The Physics of Vacuum 4

Beyond Einstein's problems

Universal Theory of Relativity and a Theory of Physical Vacuum (G.Shipov 1988)

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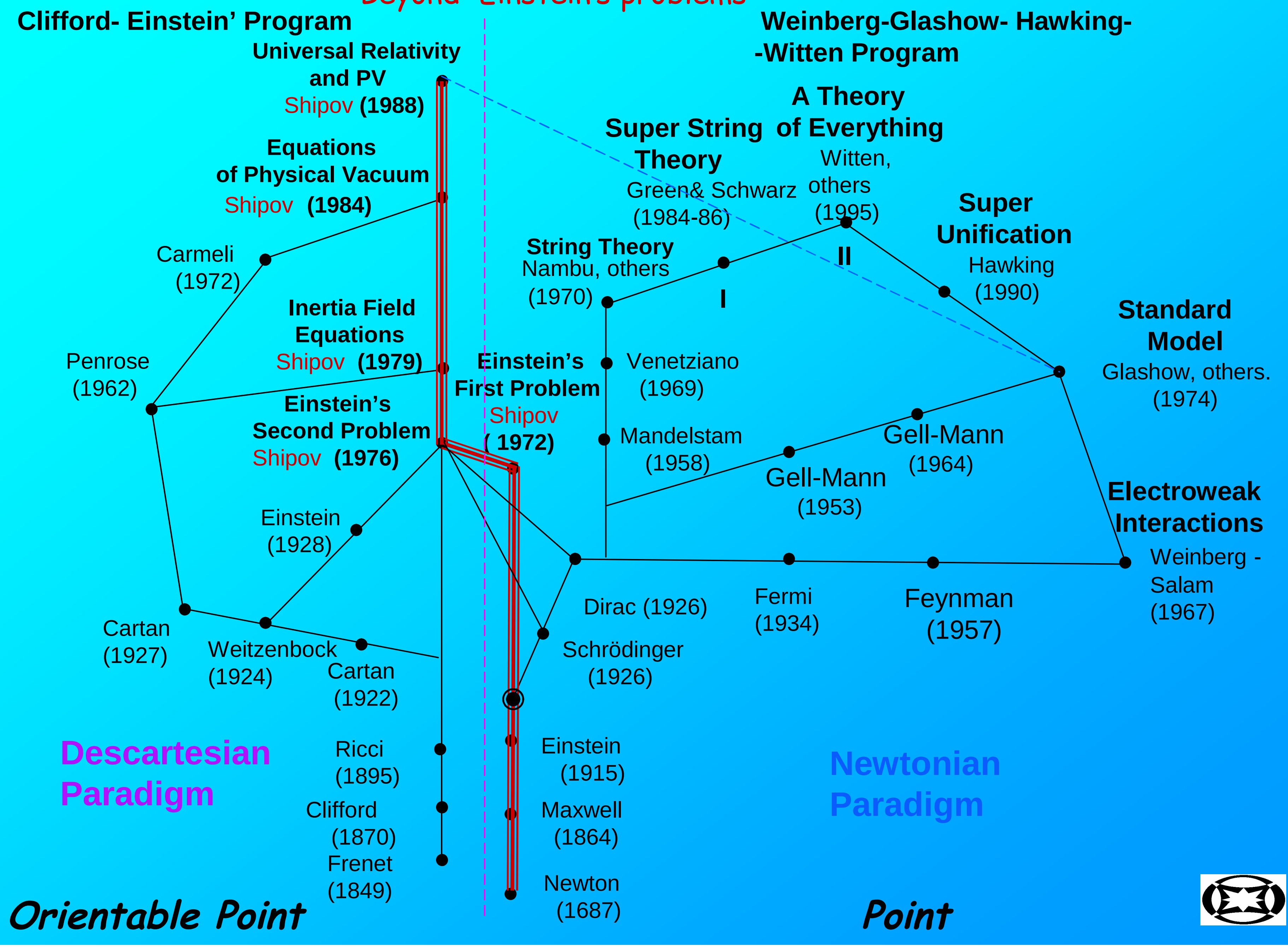
August 31, 2009

Introduction

Universal Relativity and a Theory of Physical Vacuum

Beyond Einstein's problems



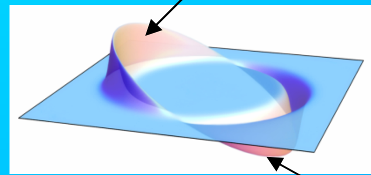
The Structure of Physical Vacuum described by a set of spinor equations

1. Geometrized nonlinear Heisenberg-like equations

$$\nabla_{\beta\dot{\chi}}\iota_\alpha = \nu o_\alpha o_\beta \bar{o}_{\dot{\chi}} - \lambda o_\alpha o_\beta \bar{\iota}_{\dot{\chi}} - \mu o_\alpha \iota_\beta \bar{o}_{\dot{\chi}} + \pi o_\alpha \iota_\beta \bar{\iota}_{\dot{\chi}} - \gamma \iota_\alpha o_\beta \bar{o}_{\dot{\chi}} + \alpha \iota_\alpha o_\beta \bar{\iota}_{\dot{\chi}} + \beta \iota_\alpha \iota_\beta \bar{o}_{\dot{\chi}} - \varepsilon \iota_\alpha \iota_\beta \bar{\iota}_{\dot{\chi}}, \qquad (\overset{+}{A}_{s^+}.1)$$

$$\nabla_{\beta\dot{\chi}} o_\alpha = \gamma o_\alpha o_\beta \bar{o}_{\dot{\chi}} - \alpha o_\alpha o_\beta \bar{\iota}_{\dot{\chi}} - \beta o_\alpha \iota_\beta \bar{o}_{\dot{\chi}} + \varepsilon o_\alpha \iota_\beta \bar{\iota}_{\dot{\chi}} - \tau \iota_\alpha o_\beta \bar{o}_{\dot{\chi}} + \rho \iota_\alpha o_\beta \bar{\iota}_{\dot{\chi}} + \sigma \iota_\alpha \iota_\beta \bar{o}_{\dot{\chi}} - \kappa \iota_\alpha \iota_\beta \bar{\iota}_{\dot{\chi}}, \qquad (\overset{+}{A}_{s^+}.2)$$

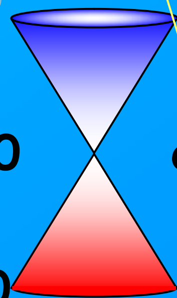
$$\alpha, \beta ... = 0,1, \quad \dot{\chi}, \dot{\gamma} ... = \dot{0}, \dot{1},$$



2. Geometrized Einstein-like equations

$$2\Phi_{AB\dot{C}\dot{D}} + \Lambda \varepsilon_{AB} \varepsilon_{\dot{C}\dot{D}} = \nu T_{A\dot{C}B\dot{D}}, \qquad (\overset{+}{B}_{s^+}.1)$$

We always have a triplet of solutions



3. Geometrized Yang-Mills-like equations

$$C_{A\dot{B}C\dot{D}} - \partial_{C\dot{D}} T_{A\dot{B}} + \partial_{A\dot{B}} T_{C\dot{D}} + (T_{C\dot{D}})_A{}^F T_{F\dot{B}} + (T^+{}_{\dot{D}C})_{\dot{B}}{}^{\dot{F}} T_{A\dot{F}} - (T_{A\dot{B}})_C{}^F T_{F\dot{D}} - (T^+{}_{\dot{B}A})_{\dot{D}}{}^{\dot{F}} T_{C\dot{F}} - [T_{A\dot{B}} T_{C\dot{D}}] = -\nu J_{A\dot{C}B\dot{D}}, \qquad (\overset{+}{B}_{s^+}.2)$$

$$A, B ... = 0,1, \quad \dot{B}, \dot{D} ... = \dot{0}, \dot{1}$$

plus $\bar{A}_{s^+}, \bar{B}_{s^+}, \overset{+}{A}_{s^-}, \overset{+}{B}_{s^-}, \bar{A}_{s^-}, \bar{B}_{s^-}$ equations.

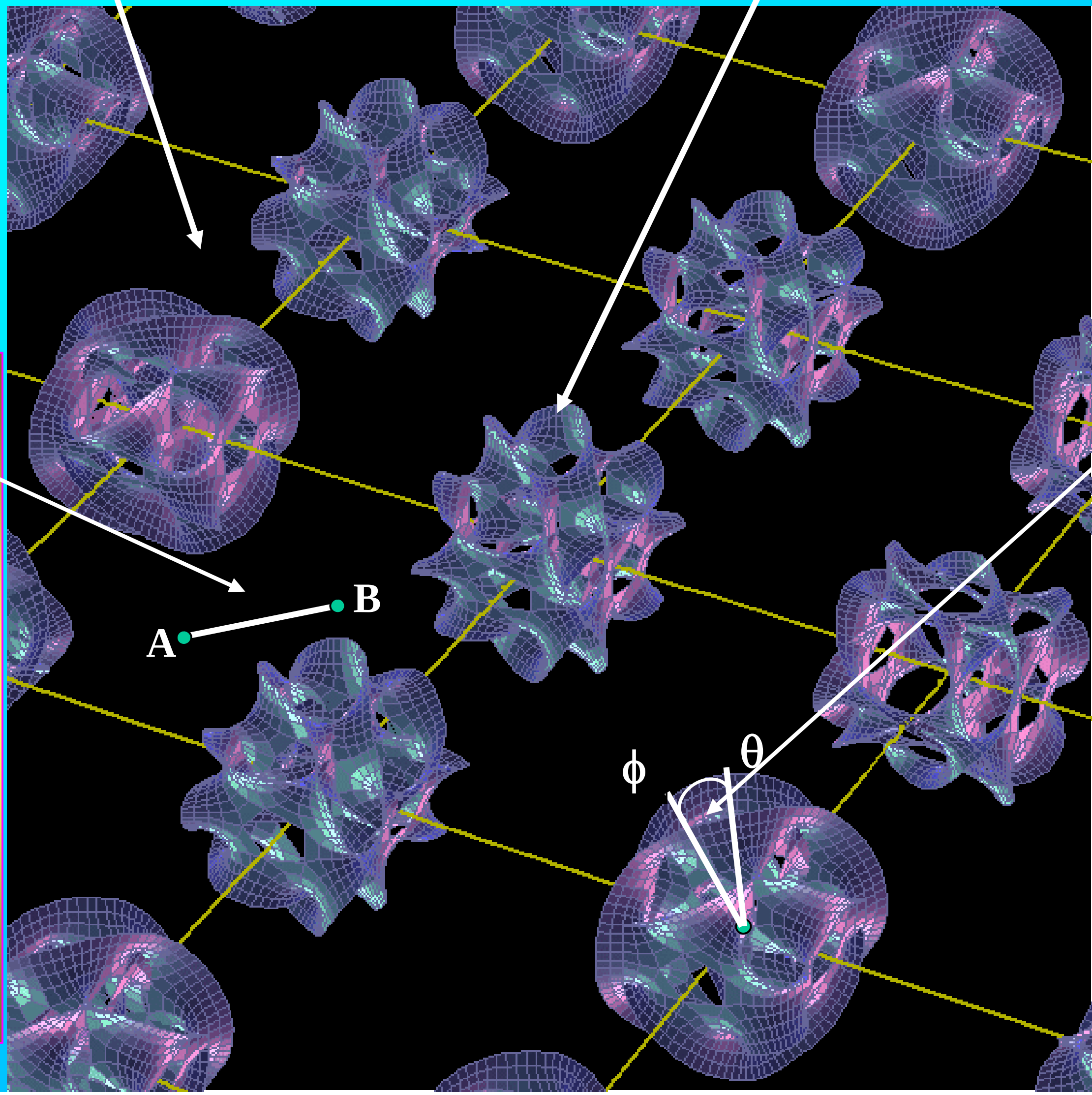
Spinor structure of $A_4(6)$ space

4 holonomic
coordinates of base : ct, x, y, z
(local spinor group T(4))

6 anholonomic
coordinates of fiber: φ, φ , ψ, θ, α, β
(local spinor group SL(2.C))

Translational metric

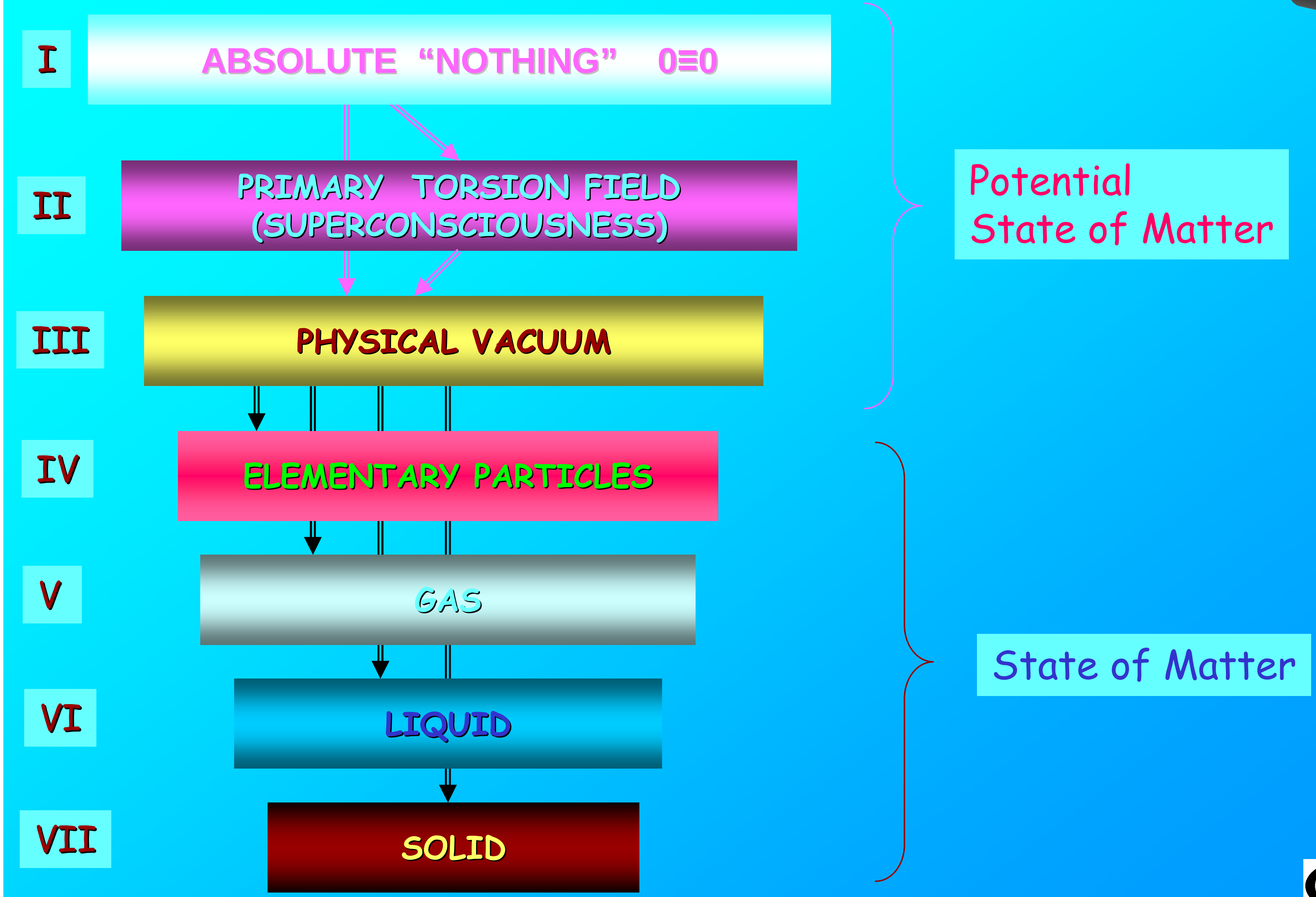
$$ds^2 = g_{ik} dx^i dx^k,$$
$$g_{ik} =$$
$$= \varepsilon_{AC} \varepsilon_{\dot{B}\dot{D}} \sigma_i^{A\dot{B}} \sigma_k^{C\dot{D}},$$
$$i, k... = 0,1,2,3,$$
$$A, B... = 0,1,$$
$$\dot{C}, \dot{D}... = \dot{0}, \dot{1},$$
$$\varepsilon^{AB} = \varepsilon_{AB} = \varepsilon^{\dot{C}\dot{D}} =$$
$$= \varepsilon_{\dot{C}\dot{D}} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}.$$



Rotational metric

$$d\tau^2 = G_{ik} dx^i dx^k,$$
$$G_{ik} = T^{A\dot{B}}{}_{C\dot{D}i} T^{C\dot{D}}{}_{A\dot{B}k},$$
$$i, k... = 0,1,2,3,$$
$$A, C... = 0,1,$$
$$\dot{B}, \dot{D}... = \dot{0}, \dot{1}$$
$$d\tau^2 = d\chi^{A\dot{B}}{}_{C\dot{D}} d\chi_{A\dot{B}}{}^{C\dot{D}},$$
$$d\chi^{A\dot{B}}{}_{C\dot{D}} = T^{A\dot{B}}{}_{C\dot{D}k} dx^k$$

Creation of Matter from the Absolute "Nothing"



Classification of Works in Theoretical Physics

Generalization of theoretical basis of physics

The importance, degree of risk and reflections

Theories in Physics	Strategical	Tactical	Operational
I. Fundamental (Mechanics, Gravity, Electrodynamics, Theory of Physical Vacuum)	**0** **Newton, Maxwell, Einstein, Shipov.**	**1** **Euler, Coulomb, Ampere, Faraday, Lorentz, Einstein, Shipov.**	**2** **Lagrange , Hamilton, Abraham, Einstein, Poynting, Lenard Gubarev, Sidorov…**
II. Semi fundamental (Quantum Mechanics, Quantum Electrodynamics)	**3** **Schrödinger, Heisenberg, Dirac.**	**4** **Plank, Einstein, Bohr, de Broglie, Pauli, Born,**	**5** **Schwinger, Lamb, Feynman, Glauber…**
III. Phenomenological (Strong, Weak, Form Factors, Quarks, Superconductivity)	**6.** **Van der Waals, Fermi, Hofstadter, Gell-Mann, Weinberg, Salam, Glashow, Lee,Yang**	**7.** **Yukawa, Hoft, Veltmann, Regge, Veneziano, Mandelshtam, Goldberg…**	**8.** **London, Bardeen, Cooper, Schrieffer, Landau, Perl, Wilson, Abricosov, Leggett …**
IV. Unified Phenomenological (Electroweak, Electro-Strong, SM, Cosmology)	**9.** **Alfen, Chandrasekhar Weinberg, Salam, Glashow, Higgs …**	**10.** **Nambu, Kobayashi, Maskawa, Wheeler, Hawking, Oaks…**	**11.** **Hawking, Wheeler, Ivanenko, Zeldovich, Linde…**
V. Semi Phenomenological (Gauge, Supersymmetries, Multidimentional)	**12.** **Yang, Mills, Utiyama, Kibble, Kaluza, Klein, Carmeli…**	**13.** **Lord, Rubakov, Vladimirov, Frolov, Krechet…**	**14.** **Majority of theoreticians**
VI. Academic (Superstring, Twistors)	**15.** **E. Whitten, M. Green, B. Green, G. Schwartz… Penrose…**	**16.** **About 1000 names**	**17.** **Several thousands of names**

0

Summary

- A Theory of Physical Vacuum is a new Paradigm based on the orientable point manifold.

- Any object created from Vacuum is described by the system of nonlinear spinor Heisenberg-Einstein-Yang-Mills-like equations.

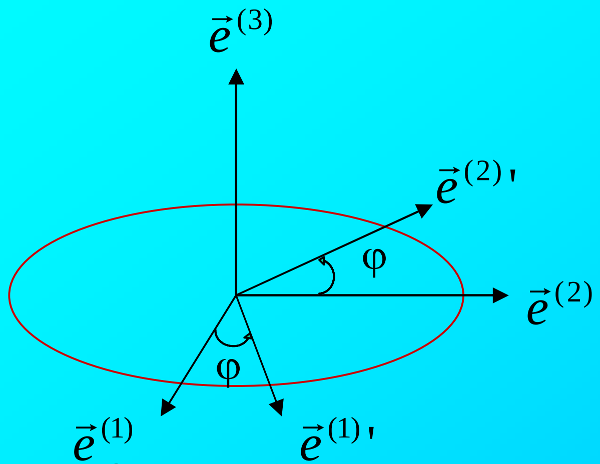
- The Physical Vacuum equations describe seven levels of the Reality including Potential State of a Matter.

The History of the Universal Relativity

Euler angels and rotational matrixes

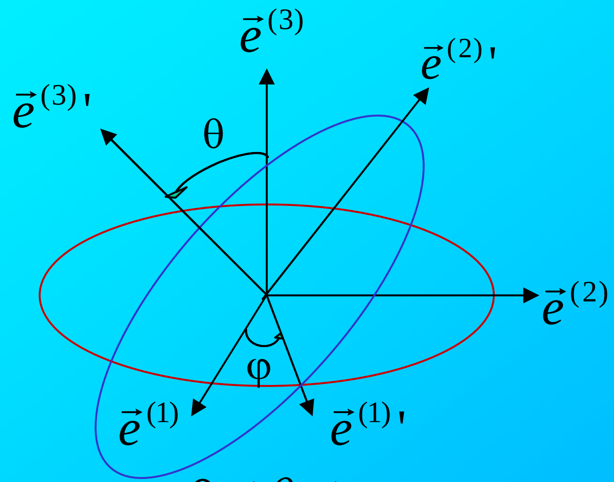
$$\left(\vec{e}^{\,(1)}\right)^2 = (\vec{e}^{\,(2)})^2 = (\vec{e}^{\,(3)})^2 = 1, \quad \vec{e}^{\,(1)}\vec{e}^{\,(2)} = \vec{e}^{\,(2)}\vec{e}^{\,(3)} = \vec{e}^{\,(3)}\vec{e}^{\,(1)} = 0$$ ⟸ Unit basis vectors

A



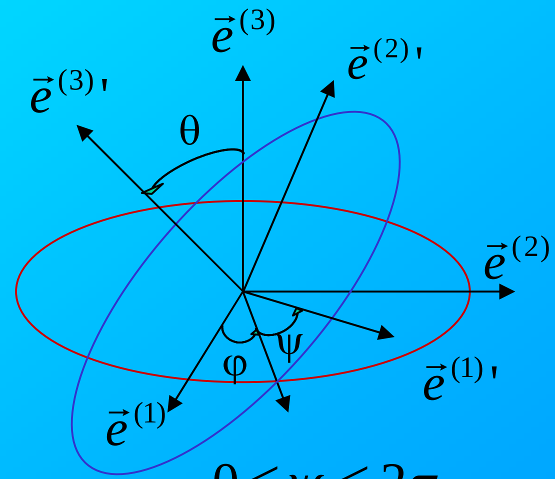
$0 \le \varphi \le 2\pi,$

B



$0 \le \theta \le \pi,$

C



$0 \le \psi \le 2\pi.$

$$A = \begin{bmatrix} \cos\varphi & \sin\varphi & 0 \\ -\sin\varphi & \cos\varphi & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{bmatrix}$$

$$C = \begin{bmatrix} \cos\psi & \sin\psi & 0 \\ -\sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

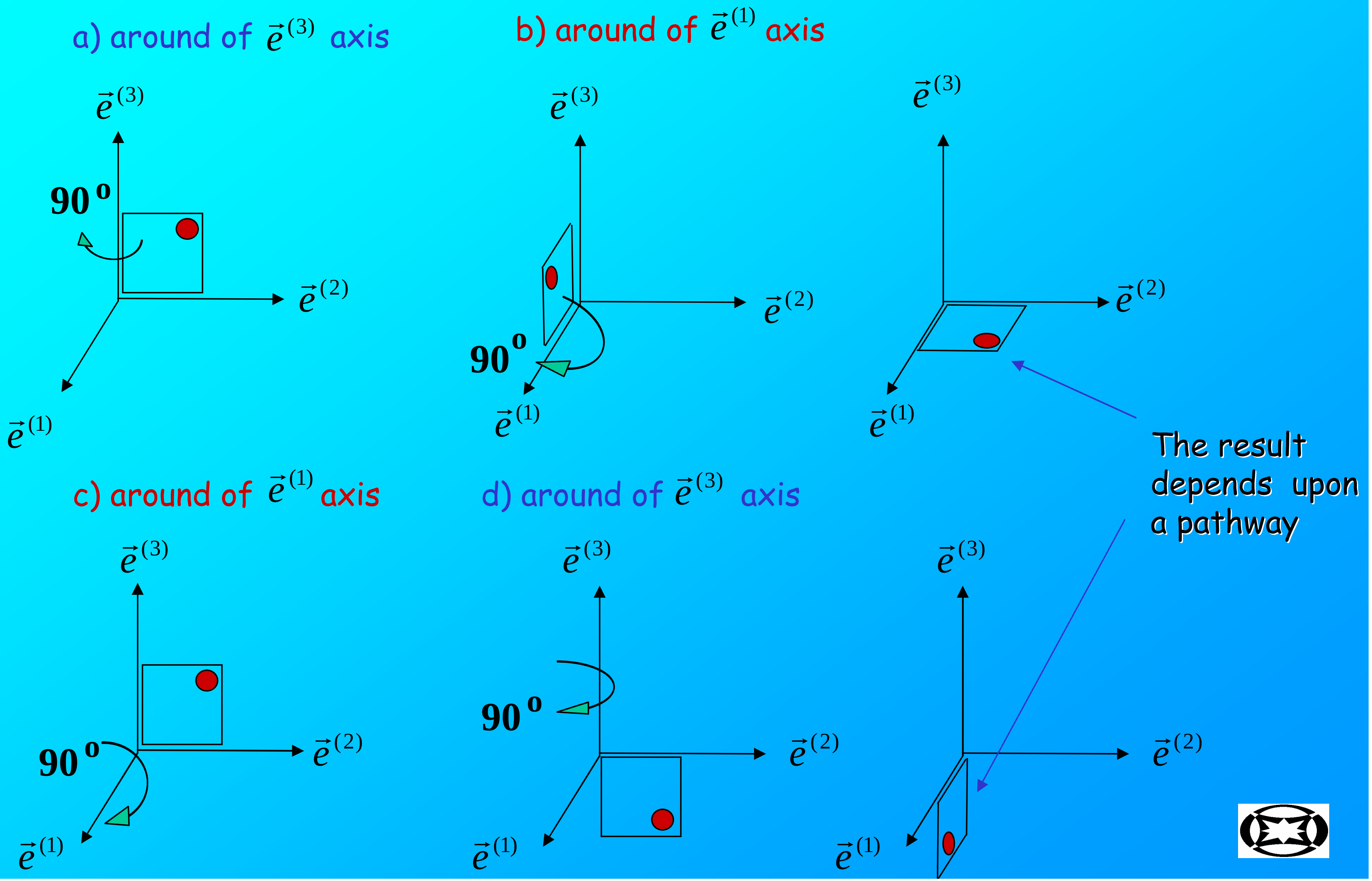
D=CBA ⟸ Total rotation

$$\vec{e}_A{}' = D^B{}_A \vec{e}_B\,, \quad D^B{}_A \in O(3)$$

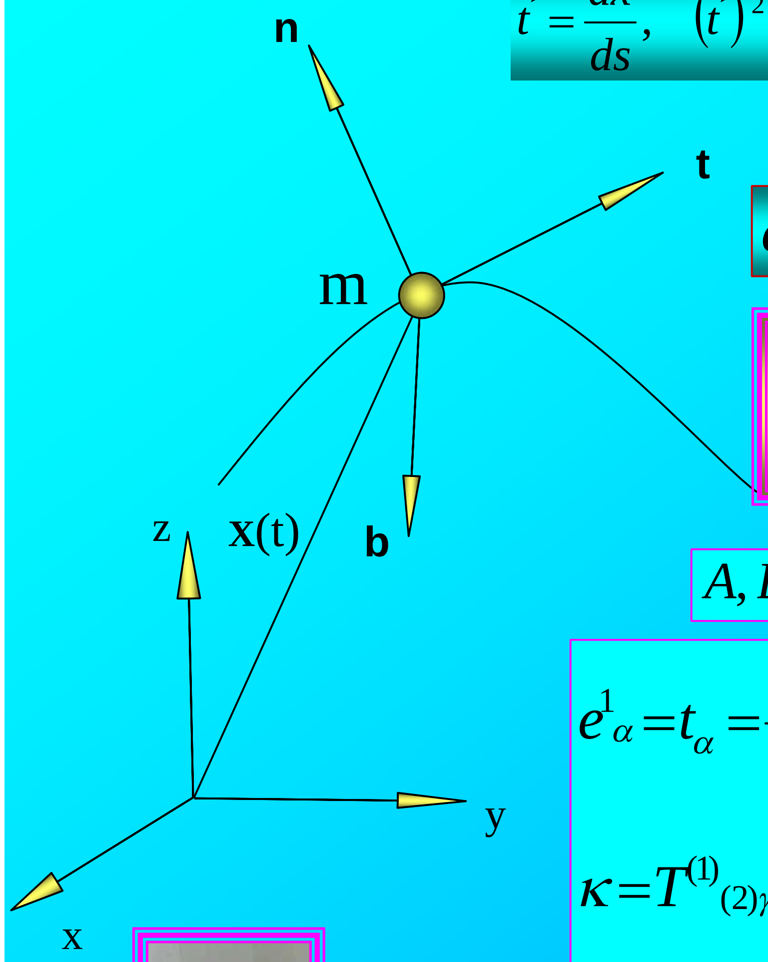
AB-BA≠0 ⟸ Euler angles are anchonomic coordinates

Noncholonomity of the rotational coordinates

Turn to 180° clockwise



3D orientable point and Frenet's equations



$$\vec{t} = \frac{d\vec{x}}{ds}, \quad (\vec{t}\,)^2 = 1, \quad (\vec{n})^2 = (\vec{b})^2 = 1, \quad \vec{t}\vec{n} = \vec{n}\vec{b} = \vec{b}\vec{t} = 0$$

⟸ Frenet's triad

Translational metric

$$ds^2 = dx^2 + dy^2 + dz^2 ,$$

$$\frac{de_\alpha{}^A}{ds} = T^A{}_{B\gamma} \frac{dx^\gamma}{ds} e^B{}_\alpha ,$$

$$A, B ... = 1,2,3 , \quad \alpha, \gamma ... = 1,2,3.$$

$$e^1{}_\alpha = t_\alpha = \frac{dx_\alpha}{ds}, \quad e^2{}_\alpha = n_\alpha , \quad e^3{}_\alpha = b_\alpha ,$$

$$\kappa = T^{(1)}{}_{(2)\gamma} \frac{dx_\gamma}{ds} , \quad \chi = T^{(2)}{}_{(3)\gamma} \frac{dx^\gamma}{ds} ,$$

Frenet's equations

$$\frac{d\vec{t}}{ds} = \kappa\vec{n} , \qquad I$$

$$\frac{d\vec{n}}{ds} = -\kappa\vec{t} + \chi\vec{b} , \qquad II$$

$$\frac{d\vec{b}}{ds} = -\chi\vec{n} , \qquad III$$

$$T^A{}_{B\gamma} = e^A{}_a e^\alpha{}_{B,\gamma}$$

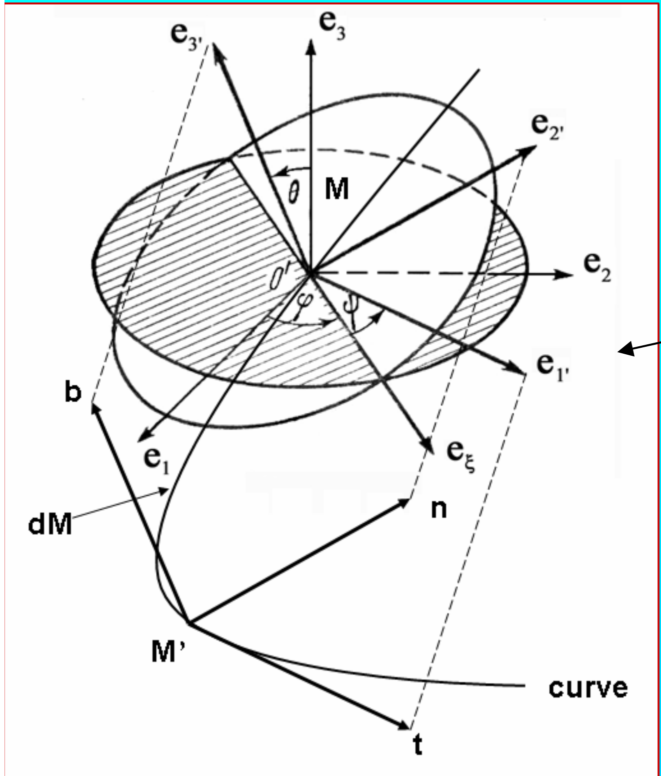
Ricci rotational coefficients

Ricci C.

Shipov's rotational metric (1997)

$$d\tau^2 = T^A{}_{B\gamma} T^B{}_{A\alpha} dx^\gamma dx^\alpha$$

Cauchy system for 3D orientable point



3D orientable point describes by 6 coordinates:
3 – translational x,y,z and 3 rotational φ, θ, ψ

$$0 \le \varphi \le 2\pi, \quad 0 \le \theta \le \pi, \quad 0 \le \psi \le 2\pi.$$

Infinitesimal displacement of an orientable point from a point M to a point M′ describes by 6 equations

$$\vec{t} = \vec{e}_{(1)}' = D^{(B)}{}_{(1)}\vec{e}_{(B)} = D^{(1)}{}_{(1)}\vec{e}_{(1)} + D^{(2)}{}_{(1)}\vec{e}_{(2)} + D^{(3)}{}_{(1)}\vec{e}_{(3)}$$

$$\vec{t} = \vec{e}^{(1)}{}', \quad \vec{n} = \vec{e}^{(2)}{}', \quad \vec{b} = \vec{e}^{(3)}{}'$$

$$dx/ds = D^{(1)}{}_{(1)} = (\cos\varphi\cos\psi - \sin\varphi\sin\psi\cos\theta),$$

$$dy/ds = D^{(2)}{}_{(1)} = (\sin\varphi\cos\psi + \cos\varphi\sin\psi\cos\theta),$$

$$dz/ds = D^{(3)}{}_{(1)} = \sin\psi\sin\theta,$$

$$d\varphi/ds = \chi\frac{\sin\psi}{\sin\theta}, \quad d\theta/ds = \chi\cos\psi,$$

$$d\psi/ds = (\kappa - \chi\sin\psi\, ctg\theta).$$

Every motion is rotation.

Rene Descartes

Only one solution

$$x = x(s),\ y = y(s),\ z = z(s),\ \varphi = \varphi(s),\ \theta = \theta(s),\ \psi = \psi(s).$$

Entry conditions

$$x = x_0,\ y = y_0,\ z = z_0,\ \varphi = \varphi_0,\ \theta = \theta_0,\ \psi = \psi_0 \quad for\ \ s = s_0,$$

define position of an original point M_0 .

Anholonomic 3D mechanics

φ, θ, ψ – anholonomic coordinates

$$\vec{v}_k = \vec{v}_m + [\vec{\omega}\vec{r}'_k] = 0,$$

$$v_m = \omega R$$

Equations of motion of center of mass

$$\dot{x}_m = R(\dot{\theta} \sin \varphi - \dot{\psi} \sin \theta \sin \varphi),$$

$$\dot{y}_m = R(\dot{\theta} \cos \varphi - \dot{\psi} \sin \theta \sin \varphi),$$

Plane-parallel motion

$$\varphi = \psi = 0,$$

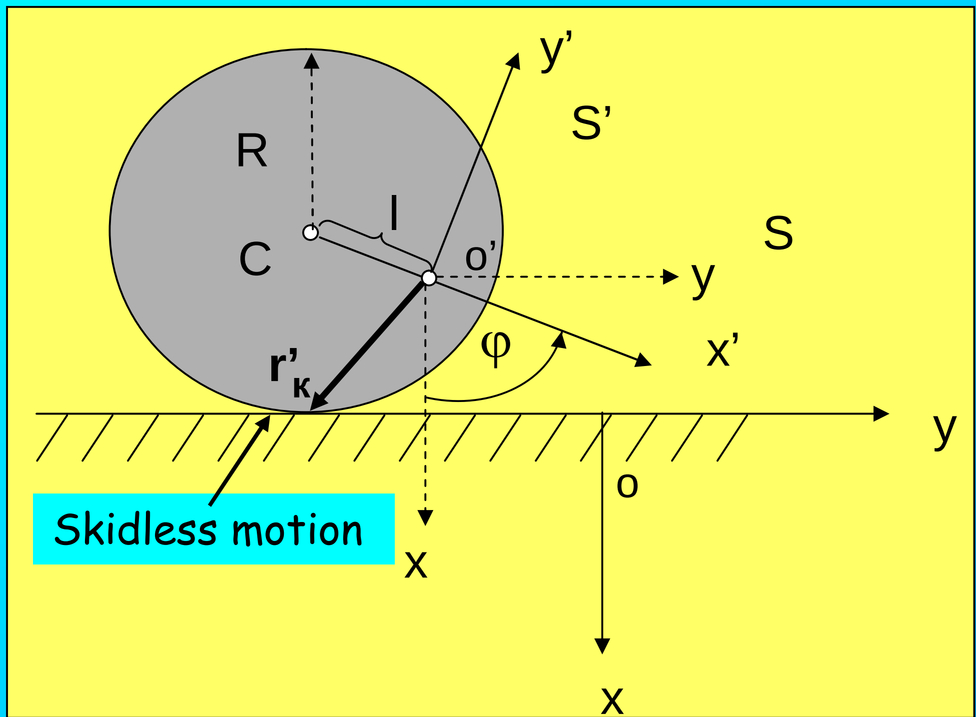
$$\dot{x}_m = 0, \quad \dot{y}_m = -R\dot{\theta},$$

$$dx_m = 0, \quad dy_m = -Rd\theta,$$

$$\dot{x}_m = x_{m0},$$

$$y_m = y_{m0} - R(\theta - \theta_0),$$

θ *became holonomic*



Frenet's equations and electro-torsion radiation

$$s=\phi(t),\quad \frac{ds}{dt}=\dot{\phi}(t),\quad \frac{d\vec{x}}{dt}=\frac{d\vec{x}}{ds}\frac{ds}{dt}$$

- Transition to time parameter t

$$v=\frac{ds}{dt}$$

- absolute velocity,

$$a=\frac{dv}{dt}$$

- tangent acceleration

$$\frac{d^2\vec{x}}{dt^2}=a\vec{t}+\kappa v^2\vec{n},$$

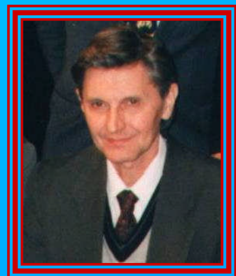
- Newton-like equations

$$\frac{d^3\vec{x}}{dt^3}=\left(\frac{da}{dt}-\kappa^2 v^3\right)\vec{t}+\left(3a\kappa+v^2\frac{d\kappa}{dt}\right)\vec{n}+\kappa\chi v^3\vec{b},$$

- have no analogues in the Newton mechanics

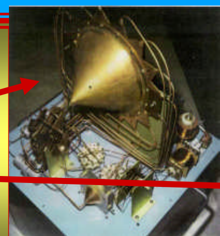
In electrodynamics for reaction force of radiation we have

$$\vec{F}_{rad}=\frac{2e^2}{3c^3}\frac{d^3\vec{x}}{dt^3}=\frac{2e^2}{3c^3}\left[\left(\frac{da}{dt}-\kappa^2 v^3\right)\vec{t}+\left(3a\kappa+v^3\frac{d\kappa}{dt}\right)\vec{n}+\kappa\chi v^3\vec{b}\right],$$

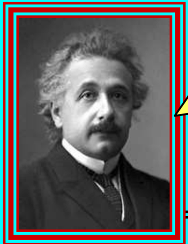



A.Akimov I.Shachparonov

Electro-torsion radiation created by own rotation of an electron (by spin). This radiation was observed experimentally and torsion generators were created in Russia by A.Akimov, I.Shachparonov and others




Einstein's Physical School:
Rotational Relativity and Quantum Mechanics



Those mathematical expressions which will be covariant concerning rotation can have real sense only (1928)

Own rotation of electron (spin) in the classical description is an orientable point (1985)

$s_{ph} = \hbar$ ← spin of photon

$s_{el} = \hbar/2$ ← spin of electron

Pupil of Einstein

N.Rosen

Pupil of Rosen

M.Carmeli

Carmeli's idea (1986)

Two constants are connected with light:

- c – speed of light, generating

Translational Relativity;

- ħ – spin of light, generating

Rotational Relativity.

Schrödinger- de Broglie matter field = **field of inertia** (Shipov 1979)

$$\psi(\vec{x},t) = \sqrt{\rho(\vec{x},t)} \cdot e^{iS(\vec{x},t)/\hbar}$$

$$S = S_0 + (i\hbar)S_1 + (i\hbar)^2 S_2 + \ldots$$

Quantum mechanics =

= orientable point mechanics

$$i\hbar \frac{\partial \psi}{\partial t} + \frac{\hbar^2}{2m}\Delta\psi + V(\vec{x},t)\psi = 0$$

Classical limit

$$\hbar \to 0$$

Classical mechanics = mechanics of nonorientable point

1. $$\frac{\partial S_0}{\partial t} = \frac{1}{2m}\left[\left(\frac{\partial S_0}{\partial x}\right)^2 + \left(\frac{\partial S_0}{\partial y}\right)^2 + \left(\frac{\partial S_0}{\partial z}\right)^2\right] + V(x,y,z,t)$$

2. $$\frac{\partial \rho}{\partial t} + div\rho\vec{v} = 0$$

Nonlocality

Summary

•The Universal Relativity based on the 10 dimensional orientable point manifold with 4 translational and 6 rotational coordinates.

•The Universal Relativity leads us to a Mechanics of an orientable point (point with spin).

•Quantum Mechanics describes the dynamics of the field of inertia and represents a part of a Mechanics of an Orientable Point.

•Mechanics of an Orientable Point predicted the electro-torsion radiation that was observed experimentally.

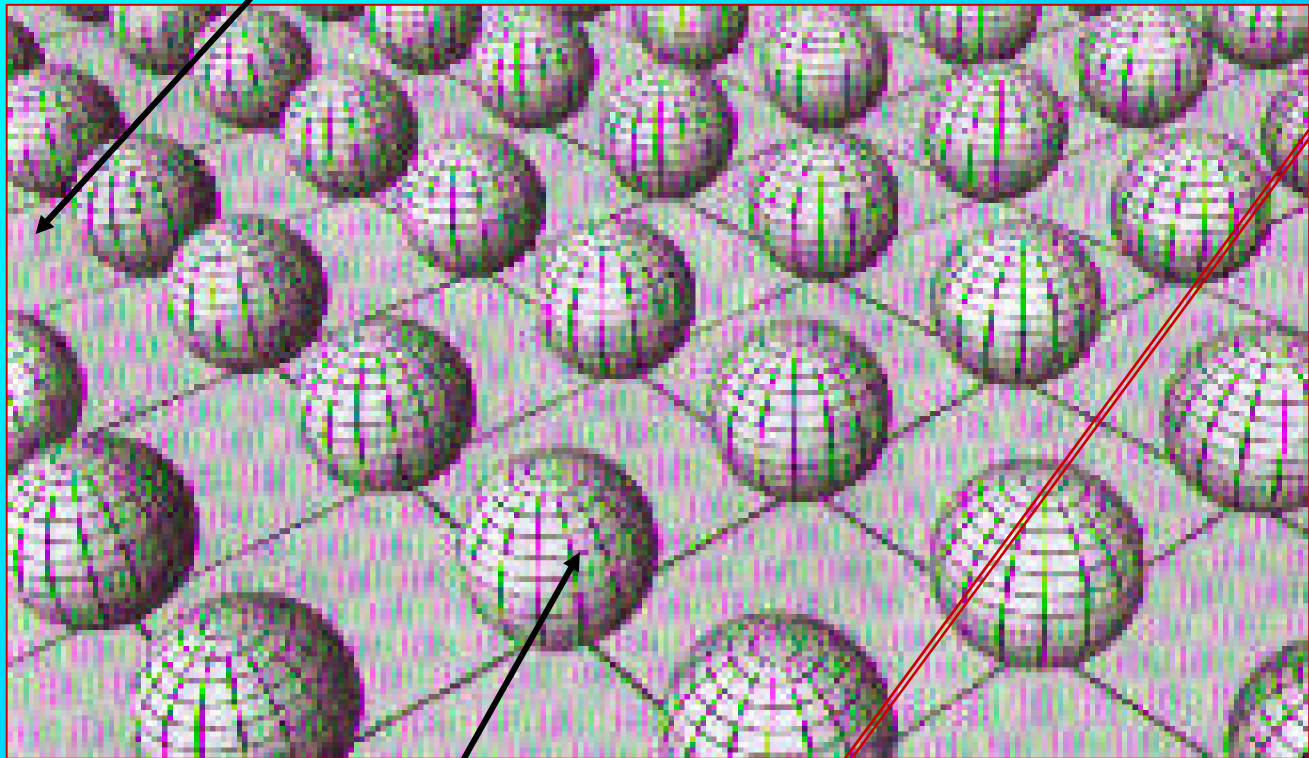
The Mathemathical Equipment of the Thanslational + Rotational Relativity

Universal (Translational + Rotational) Relativity based on the 10 dimensional structure of 4D orientable points manifold

$A_4(6)$

4 translational coordinates ct, x, y, z ,
form external space (base) on which the local group T(4) operates.

$$ds^2 = g_{ik}dx^i dx^k = \eta_{ab} e^a{}_i e^b{}_k dx^i dx^k$$ ⟸ Translational metric



Ricci rotational coefficients

$$T^a{}_{bk} = \nabla_k e^a{}_j e^j{}_b$$

6 rotational coordinates φ, ϕ , ψ, θ, α, β,
form inner space (fiber) on which local group O(3.1) operates.

$$d\tau^2 = d\chi^a{}_b d\chi^b{}_a = T^a{}_{bi} T^b{}_{ak} dx^i dx^k$$ ⟸ Rotational metric

The equations of an Orientable Point Mechanics (Shipov 1985)

Springer New York , Russian Physic Journal,
Volume 3, pages 238-241 / March 1985, ISSN 1064-8887

Structural Cartan equations of local translational group T(4) =
= first Structural Cartan equations of $A_4(6)$ space

$$\nabla_{[k} e^{a}_{m]} - e^{b}_{[k} T^{a}_{|b|m]} = 0, \qquad \text{(A)}$$

Structural Cartan equations of local rotational group O(3.1) =
= second Structural Cartan equations of $A_4(6)$ space

$$R^{a}_{bkm} + 2\nabla_{[k} T^{a}_{|b|m]} + 2T^{a}_{c[k} T^{c}_{|b|m]} = 0, \qquad \text{(B)}$$

$i,j,k... = 0,1,2,3, \quad a,b,c... = 0,1,2,3.$

Coordinate (external) indexes

Matrix (inner) indexes

Equations of Physical Vacuum (Shipov 1984)

or Equations of Newman-Penrose formalism (1962)

or Structural Cartan equations of $A_4(6)$ geometry (1926)

$$\nabla_{[k} e^{a}{}_{m]} - e^{b}{}_{[k} T^{a}{}_{|b|m]} = 0, \qquad \text{(A)} \quad \text{(2.11 NP)}$$

$$R^{a}{}_{bkm} + 2\nabla_{[k} T^{a}{}_{|b|m]} + 2T^{a}{}_{c[k} T^{c}{}_{|b|m]} = 0, \qquad \text{(B)} \quad \text{(2.7 NP)}$$

i, j, k... =0,1,2,3, a, b, c... =0,1,2,3.

$e^{a}{}_{k}$ - anholonomic tetrad – Frenet orientable point (1847)

$R^{a}{}_{bkm}$ - Riemann curvature (1854)

$T^{a}{}_{bk}$ - Ricci torsion field (1895) (or field of inertia)

Equations of Physical Vacuum as an expanded system of Einstein-Yang –Mills equations

Torsion field equations

$$\nabla_{[k} e^{a}_{j]} + T^{i}_{[k\,j]} e^{a}_{i} = 0,$$

$i,j,k\ldots=0,1,2,3$ $\quad a,b,c\ldots=0,1,2,3$ **(A)**

Einstein's generalized vacuum equations

$$R_{jm} - \frac{1}{2} g_{jm} R = \nu T_{jm}, \qquad \textbf{(B.1)}$$

Geometrized energy- momentum tensor

$$T_{jm} = -\frac{2}{\nu}\left\{\left(\nabla_{[i}T^{i}_{|j|m]} + T^{i}_{s[j}T^{s}_{|i|m]}\right) - \frac{1}{2} g_{jm} g^{pn}\left(\nabla_{[i}T^{i}_{|p|n]} + T^{i}_{s[i}T^{s}_{|p|n]}\right)\right\}$$

Generalized Yang-Mills equations

$$C^{i}_{jkm} + 2\nabla_{[k}T^{i}_{|j|m]} + 2T^{i}_{s[k}T^{s}_{|j|m]} = -\nu J^{i}_{jkm}, \qquad \textbf{(B.2)}$$

Geometrized tensor current

$$J_{ijkm} = 2g_{[k(i}T_{j)m]} - \frac{1}{3} T g_{i[m}g_{k]j}.$$

Summary

- Torsion field is a Matter field which describes a structure of sources of all other fields.

- In the Universal Relativity all physical laws have ancholonomic nature connected with the rotational coordinates.

The example showing ancholonomity of space. The experiments with 4D gyroscope

4D Orientable Point Mechanics as an Anholonomic Mechanics

4D Frenet equations

$$\frac{de^i{}_a}{ds} + \Gamma^i{}_{jk} e^j{}_a \frac{dx^k}{ds} + 2g^{im}\Omega_{m(jk)} e^j{}_a \frac{dx^k}{ds} = 0,$$

6 equations

where

$$\Gamma^i{}_{jk} = \frac{1}{2} g^{im}(g_{im,k} + g_{km,j} - g_{jk,m})$$

- Christoffel symbols and

$$\Omega^{..i}{}_{jk} = e^i{}_a e^a{}_{[k,j]} = \frac{1}{2} e^i{}_a (e^a{}_{k,j} - e_{j,k})$$

- anholonomity object

Let's

$$e^i{}_0 = \frac{dx^i}{ds}$$

and we have from 4D Frenet equations

$$\frac{d^2x^i}{ds^2} + \Gamma^i{}_{jk} \frac{dx^j}{ds}\frac{dx^k}{ds} + 2g^{im}\Omega_{m(jk)} \frac{dx^j}{ds}\frac{dx^k}{ds} = 0,$$

4 equations

Here $m\Gamma^i{}_{jk} \frac{dx^j}{ds}\frac{dx^k}{ds}$ - gravitational force and $2mg^{im}\Omega_{m(jk)} \frac{dx^j}{ds}\frac{dx^k}{ds}$ - force of inertia

Upon the absence of external gravitational force the center of mass of an isolated system moves under the action of controllable force of inertia

$$m\frac{d^2x^i}{ds^2} + 2mg^{im}\Omega_{m(jk)} \frac{dx^j}{ds}\frac{dx^k}{ds} = 0,$$

The basic scheme of the 4D gyroscope

The 4D gyroscope = oscillator + rotator

The big mass M

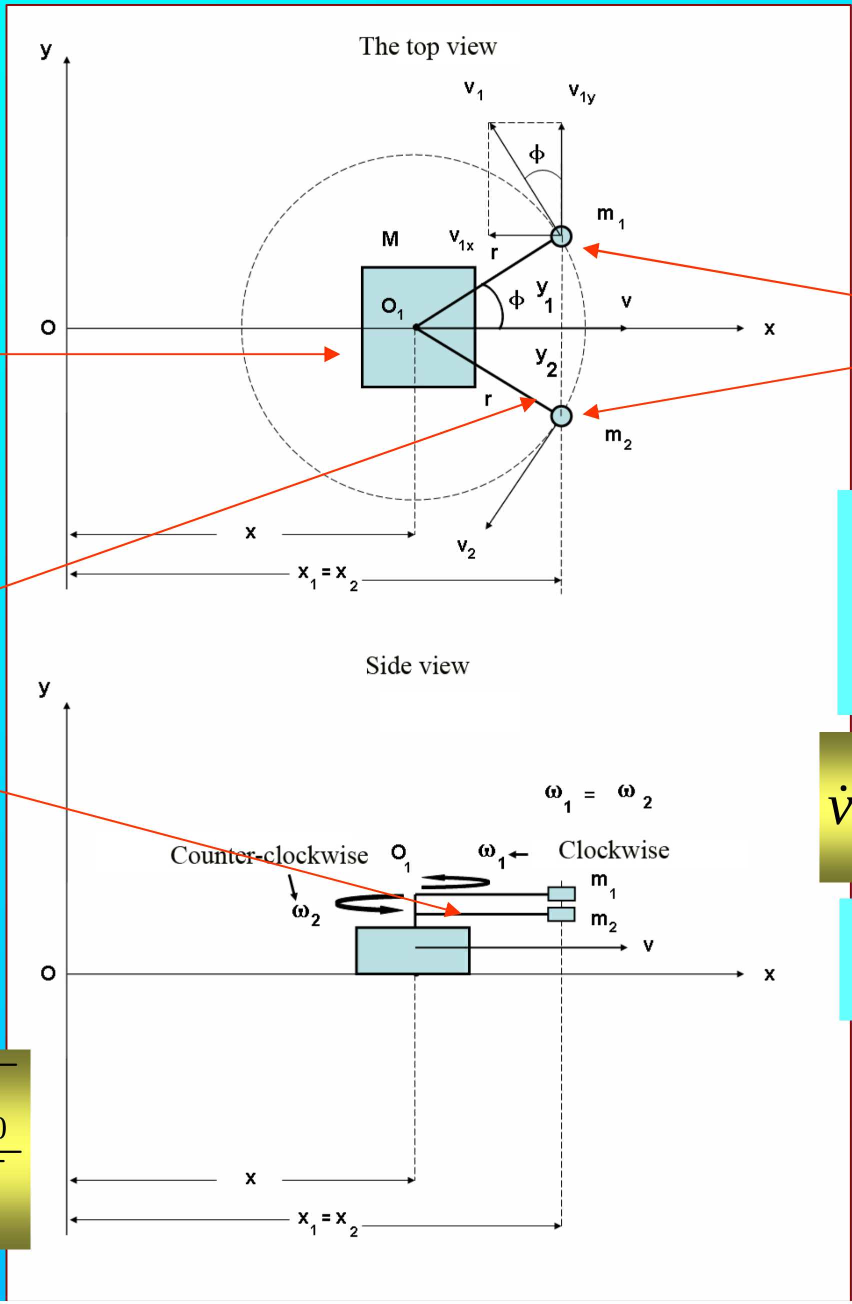
$$k^2 = \frac{2m}{M + 2m}$$

The rods

Solution:

1. $v_c = const$

2. $\omega = \dfrac{\omega_0 \sqrt{1 - k^2 \sin^2 \phi_0}}{\sqrt{1 - k^2 \sin^2 \phi(t)}}$



v_c - center mass velocity

v - cart velocity

ω - angular velocity

The Small masses m rotate around of an axis O_1

Using Newton mechanics we will receive:

1. Translational equation

$$\dot{v}_c = v - B\frac{d}{dt}(\omega \sin\phi) = 0$$

2. Rotational equation

$$\dot{\omega} - \frac{\dot{v}}{r}\sin\phi = 0$$

$$B = rk^2$$

Space-time precession of a free 4D gyro

$$\frac{d^2x^i}{ds^2}+\Gamma^i_{jk}\frac{dx^j}{ds}\frac{dx^k}{ds}+2g^{im}\Omega_{m(jk)}\frac{dx^j}{ds}\frac{dx^k}{ds}=0,\quad i,j,k...=1,2$$

$$\dot{v}_c = B\Phi\omega,$$
$$r\dot{\omega}-\dot{v}\sin\phi=-\Phi v_c$$

where

$$\Phi=-\frac{\sqrt{g'}}{k^2}\frac{d\eta}{dt}$$

$$\cos\eta(t)=V_c=\frac{dx_c}{ds},\quad \sin\eta(t)=g'\Omega=g'\frac{d\omega}{ds}$$

$$\dot{v}=dv/dt$$

$$g'(t)=k^2(1-k^2\sin^2\phi(t))$$

Andrei Sidorov

v_c - center mass velocity

ω - angular velocity

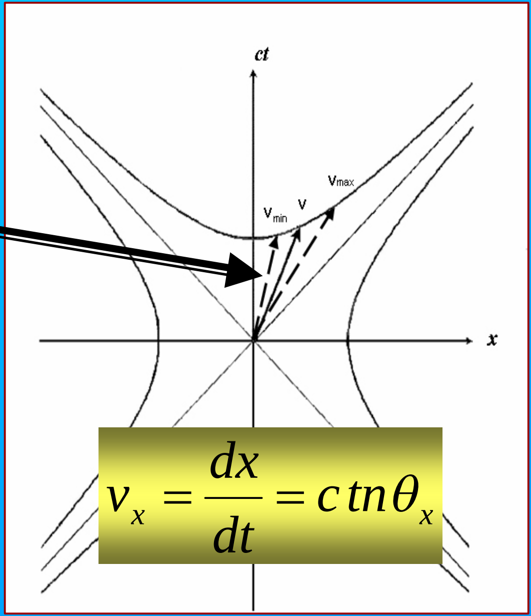
$$B=k^2r=2mr/(M+2m)$$

v - cart velocity

Solution for $k_0=\frac{\Phi}{\sqrt{g'}}=const$ gives

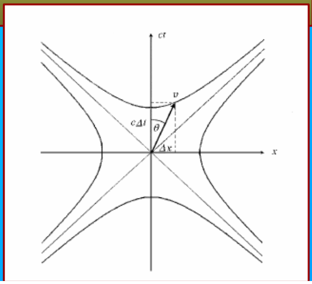
$$v_c=v_0(1+\sin(kk_0t))-\ space-time\ \ precession\ of\ \ free\ 4D\ gyro$$

$$\omega=\frac{v_0}{rk\sqrt{g'}}\cos(kk_0t)+\frac{r\omega_0\sqrt{k^2(1-k^2\sin^2\phi_0)}-v_0/k}{r\sqrt{g'}}$$



$$v_x=\frac{dx}{dt}=c\,tn\,\theta_x$$

v_0 - initial velocity of center of mass

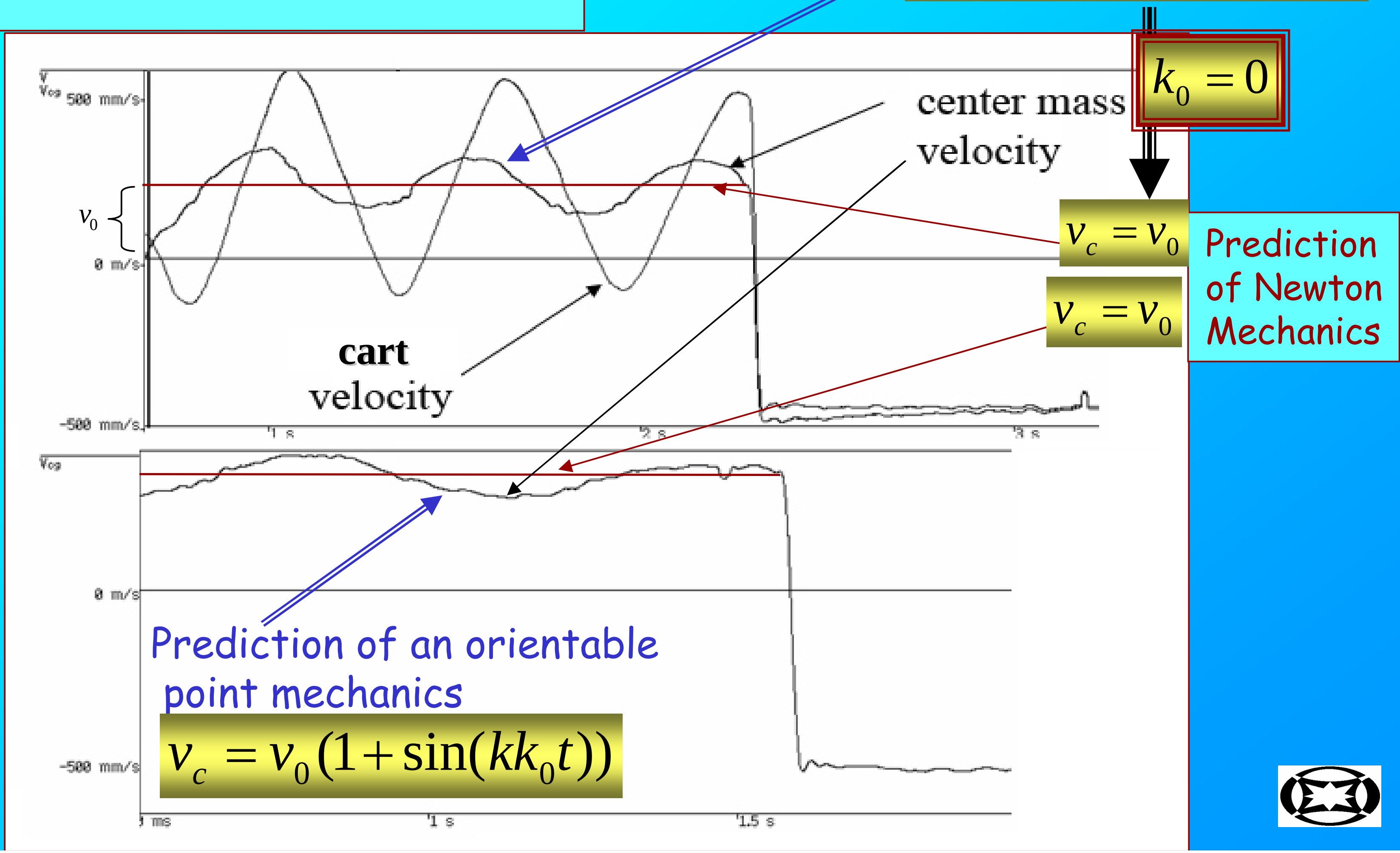


Newton solution appears when $k_0=0$

Experimental observations of the space-time precession of free 4D gyro

Prediction of an orientable point mechanics

$$v_c = v_0(1+\sin(kk_0 t))$$



The 4D gyroscope wiht self-action

The small masses **m** rotate around an axis **O**$_1$ in opposite directions

Spring is a source of the internal energy

Weels are free

Theoretical prediction of self-action of 4D gyroscope

$$\frac{de^i{}_a}{ds} + \Gamma^i{}_{jk} e^j{}_a \frac{dx^k}{ds} + 2 g^{im} \Omega_{m(jk)} e^j{}_a \frac{dx^k}{ds} = L^i{}_a ,$$

Here $mL^i{}_a$ - external and internal forces

For 4D gyro we have

$$\frac{d^2 x^i}{ds^2} + \Gamma^i{}_{jk} \frac{dx^j}{ds}\frac{dx^k}{ds} + 2 g^{im} \Omega_{m(jk)} \frac{dx^j}{ds}\frac{dx^k}{ds} = L_0{}^i , \quad i, j, k... = 1,2$$

If $L^1 = 0,\ L^2 =/= 0$ we will have

1. $$\dot{v}_c = \frac{\left[\frac{B \sin\phi}{2mr^2} L + k^2 \Phi (r\omega - v \sin\phi)\right]}{1 - k^2 \sin^2\phi} = a_L$$

where $L^2 = L$

2. $$\dot{\omega} - \frac{k^2 \omega^2 \cos\phi \sin\phi}{1 - k^2 \sin^2\phi} = \frac{\left[\frac{L}{2mr^2} + \frac{\Phi}{r}(B\omega \sin\phi - v)\right]}{1 - k^2 \sin^2\phi} = N_L$$

-internal angular momentum changes velocity of the center of mass

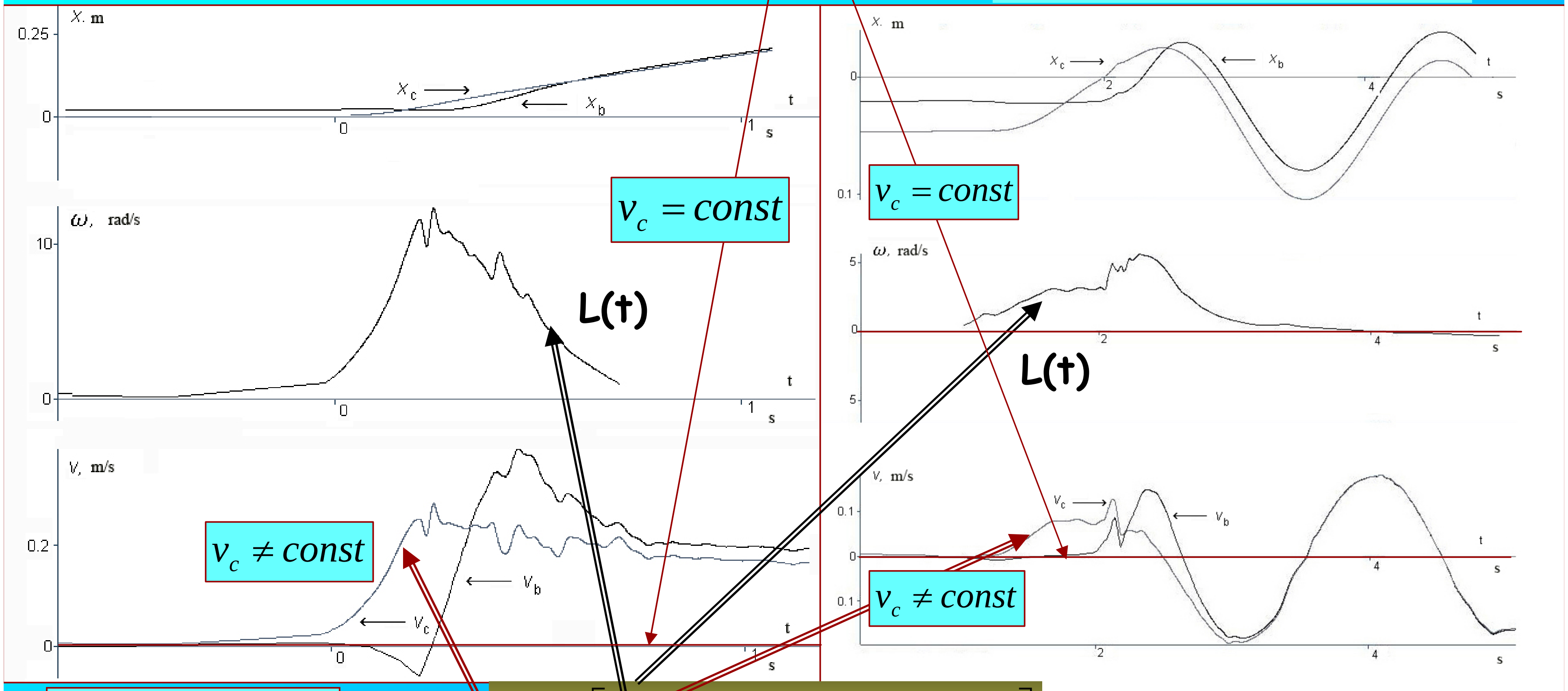
When $\Omega_{m(jk)} = 0$ then $\Phi = 0$ and self-action disappears !

Experimental data on self-action of 4D gyroscope (one step)

4D gyro on a table

Prediction of Newton Mechanics

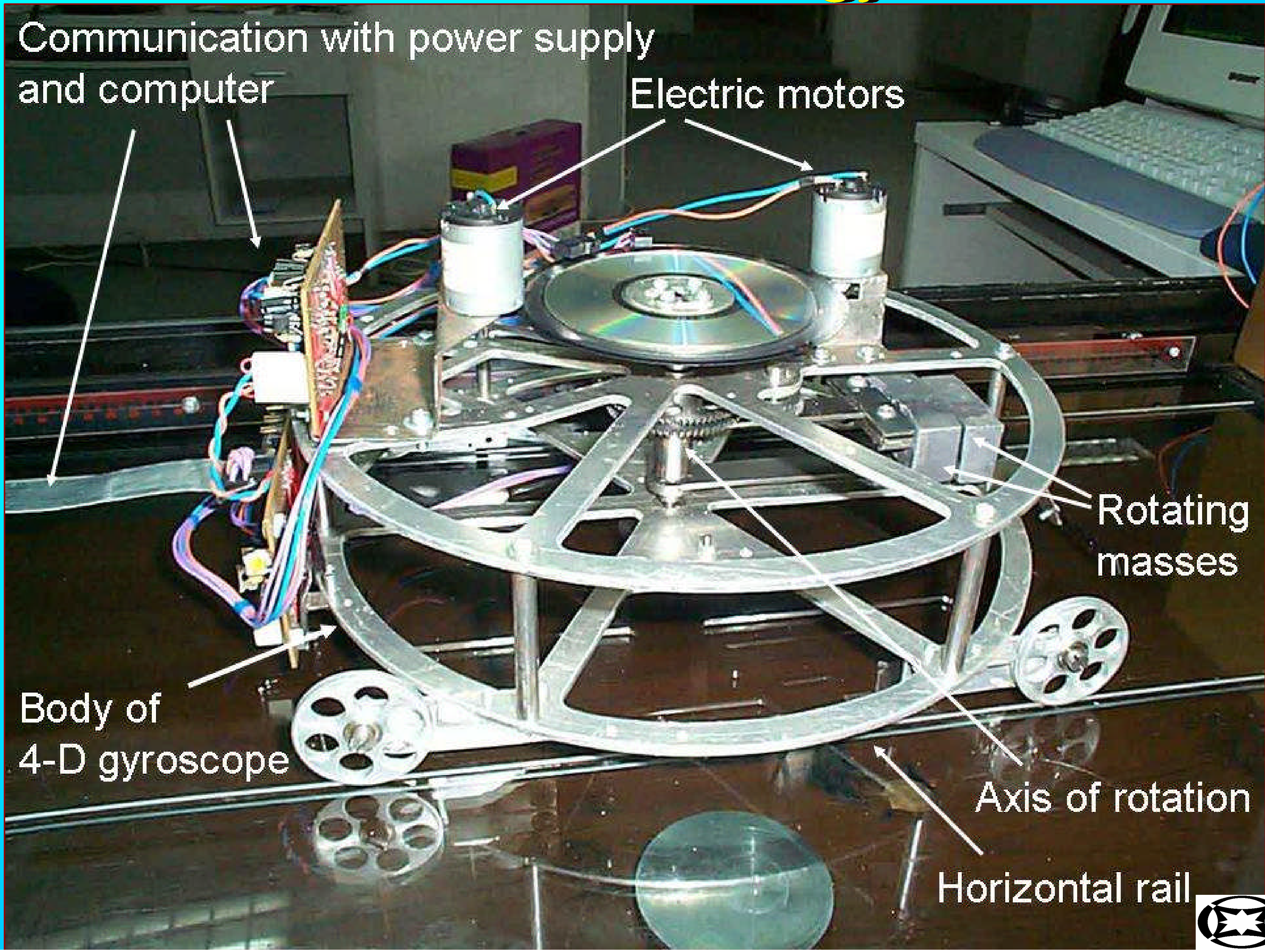
4D gyro suspended on the string



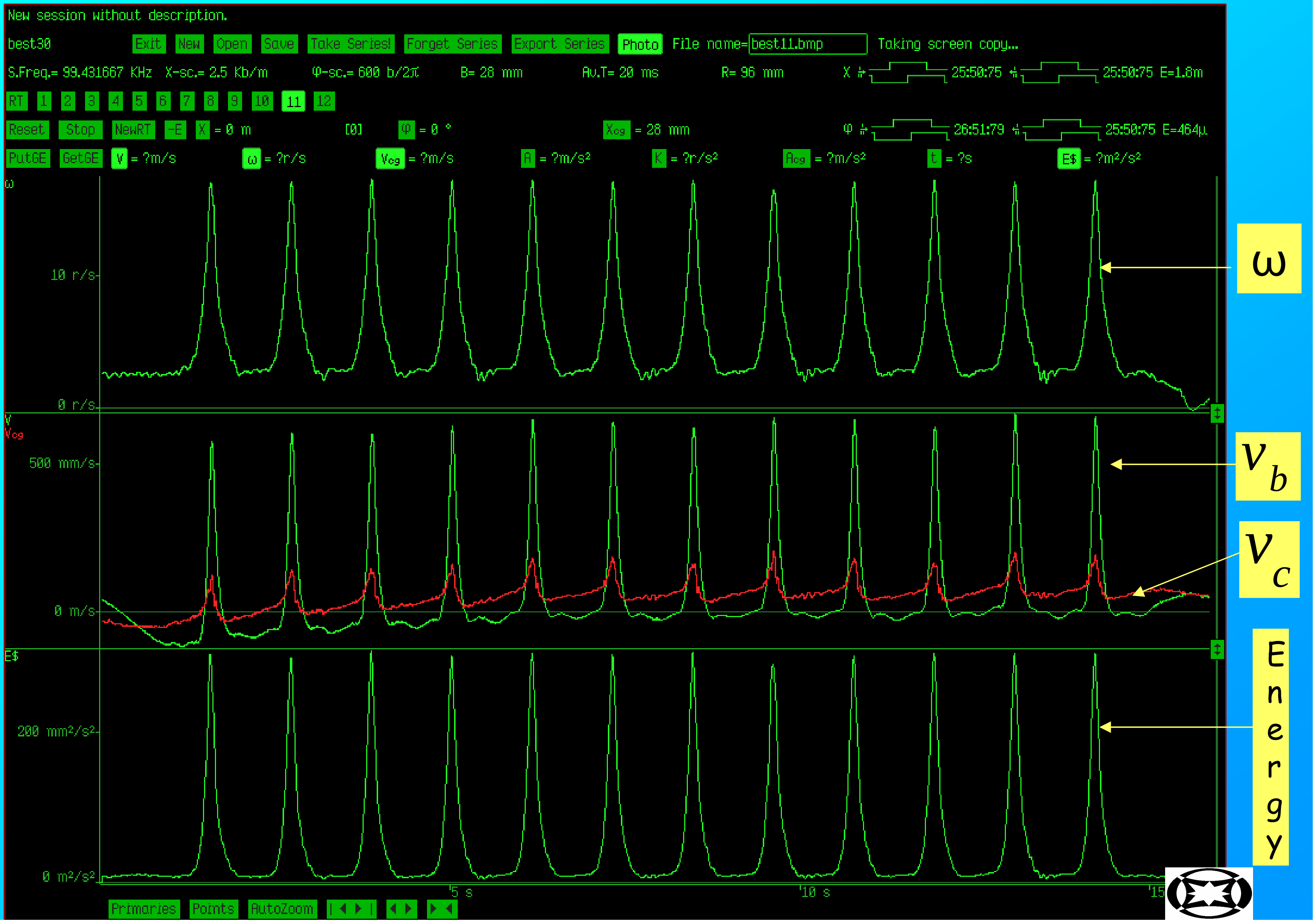
Prediction of an orientable point mechanics

$$\frac{dv_c}{dt} = \frac{\left[\frac{LB\sin\phi}{2mr^2} + k^2\Phi(r\omega - v\sin\phi)\right]}{1 - k^2\sin^2\phi}$$

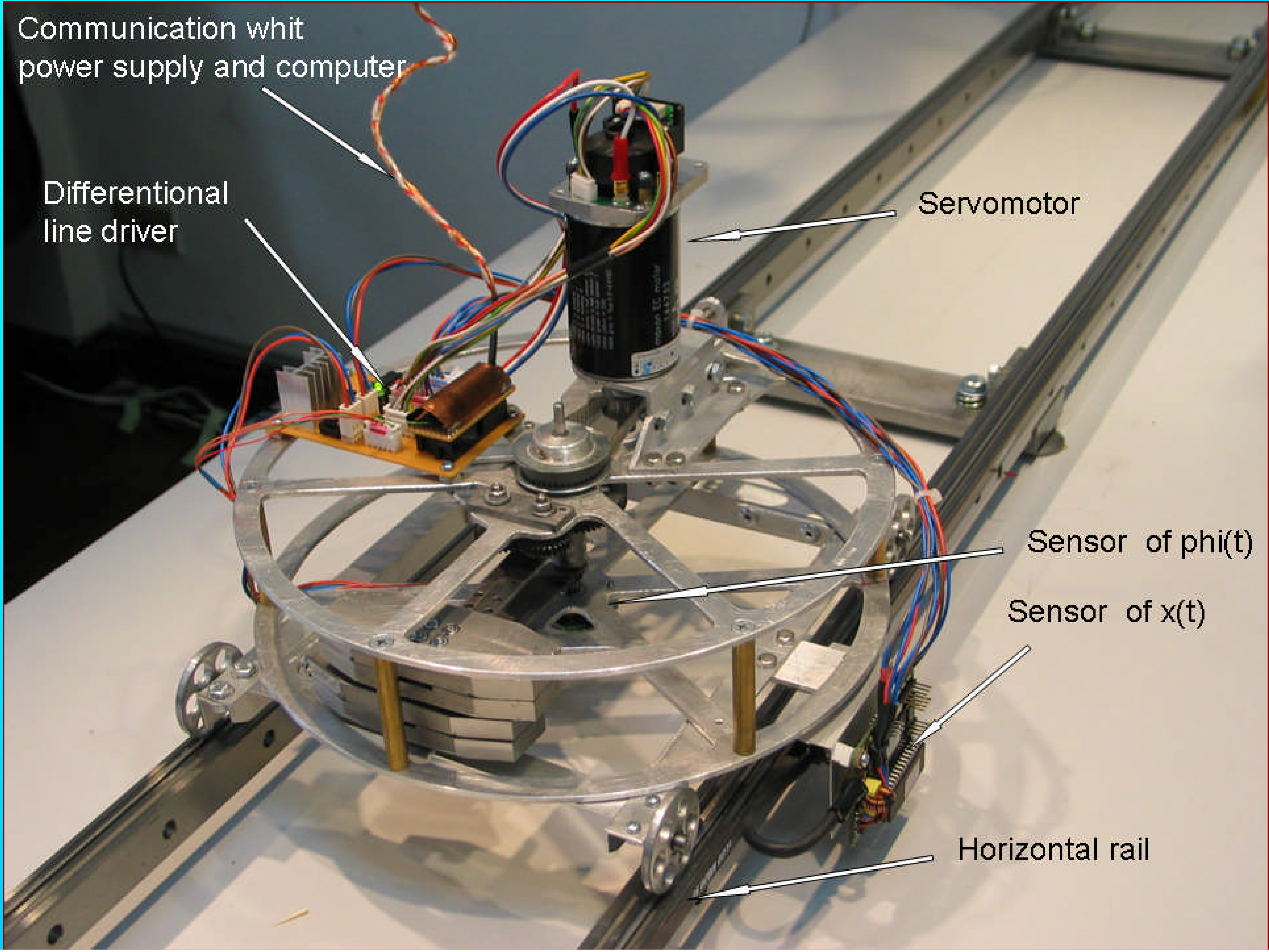
4D gyroscope with electric motors as a source of the internal energy



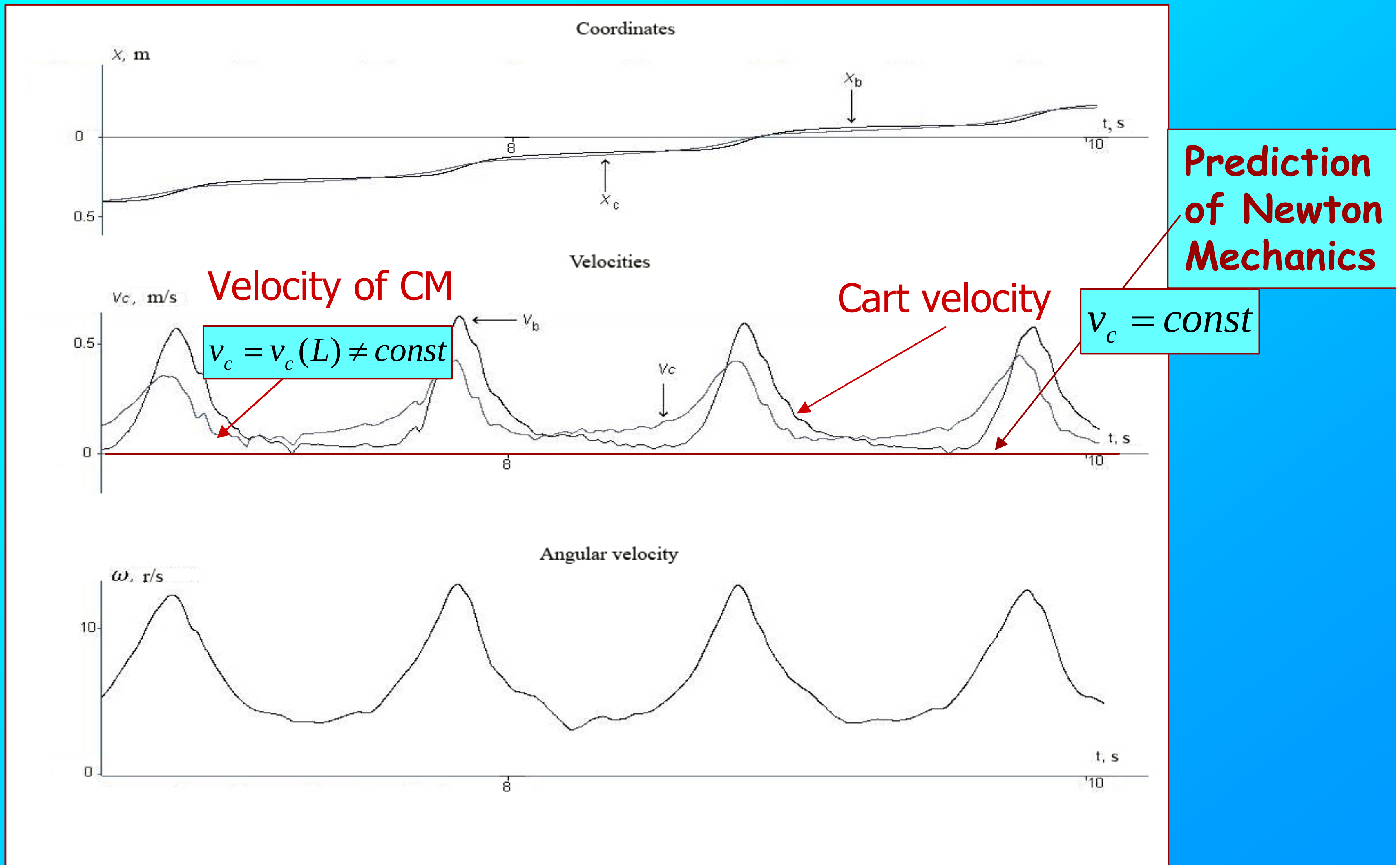
Experimental data on self-action of 4D gyroscope (many steps)



4D gyro under computer control



Experimental data.
Under computer control 4D gyro moves only forward



Look films on a site www.shipov.com

Summary

- Mechanics of an Orientable Point predicts new ancholonomic effects:
  1. space-time precession of 4D gyroscope;
  2. controllable precession of 4D gyroscope,

  that were confirmed experimentally.

- Results of experiments with 4D gyroscope confirm existence of 6 additional angular coordinates as elements of 10 dimensional space of the Universal Theory of Relativity.

- The discovered properties of space allow to create the propulsion system of a new kind that can move in space without rejection of mass.

Basic articles and books

To be continued by

Vacuum 5

Kob Khun Krab!

Thank You for Your Attention !