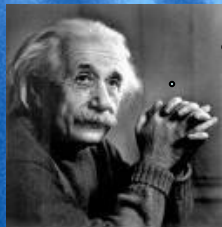
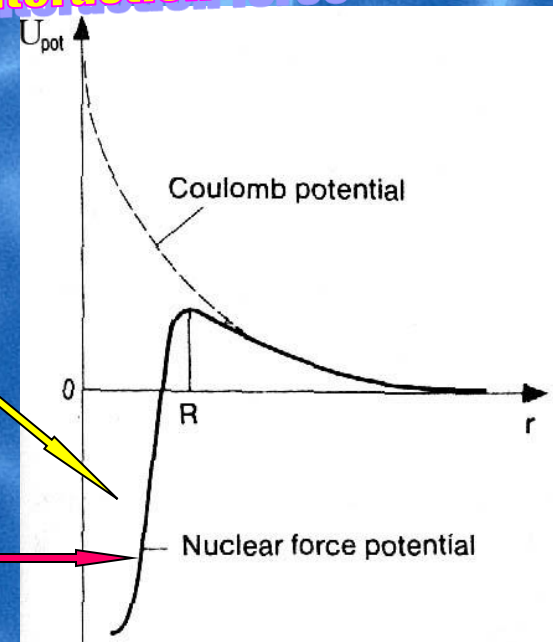
Wow !!!

Boys, can you try to use NUT solution of $R_{ij} = 0$ for the description of nuclear force

$$U = -\frac{mc^2 r r_e + 2r_N^2}{2(r^2 + r_N^2)},$$

$r_N = \text{const}, \quad r_e = \text{const}$

Ezra Newman

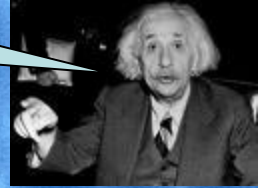


Ernst Rutherford
(1871-1937)



Comparison with experimental data

It seems to me that these guys have found what I looked for over 30 years



Nuclear potential

1988 -1994

$$U = -\frac{mc^2 rr_e + 2r_N^2}{2(r^2 + r_N^2)},$$

$$r_N = \text{const}, \quad r_e = \text{const}$$



Evgeny Gubarev



Andrei Sidorov

$$\Phi = -1 + \frac{rr_e + 2r_N^2}{r^2 + r_N^2},$$

$$ds^2 = -\Phi [cdt + 4r_N \sin^2(\theta/2) d\varphi]^2 + \frac{dr^2}{\Phi} - (r^2 + r_N^2)(d\theta^2 + \sin^2 \theta d\varphi)$$

$$g^{ik} \frac{\partial S}{\partial x^i} \frac{\partial S}{\partial x^k} - m^2 c^2 = 0$$

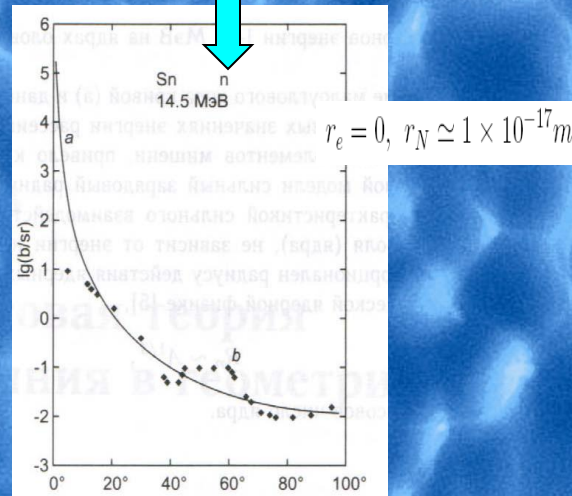
$$\left[\frac{1}{\sqrt{-g}} \frac{\partial}{\partial x^i} \left(\sqrt{-g} g^{ik} \frac{\partial}{\partial x^k} \right) + \frac{m^2 c^2}{\hbar^2} \right] \psi = 0$$

r_e is calculated after
the formula

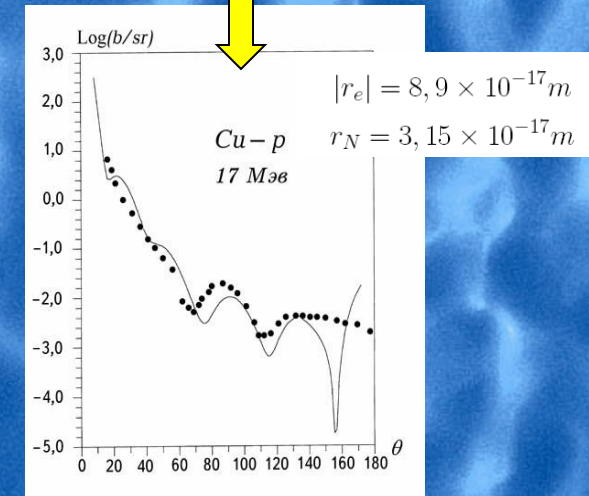
$$r_e = -2Z\alpha \frac{\hbar}{m_p c}$$

Here $\alpha=1/137$
 r_N is obtained from the experiment

$$r_N \approx A^{1/3}$$



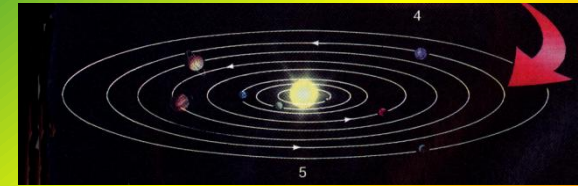
Classical calculations



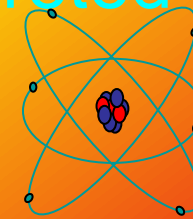
Quantum calculations

Summary of the Vacuum Electrodynamics

- VE could be naturally unified with Einstein's gravity.

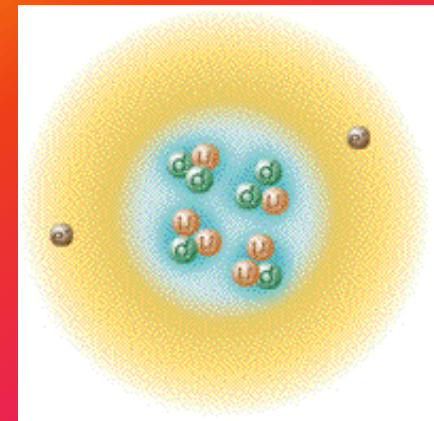


- The Bohr principle could be interpreted as a consequence of VE.



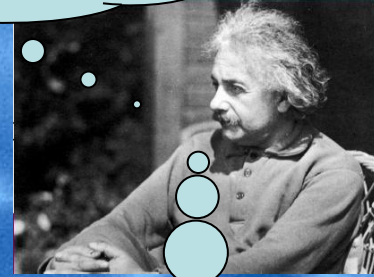
*The
spectral
properties
and
stability of
the atom*

- Nuclear potentials follow from VE.



Surprise: Torsion field appears in Physics

My intuition prompts me that there is something afoot here



Oh!!! During 1928-1931 I have published 13 articles, where I tried to connect this torsion with an electromagnetic field

Maybe it is about
"something that
we all have missed..."



Rodger Penrose

You are right, Master Einstein. The NUT metric has been received as a solution of Newman-Penrose formalism equations of the following view

$$\nabla_{[k} e_{j]}^a + T_{[kj]}^i e_i^a = 0, \quad (i)$$

$$R_{jm} = 0, \quad (ii)$$

$$C^i_{jkm} + 2\nabla_{[k} T_{j|m]}^i + 2T_{s[k}^i T_{j|m]}^s = 0. \quad (iii)$$

which contains Ricci rotation coefficients (torsion field) and torsion of the absolute parallelism geometry. Your vacuum equations (ii) in these systems of equations play a role of a 'tie'.

Gennady is absolutely right.
We solved this system of
equations.



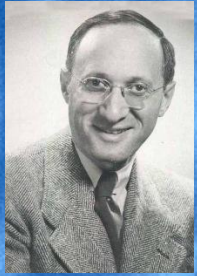
Ezra Newman

Anchonomic
tetrad

Wyle tensor

Torsion effects in Nuclear Physics

When $r_e \gg r_g$ than we can get from Kerr-NUT solution



Ezra Newman

$$U = \frac{mc^2}{2} \left(\frac{r^2 - r_e r - r_N^2 + r_s^2 \cos^2 \theta}{r^2 + (r_N - r_s \cos \theta)^2} - 1 \right)$$

Where r_s - is Kerr's parameter

$$r_s = \frac{Z_1 \hbar}{M_s c},$$

$Z_1 \hbar = \pm(0, 1/2, 1, 3/2, \dots) \hbar$ - spin and M - mass of nuclear



Roy Kerr

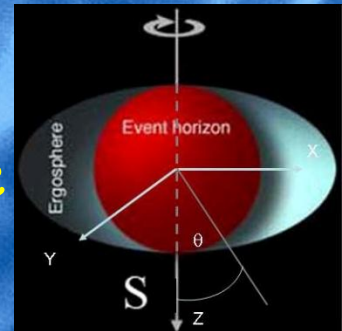
Mass with rotation

The main component, T_{130} , of the torsion field defines rotation ω of the Kerr-NUT space

$$r_N \sim A^{1/3}$$

$$T_{130} = -(r + ir_N - ir_s \cos \theta)^{-1}$$

$$\omega = |(T_{130} - \bar{T}_{130})|/2$$



$$r_e = -2Z\alpha \frac{\hbar}{m_p c}$$



In our case the Kerr's parameter describes the dependence of the nuclear interactions on the spin of the particles. We are waiting for the verification by an experiment!

Torsion Field - Neutrino!



Niels Bohr
(1885-1962)

The first Shipov's law



Free torsion
field ($m=0, r_e=0$)
has $U=0$,
but $r_s \neq 0$!

In case if one observes the violation
of a conservation law in the
experiment – it occurs due
to the torsion field!



In micro-world
conservation laws are
not applicable

β -decay

Violation of
the Energy
Conservation Law

Let's name this violation
of the conservation law
as **neutrino** $\bar{\nu}$

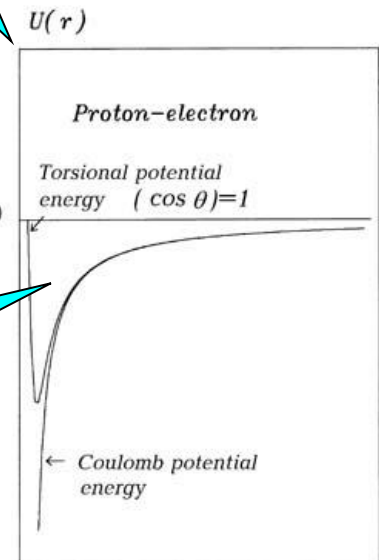
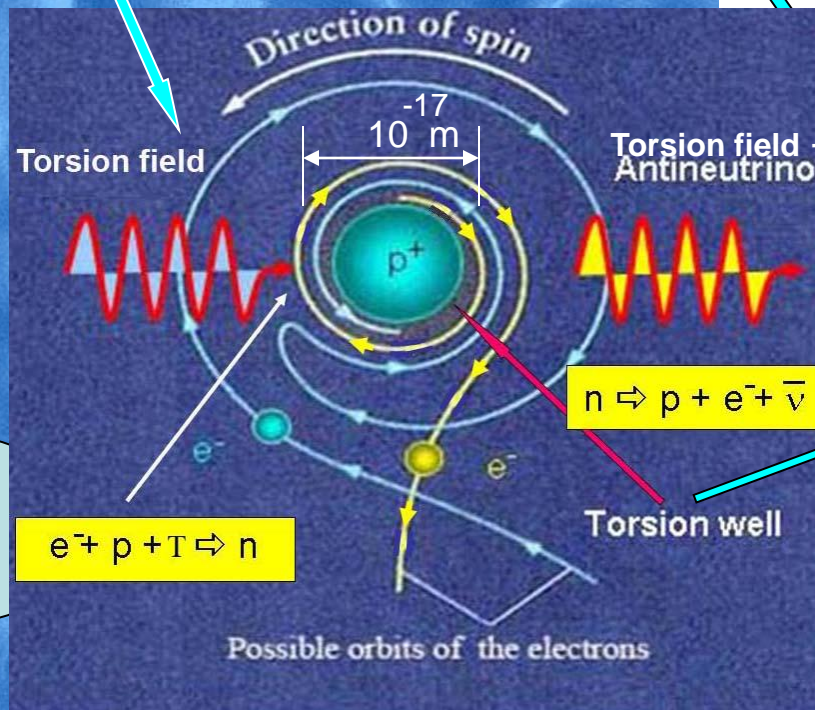
New model of
neutron



Wolfgang
Pauli
(1900-1958)

$$U = \frac{mc^2}{2} \left(\frac{r^2 - r_e r + r_s^2 \cos^2 \theta}{r^2 + (r_s \cos \theta)^2} - 1 \right)$$

$$r_s = |r_e|/3 = 1.8 \times 10^{-15} m$$



A torsion hypothesis of the electromagnetic formfactors

Elastic electron-proton scattering (1950's)

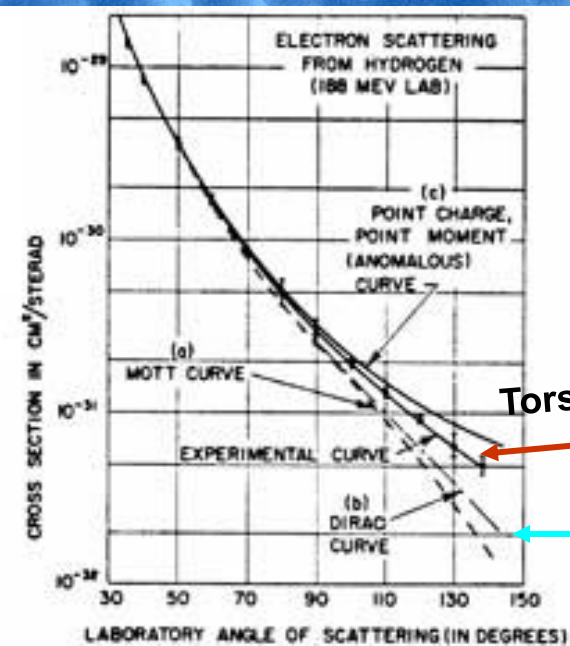
Hofstadter discovered deviation from Coulomb potential



Robert Hofstadter

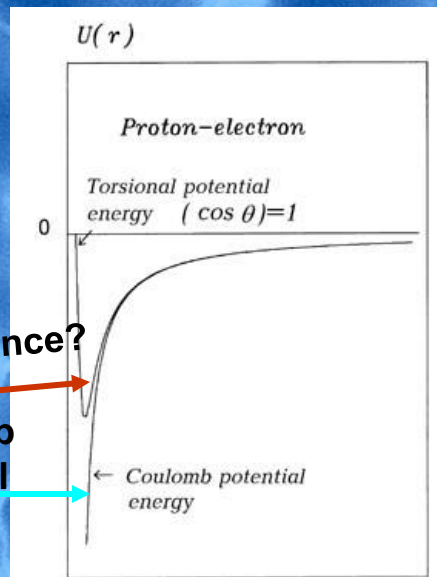
McAllister and Hofstadter,
PR, V102, May 1, 1956.
Scattering of 188 MeV electrons
from protons and helium.

$$U = \frac{mc^2}{2} \left(\frac{r^2 - r_e r + r_s^2 \cos^2 \theta}{r^2 + (r_s \cos \theta)^2} - 1 \right)$$



Torsion influence?

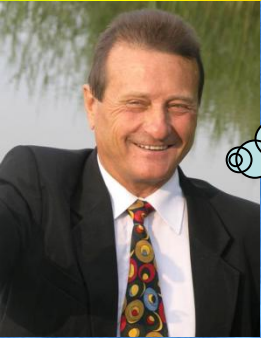
Coulomb
potential



We are waiting
for verification
by an experiment!



Geometrical model of quarks



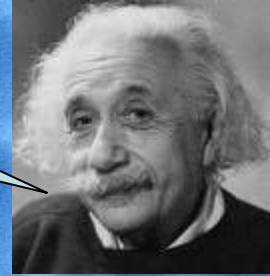
Evgeny Gubarev



We shall obtain potential energy, which describes quarks interaction



What will happen in case if we will apply your approach to my equations with Λ term?



$$\begin{aligned}\nabla_{[k} e^a_{j]} + T^i_{[kj]} e^a_i &= 0, \\ R_{jm} - \frac{1}{2} R g_{jm} &= -\Lambda g_{jm}, \\ C^i_{jkm} + 2\nabla_{[k} T^i_{|j|m]} + 2T^i_{s[k} T^s_{|j|m]} &= 0.\end{aligned}$$

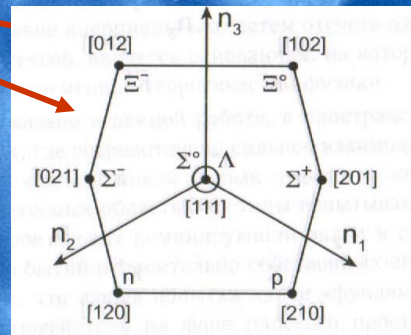
Quark term

When $r_e \gg r_g$, we have

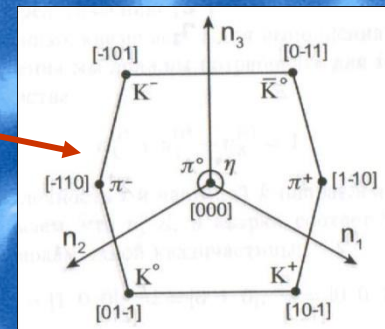
$$U = -\frac{mc^2}{2} \left(\frac{rr_e + 2r_N^2 - 96\Lambda r_N^4}{r^2 + r_N^2} + \frac{1}{3}\Lambda(r^2 + 5r_N^2) \right)$$

Exceptional!

Baryons



Mesons

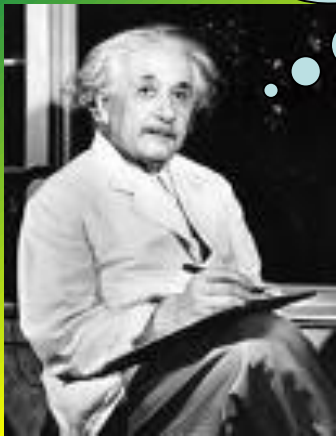


The summary on the Vacuum Electrodynamics

- VE naturally allows to unify gravity with electromagnetic, strong and weak interactions.
- The Torsion field T_{ijk} plays an important role in Elementary Particle Physics

Gennady, you have received more results, than I assumed. But how to geometrize the right part of my equations, i.e. quantum fields?

Dear Teacher, I have always admired your intuition. Actually, geometrization of quantum fields is connected with the geometrization of the right part of your equations. But it is another story...



**To be continued by
Vacuum 3**

Kob Khun Krab!

Thank You for Your Attention !