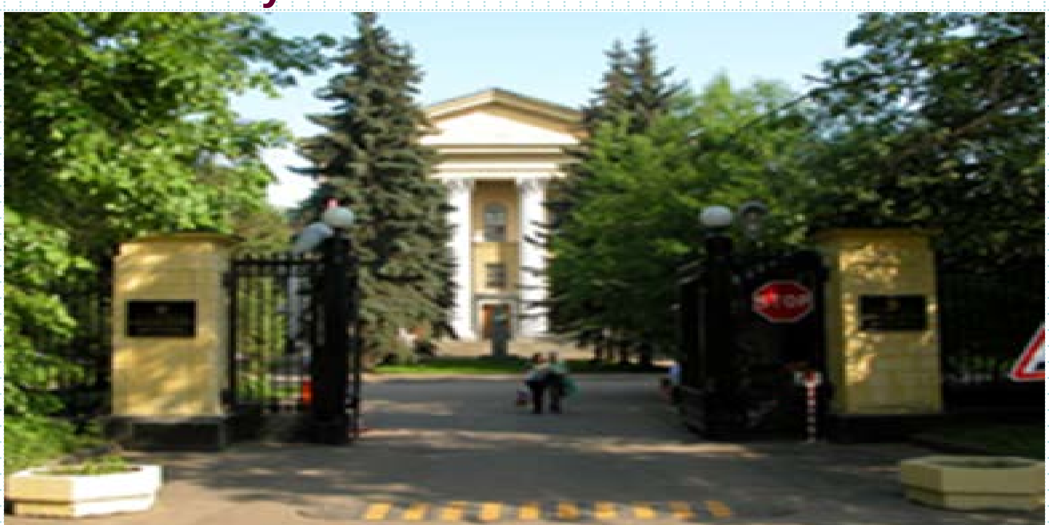
Einstein Equation for Nondual Field Matter Modifies the Naiver-Stokes Equation

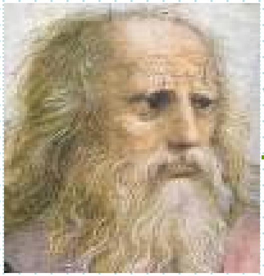
Igor E. Bulyzhenkov, **bulyzhenkov.ie@mipt.ru**
Moscow Institute of Physics and Technology
Lebedev Physics Institute RAS



Abstract. *Continuous material space in the nondual field physics of Einstein and Infeld replaces the assumed emptiness between point particles in the Newton model of reality. The internal heat of circular metric flows creates the elementary mass-energy and this kinetic energy is balanced by the negative self-gravitation energy.*

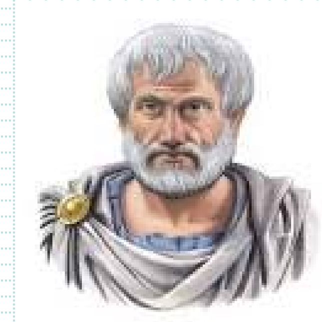
The Einstein equation analog for continuous field densities of the moving nondual matter results in the vector geodesic relations for metric mass-energy flows that modifies the Navier-Stokes equation by the 1738 Bernoulli effect.

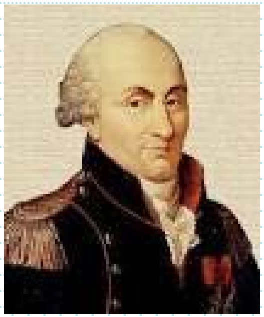
I tried to make this presentation without overloading by the material, and in such a way that everyone can understand clearly non-empty space physics for macroscopic reality



Critical point of the modern particle physics is the millennium problem of the Ancient Greeks

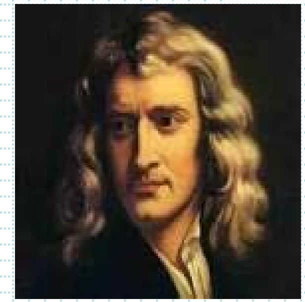
Is space empty in physical reality?





$$\vec{F} = q\frac{Q\hat{r}}{r^2} \equiv qE(r)\hat{r}$$

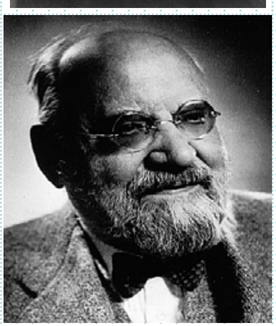
$$div[E(r)\hat{r}] = \frac{1}{r^2}\partial_r[r^2 E(r)] \equiv \frac{1}{r^2}\partial_r Q \equiv 0$$



Now all textbooks say Yes, space is empty due to the laws of Newton and Coulomb, where div E = 0 for dual physics of fields and charges

But:

René Descartes *(1596—1650) empty space is impossible - the primary characteristic of matter is extension (res extensa)*



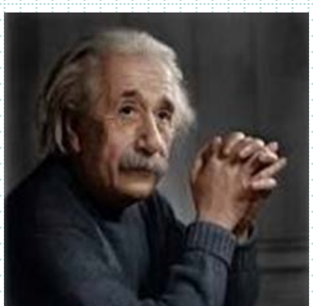
Gustav Mie *(1868-1957) space is not empty and div E = f (|E|) ≠ 0 for continuous sources in nondual physics of charged material fields*

Drawing by Rea Irvin; 1929 The New Yorker Magazine, Inc.

A 1929 cartoon:

"People slowly accustomed themselves to the idea that the physical states of space itself were the final physical reality."

Professor Albert Einstein

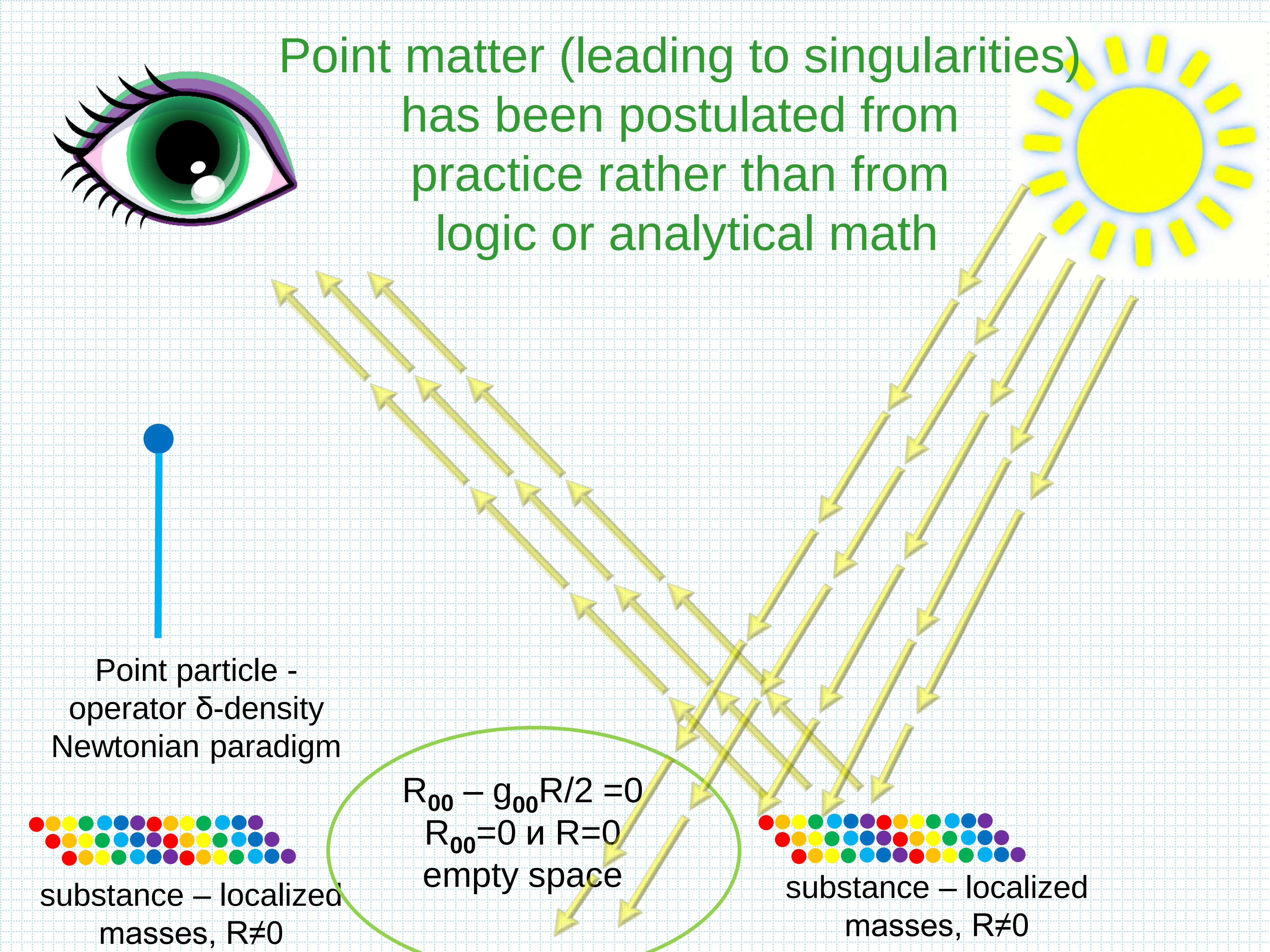


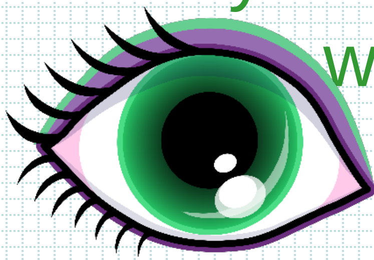
THE EVOLUTION OF PHYSICS, A.Einstein and L.Infeld, Cambridge Press, 1938

We could regard matter as the regions in space where the field is extremely strong... A thrown stone is, from this point of view, a changing field, where the states of greatest field intensity travel through space with the velocity of the stone. There would be no place, in our new physics, for both field and matter, field being the only reality.

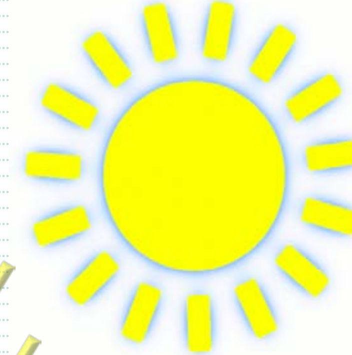
This new view is suggested by the great achievements of field physics, by our success in expressing the laws of electricity, magnetism, gravitation in the form of structure laws, and finally by the equivalence of mass and energy.

Our ultimate problem would be to modify our field laws in such a way that they would not break down for regions in which the energy is enormously concentrated."

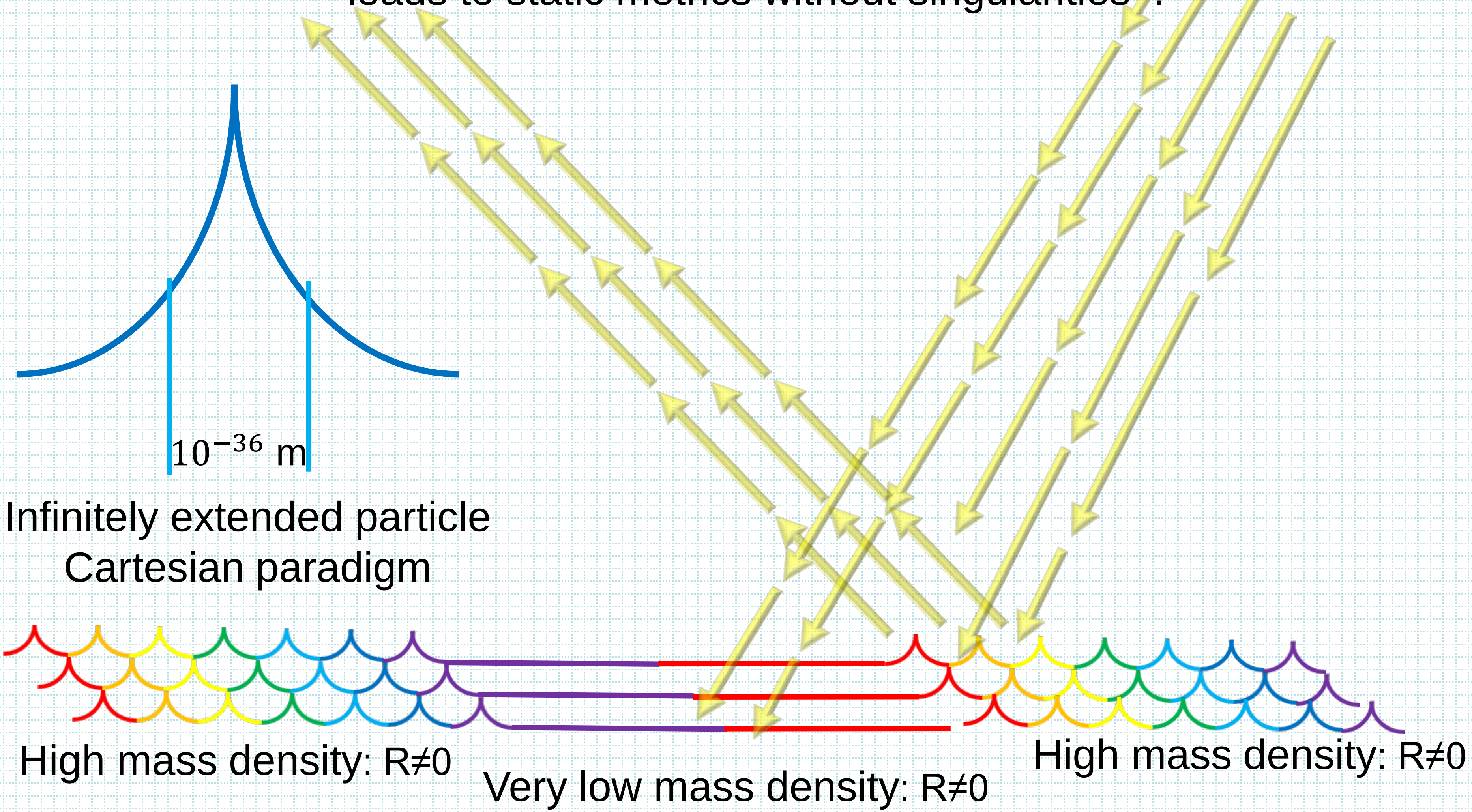

Point matter (leading to singularities)
has been postulated from
practice rather than from
logic or analytical math
Point particle -
operator δ-density
Newtonian paradigm
$R_{00} – g_{00}R/2 =0$
$R_{00}=0$ и $R=0$
empty space
substance – localized
masses, R≠0
substance – localized
masses, R≠0



By accepting continuous material space without singularities we comply with the same observations in practice



Einstein's curvature $R_{00} - g_{00}R/2 = 0$ at $R \neq 0$ leads to static metrics without singularities !



- “A coherent field theory requires that all elements continuous… And from this requirement arises be the fact that the material particle has no place as a basic concept in a field theory. Thus, even apart from the fact that it does not include gravitation, Maxwell’s theory cannot be considered as a complete theory.” 1938

Dual Physics – localized particles in empty space

$$R_\mu^\nu - \delta_\mu^\nu (R/2) = (c/\Upsilon) T_\mu^\nu \Rightarrow (8\pi G/c^2) m \delta(x) u_\mu u^\nu$$

$$\text{1916 solution for empty space: } R \equiv g^{\mu\nu} R_{\mu\nu} = 0, R_{\mu\nu} = 0$$

$$ds^2 = (1 - 2r_o/r)dt^2 + (1 - 2r_o/r)^{-1} dr^2 + r^2 d\theta^2 + r^2 sin^2\theta d\phi^2$$

There is no math error in the Schwarzschild metric solution for the curved empty space. But Einstein, «the reluctant father of black holes», published «... a clear understanding as to why the Schwarzschild singularities do not exist in physical reality»,

Annals of Math. 40, p.922, 1939

To confirm the event horizon is the critical point for all black hole proponets. There are *no black holes* in the nondual field reality and *in Einstein's GR* since1938-1939

4 stages in the theory of inertia/gravitation

Stage 1. 1687 – 1908. Philosophiae Naturalis Principia Mathematica, Newton, (flat empty space)
4 notions: space + time + force's field + substance

Stage 2. 1908 – 1916. Minkowski spacetime (flat empty space)
3 notions: spacetime + force's field + substance

Stage 3. 1916 – today. GR with Schwarzschild metric (curved empty space) *2 notions: field spacetime + substance*

Stage 4. 1938 – today. GR of Einstein-Infeld (flat material space in curved spacetime) *1 notion: material spacetime*

1979 Logunov – to return back to stage 2 from stage 3
1938 Einstein – to move ahead to stage 4 from stage 3

PHY2323 - Electricity and Magnetism

$\odot$ Midterm problem, 2 year

$\succ$ Let the charge density distribution of the astroelectron is given as $\rho(r) = -er_e/4\pi r^2(r+r_e)^2$, where $e = 1.6 \times 10^{-19}C$ and $r_e = const << 10^{-18}m$. Compute the electric field intensity and the electric potential of this extended elementary charge everywhere in the Universe. Assume that the post Coulomb potential of the non-point charge $(-e)$ is zero at $r = \infty$.

$\otimes$ Continuous field and charge distributions with the spherical symmetry.

Step 1. Illustration of $\rho(r)$.

Step 2. Right formulas: $\nabla \epsilon_o \vec{E} = \rho$ and $\vec{E} = -\nabla W$

Step 3. Right coordinate system (spherical): $\vec{E} = E(r)\hat{a}_r$, $\nabla \vec{E}(r) = r^{-2}\partial_r[r^2 E(r)] = \rho(r)/\epsilon_o$, $\hat{a}_r E(r) = -\hat{a}_r \partial_r W(r)$.

The extended electron solution

Step 4. Calculations. Let q $= (-e)/4\pi\epsilon_o$.

$$\partial_r(r^2E) = \frac{qr_e}{(r+r_e)^2}, r^2E = -\frac{qr_e}{(r+r_e)} + C_1, E(r) = -\frac{qr_e}{r^2(r+r_e)} + \frac{C_1}{r^2}$$

$$E(r\to\infty) \to \frac{q}{r^2} \ (\to \text{Coulomb}), \ \text{therefore } C_1 \equiv q,$$

$$E(r) = \frac{q}{r^2} - \frac{qr_e}{r^2(r+r_e)} = \frac{q}{r(r+r_e)} = \frac{q}{r_e}\left(\frac{1}{r} - \frac{1}{r+r_e}\right) \text{(post}-\text{Coulomb)}$$

$$E(r) = \frac{q}{r(r+r_e)} = -\partial_r W(r), W(r) = -\int E(r)dr = -\frac{q}{r_e}\int\left(\frac{1}{r} - \frac{1}{r+r_e}\right)$$

$$= \frac{q}{r_e} ln\left(1 + \frac{r_e}{r}\right) + C_2. \text{ Here } C_2 = 0, \text{ because } W(\infty) = 0.$$

Step 5. Verification. $W(r) \to \frac{q}{r}$ ($\to$Coulomb) for $r \geq 10^{-18}m$.

"Einstein's gravitation for Machian relativism of nonlocal energy-charges" Int. J. Theor. Phys. 47, 1261 (2008)

Full similarity of GR and EM theories in nondual physics of nonempty charged space

$$\mu_p(r) \equiv \mu_a(r) = m\frac{r_o}{4\pi r^2(r_o+r)^2} = \frac{c^2}{4\pi G r^2}\frac{1}{[1+(rc^2/Gm)]^2},$$

$$Gm_o/c^2 = 7\times 10^{-58}m$$

$$e \equiv \int_o^\infty 4\pi r^2\rho(r)dr = -e_o$$

$$\mathbf{E}^2/4\pi = (e/r_e)\nabla\mathbf{E} = (e/r_e)\rho(r)$$

$$\begin{cases} \mu(r) = Mr_o/4\pi r^2(r+r_o)^2 = \mathbf{w}^2/4\pi Gc^2 \\ \mathbf{w}(r) = -\nabla W(r) = -GM\hat{\mathbf{r}}/r(r+r_o) \\ W(r) = -c^2 ln[(r+r_o)/r] \\ E_M = \int \mu c^2 d^3x \equiv r_o c^2/G = Mc^2. \end{cases}$$

$$\begin{cases} 4\pi\rho(r) = er_e/r^2(r+r_e)^2 = \nabla\mathbf{E}(r) = \mathbf{E}^2/(e/r_e) \\ \mathbf{E}(r) \equiv -\nabla W_e(r) = e\hat{\mathbf{r}}/r(r+r_e) \\ W_e(r) = (e/r_e)ln[(r+r_e)/r] \\ E_e = \int d^3x\rho W_e = \int d^3x\rho e/r_e = \int d^3x\mathbf{E}^2/4\pi = e^2/r_e \end{cases}$$

Action of the extended mass

$$S = -c \iiiint \sqrt{\gamma}\,\mu(\mathbf{x})\,ds\,d^3x = -c\int m\,ds(\boldsymbol{\xi})$$

$$\sqrt{-g}\,d^4x \equiv \sqrt{g_{oo}}\,dx^o\,\sqrt{\gamma}\,d^3x$$

$$S = -c\iiiint \mu(x)\,ds(x)\sqrt{\gamma}\,d^3x = -\frac{\zeta\varphi_o^2}{c}\iiiint R(x)\frac{ds(x)}{\sqrt{g_{oo}}\,dx^o}\sqrt{-g}\,d^4x$$

$$B(x) \equiv \frac{\sqrt{g_{\mu\nu}dx^\mu dx^\nu}}{\sqrt{g_{oo}}\,dx^o} \equiv \frac{1}{\sqrt{g_{oo}}\,u^o} \equiv \frac{\sqrt{1-\beta^2}}{1-g_{oi}v^i/\sqrt{g_{oo}}} \equiv \sqrt{1-\beta^2}\left(1+\frac{g_{oi}dx^i}{g_{oo}dx^o}\right)$$

$$v^i \equiv c\,dx^i/\sqrt{g_{oo}}\,dx^o\left[1+\left(g_{oi}dx^i/g_{oo}dx^o\right)\right] \qquad \beta^2 \equiv \gamma_{ij}v^iv^j/c^2$$

$$\varphi_o \equiv c^2/\sqrt{G} = 1.04\times 10^{27} \qquad \gamma_{\mu\nu} \equiv g_{o\mu}g_{o\nu}g_{oo}^{-1} - g_{\mu\nu}$$

Energy tensor of material spacetime

$$\delta S = \int \delta g^{\mu\nu} T_{\mu\nu} \sqrt{-g} d^4 / 2c$$

$$\zeta \varphi_o^2 R u_\mu \equiv \varphi_o^2 \zeta R g_{\mu\nu} dx^\nu / ds$$

$$T_{\mu\nu} \equiv \zeta \varphi_o^2 \left[(u_\mu u_\nu - \gamma_{\mu\nu}) BR - 2BR_{\mu\nu} + 2\nabla_\mu \nabla_\nu B - 2g_{\mu\nu} \nabla_\lambda \nabla^\lambda B \right]$$

For static fields:

$$B = 1, \text{ for the static case, when } v^i = 0, \beta^2 = 0, u_\mu = \left\{ \sqrt{g_{oo}};\ g_{oi} / \sqrt{g_{oo}} \right\}$$

$$u_\mu u_\nu - \gamma_{\mu\nu} = g_{\mu\nu}, \text{ and } T_{\mu\nu} \Rightarrow \zeta \varphi_o^2 (g_{\mu\nu} R - 2R_{\mu\nu}) \equiv T_{\mu\nu}^{static}$$

Static energy tensor $(g_{\mu\nu} R - 2R_{\mu\nu}) c^4 / 16\pi G$

Einstein equation for static densities of one elementary (radial) mass

$$\frac{c^4}{8\pi G}(R_{oo} - g_{oo}R/2) = 0$$

$$ds^2 = g_{oo}(dx^o)^2 - \delta_{ij}dx^i dx^j$$

METRIC SOLUTION:

$$g_{oo} = r^2/(r + r_o)^2 \qquad r_o = Gm/c^2$$

$$\gamma_{ij} = \delta_{ij}, \text{ with } g^{ij} = -\delta^{ij}, \sqrt{-g}/\sqrt{g_{oo}} \equiv \sqrt{\gamma} = 1$$

$$\frac{c^2}{8\pi G}R = mn(r) = m\frac{r_o}{4\pi(r+r_o)^2 r^2}$$

Ricci scalar is the scalar mass density of material space

Bulyzhenkov, *Geometrization of Radial Particles in Non-Empty Space Complies with Tests of General Relativity*, Jour. Mod. Phys. 2012, 3, 1465-1478

Same post-Newton weak field dynamics of probe bodies in empty and non-empty gravitational spaces, but not in strong fields

$$\gamma_{ij}(\mathrm{x}) \equiv \frac{g_{oi}(\mathrm{x})g_{oj}(\mathrm{x})}{g_{oo}(\mathrm{x})} - g_{ij}(\mathrm{x}) \Rightarrow \begin{cases} \neq \delta_{ij}, \ \textit{warped empty 3D space with holes} \\ = \delta_{ij}, \ \textit{inherent metric symmetries for} \\ \quad \textit{Euclidean nonempty 3D space in curved 4D} \end{cases}$$

$$mn[\mathrm{x}, \mathrm{X}_e(t)] = m\frac{r_o}{4\pi[\mathrm{x} - \mathrm{X}_e(t)]^2[|\mathrm{x} - \mathrm{X}_e(t)| + r_o]^2}$$

$$\int d^3xn[\mathbf{x}, \mathbf{X}_e(t)] = 1$$

Strong gravitational fields of many bodies

$$W(\mathbf{x}) \equiv -c^2 ln \frac{1}{\sqrt{g_{oo}(\mathbf{x})}} = -c^2 ln \left(1 + \frac{r_1}{|\mathbf{x}-\mathbf{a}_1|} + \frac{r_2}{|\mathbf{x}-\mathbf{a}_2|} + ... + \frac{r_n}{|\mathbf{x}-\mathbf{a}_n|}\right)$$

$$r_i \equiv GE_i/c^4 = Gm_i/c^2$$

$$\mu_p(\mathbf{x}) \equiv \frac{[\nabla W(\mathbf{x})]^2}{4\pi G c^2} = \frac{\nabla^2 W(\mathbf{x})}{4\pi G} \equiv \mu_a(\mathbf{x})$$

This is the many-body Principle of Equivalence or the Yin-Yang dialectics of material space densities

$$\int d^3x \mu_p c^2 = \int d^3x \mu_a c^2 = E_{metric}$$

$$E_{metric} \equiv \frac{c^4}{4\pi G} \int d^3x \left(\frac{\frac{(\mathbf{x}-\mathbf{a}_1)r_1}{|\mathbf{x}-\mathbf{a}_1|^3} + \frac{(\mathbf{x}-\mathbf{a}_2)r_2}{|\mathbf{x}-\mathbf{a}_2|^3} + ... + \frac{(\mathbf{x}-\mathbf{a}_n)r_n}{|\mathbf{x}-\mathbf{a}_n|^3}}{1 + \frac{r_1}{|\mathbf{x}-\mathbf{a}_1|} + \frac{r_2}{|\mathbf{x}-\mathbf{a}_2|} + ... + \frac{r_n}{|\mathbf{x}-\mathbf{a}_n|}} \right)^2$$

$$= (m_1 + m_2 + ... + m_n)c^2 = const$$

Energy conservation under the global overlap of elementary material spaces

Einstein equation for moving material space

$$\zeta\varphi_o^2\left[(u_\mu u^\nu - g^{\nu\lambda}\gamma_{\mu\lambda})\,BR - 2BR_\mu^\nu + 2\nabla_\mu\nabla^\nu B - 2\delta_\mu^\nu\nabla_\lambda\nabla^\lambda B\right] + g^{\nu\lambda}P_{\mu\lambda} = 0$$

stress

$$\nabla_\nu(T_\mu^\nu + P_\mu^\nu) = 0$$

- vector geodesic conditions for material fields

$$\zeta\varphi_o^2[\nabla_\nu(BRu_\mu u^\nu) - B\nabla_\mu R - \gamma_{\mu\lambda}\nabla^\lambda(BR)] + \nabla_\nu P_\mu^\nu = 0$$

$$\mu = \zeta\varphi_o^2 R/c^2$$

- field mass density of material space

$$B\mu c^2 u^\nu\nabla_\nu u^\mu - \frac{c^2(\delta_0^\mu - u^\mu u_0)}{g_{00}}\nabla_0(B\mu) = (u^\mu u^\nu - g^{\mu\nu})(\mu c^2\nabla_\nu B + \nabla_\lambda P_\nu^\lambda)$$

relativistic acceleration vs forces

Modified Navier-Stokes equation

$$B\mu c^2 u^\nu \nabla_\nu u^\mu - \frac{c^2(\delta_o^\mu - u^\mu u_o)}{g_{oo}} \nabla_o (B\mu) = (u^\mu u^\nu - g^{\mu\nu})(\mu c^2 \nabla_\nu B + \nabla_\lambda P_\nu^\lambda)$$

$$g_{\mu\nu} \to \eta_{\mu\nu} \equiv \{1, -1, -1, -1\}$$

$$\beta^2 \to 0,\ B \to 1 - \beta^2/2$$

$$v^i \to c dx^i / dx^o \equiv V^i = V_i$$

$$V^j \partial_j V^i = \delta^{ij} \partial_j V^2/2 - [\mathbf{V} \times curl \mathbf{V}]^i$$

$$\frac{\partial_t(\mu V^i)}{\mu} + V^j \partial_j V^i = -\partial_i \left(\frac{V^2}{2} + \mu_{chem} \right) - \frac{\partial_i p}{\mu} + \nu \partial_j \partial^j V^i$$

Since 1738 Bernoulli's pressure depends on the speed of a stationary fluid where the Newtonian accelerations is balanced by the non-Newtonian one

Nondual Classical Electrodynamics of charged fields

$$\begin{cases} \nabla_\nu F^{\nu\mu}(x) \equiv 4\pi j^\mu(x)/c \equiv 4\pi\rho(x)u^\mu(x) \\ u_\mu(x)\nabla_\nu F^{\nu\mu}(x) \equiv 4\pi\rho(x) \\ \nabla_\nu F^{\nu\mu}(x) \equiv u^\mu(x)u_\lambda(x)\nabla_\nu F^{\nu\lambda}(x). \end{cases}$$

Maxwell's equations in purely field terms for
4-momentum of electric energy flows $\rho\varphi_o u^\mu/c$

$$\begin{cases} [\nabla_\lambda F_{\mu\nu}(x) + \nabla_\mu F_{\nu\lambda}(x) + \nabla_\nu F_{\lambda\mu}(x)]\varphi_o/4\pi c \equiv 0 \\ [\delta^\mu_\lambda - u^\mu(x)u_\lambda(x)]\nabla_\nu F^{\nu\lambda}(x)\varphi_o/4\pi c \equiv 0. \end{cases}$$

Einstein's equations takes the same form for non-relativistic energy flows. Therefore, *magnetic monopoles* in Classical Electrodynamics and same *gravimagnetic monopoles* in General Relativity have equal theoretical rights to be discussed or to be searched in experiments.

Just in two words:

Electron's self-energy is complex - real energy quantization leads to the Compton length 2,4 x 10^{-12} m, while imaginary energy part is quantized on the electric analog length 1,2 x 10^{-33} m

$$E = (\sqrt{G}m + q)\varphi_o$$

$$= mc^2 + ieG^{-1/2}c^2$$

$$= (0.511 - 1.04i \times 10^{21})MeV$$

Finite imaginary energy in the nondual physics of charged fields instead of the unphysical Coulomb divergence in the dual (particle +field) approach to reality

Logarithmic potential is the strong field solution for elementary radial charges in Maxwell's electrostatics

$$W(r) = \frac{e}{r_e} ln\left(1 + \frac{r_e}{r}\right) \approx \begin{cases} e/r, & r_e \ll r \\ c^2/\sqrt{G}, & r \approx r_e \end{cases}$$

$$r_e = e\sqrt{G}/c^2 = 1.38 \times 10^{-36} m$$

Half of the radial charge q =ie is within the sphere of this fundamental radius

$$\varphi_o \equiv c^2/\sqrt{G} = 1.04 \times 10^{27}$$

B – the universal potential for complex self-energy of gravitational and electric charges

$$E = (\sqrt{G}m + q)\varphi_o = mc^2 + ieG^{-1/2}c^2$$

Pure field physics for nondual material continuum

1. There is no spatial scale in reality for an assumed transition from nondual field physics of the quantum microworld to dual Newton physics of the "observed" macroworld.

2. Classical Electrodynamics and General Relativity should be redesigned in nondual terms of continuous material fields with high and low densities of relevant energy flows.

My semester courses:

1. *1st year - "Introductory Electromagnetism and Wave Motion" PHYS 1004, Carleton University, Ottawa*
2. *1st year - "Kinematics and Mechanics" PHY2210, Algonquin College, Ottawa*
3. *2d year - "Electricity and Magnetism" PHY 2307, U of Ottawa*
4. *3d year – "Elements of Quantum Mechanics" PHYS 3701, Carleton University, Ottawa*
5. *4th year – "General Relativity" PHY 4346, U of Ottawa*
6. *4th year – "Nonlinear Electrodynamics", MIPT*
7. *5th year – "Microwave plasma", MIPT*
8. *5th year – "Electromagnetic waves in the Ionosphere", MIPT*
9. *5th year – "Fundamental interactions and principle experiments", MIPT*
10. *PhD – "Fundamentals of Nanoengineering" CHG8145, U of Ottawa*
11. *PhD – "Advanced Magnetism", PHY 5922, U of Ottawa*

My papers on nonempty space physics

1) Int. J. Theor. Phys. 47, 1261-1269 (2008), "Einstein's gravitation for Machian relativism of nonlocal energy-charges"
2) Jour. Supercond. and Novel Magn. 22, 627-629 (2009), "Relativistic quantization of Cooper pairs and nonlocal electrons in rotating superconductors"
3) Jour. Supercond. and Novel Magn. 22, 723-727 (2009), "Superfluid mass-energy densities of nonlocal particle and gravitational field"
4) J. Modern Physics, 3, N.10, 1465-1478 (2012), "Geometrization of Radial Particles in Nonempty Space Complies with Tests of General Relativity"
5) J. Chem. Chem., 7, 330-333 (2013), "From Steady 4D Quantization of Valence Electrons to Material Space Paradigm"
6) Bullet. Lebedev Phys. Inst. 41, 1-5 (2014), "Electron's continuous densities in gravitational and electromagnetic fields"
7) Bullet. Lebedev Phys. Inst. 43, N4, 140 (2016), "Complex Charge Densities Unify Particles with Fields and Gravitation with Electricity"
8) "Fizicheskoe Obrazovanie v VUZah" (Physics in Higher Education, in Russian) 22, N1, 59-74 (2016) Practice of Nondual Electrodynamics Teaching Toward Unification of Continuous Charge with its Coulomb Field

Mass-energy unification with electric charge-energy

$$E = (\sqrt{G}m + q)\varphi_o = mc^2 + ieG^{-1/2}c^2$$

50th Rencontres de Moriond March 21–28

GRAVITATION GRAM 2015

Bulyzhenkov, *Pure field physics of continuous charges without singularities*, Proceedings of “Gravitation: 100 years after GR”, p.317, Recontres de Moriond 2015, La Thuile, Italy http://moriond.in2p3.fr/Proceedings/2015/Moriond_Grav_2015.pdf

Complex Charge Densities Unify Particles with Fields and Gravitation with Electricity,
Bulletin of Lebedev Physics Inst, v4, N4 (2016) p.140;

Pure field electrodynamics of continuous complex charges,
Tutorial of the 4th year course, MIPT, Moscow 2015
ISBN 978-5-7417-0554-4. Physics in Higher Education (in Russian) v22 (2016) p.59, http://pinhe.lebedev.ru/;

MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION
MOSCOW INSTITUTE OF PHYSICS AND TECHNOLOGY
(STATE UNIVERSITY)

Faculty of General and Applied Physics
Department of Quantum Physics Problems

Igor E. Bulyzhenkov

PURE FIELD ELECTRODYNAMICS OF CONTINUOUS COMPLEX CHARGES

MOSCOW
MIPT
2015

Tutorial for the 4th year course
"Nonlinear Electrodynamics"

MIPT and many other top universities enroll graduate students in courses taught at the leading laboratories where the cutting edge science of currently unresolved problems is explored. Suggested learning through brainstorming of continuous charges instead of customary localized carriers of mass and electricity can open a new vision of the nonlocal material world, which is invisible to superficial human perception. Well-established Euclidean electrodynamics and Sommerfeld relativistic quantization together require us to turn our attention back to the nonempty space plenum of the Ancient Greeks. Modern researchers should reject the conventional paradigm of curved empty space, which does not exist in physical reality. Contemporary empty space physics is overloaded with controversial energy problems, sophisticated metric constructions and unphysical singularities. By accustoming nonempty space and continuous charges under this tutorial (which tends to resolve radiation self-acceleration, Coulomb energy divergence and many other failures of Classical Electrodynamics), a reader on his own may renew the Einstein mass-energy formula by electric terms, may relate the physical meaning of the Ricci scalar of material metric space to its scalar mass density, etc. Nonempty space Euclidean electrodynamics is a prerequisite to new interpretations in General Relativity and to a better reading of the Einstein Equation, where conventional point masses at the Equation right-hand side should be moved to the pure field (left-hand) side as continuous Ricci curvatures.

ISBN 978-5-7417-0554-4

Einstein and Infeld: “Classical physics introduced two substances: matter and energy. The first had weight, but the second was weightless. In classical physics we had two conservation laws: one for matter, the other for energy. We have already asked whether modern physics still holds this view of two substances and the two conservation laws. The answer is: ***No***. According to the theory of relativity, there is no essential distinction between mass and energy. Energy has mass and mass represents energy. Instead of two conservation laws we have only one, that of mass-energy.

This new view proved very successful and fruitful in the further development of physics. How is it that this fact of energy having mass and mass representing energy remained for so long obscured?

Is the weight of a piece of hot iron greater than that of a cold piece? The answer to this question is now ***Yes***, but on p. 43 it was ***No***..

We have two realities: matter and field. There is no doubt that we cannot at present imagine the whole of physics built upon the concept of matter as the physicists of the early nineteenth century did. For the moment we accept both the concepts. Can we think of matter and field as two distinct and different realities? Given a small particle of matter, we could picture in a naive way that there is a definite surface of the particle where it ceases to exist and its gravitational field appears. In our picture, the region in which the laws of field are valid is abruptly separated from the region in which matter is present. But what are the physical criterions distinguishing matter and field? Before we learned about the relativity theory we could have tried to answer this question in the following way: matter has mass, whereas field has not. Field represents energy, matter represents mass. But we already know that such an answer is insufficient in view of the further knowledge gained.

From the relativity theory we know that matter represents vast stores of energy and that energy represents matter. We cannot, in this way, distinguish qualitatively between matter and field, since the distinction between mass and energy is not a qualitative one. By far the greatest part of energy is concentrated in matter; but the field surrounding the particle also represents energy, though in an incomparably smaller quantity.

We could therefore say: Matter is where the concentration of energy is great, field where the concentration of energy is small. But if this is the case, then the difference between matter and field is a quantitative rather than a qualitative one.

There is no sense in regarding matter and field as two qualities quite different from each other. We cannot imagine a definite surface separating distinctly field and matter.

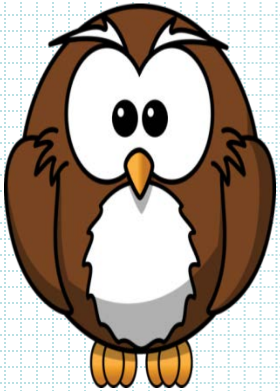
The same difficulty arises for the charge and its field. It seems impossible to give an obvious qualitative criterion for distinguishing between matter and field or charge and field.

Our structure laws, that is, Maxwell's laws and the gravitational laws, break down for very great concentrations of energy or, as we may say, where sources of the field, that is electric charges or matter, are present. But could we not slightly modify our equations so that they would be valid everywhere, even in regions where energy is enormously concentrated?

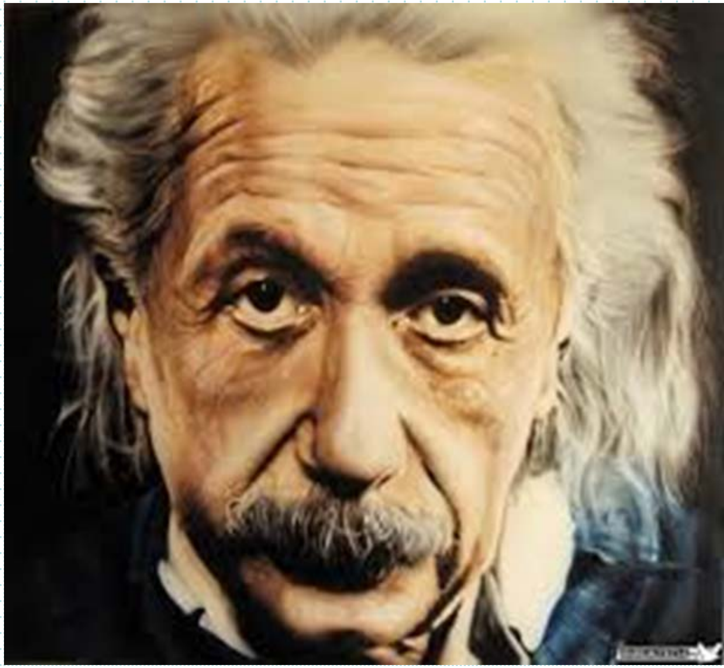
We cannot build physics on the basis of the matter concept alone. But the division into matter and field is, after the recognition of the equivalence of mass and energy, something artificial and not clearly defined. Could we not reject the concept of matter and build a pure field physics? What impresses our senses as matter is really a great concentration of energy into a comparatively small space.

We could regard matter as the regions in space where the field is extremely strong. In this way a new philosophical background could be created. Its final aim would be the explanation of all events in nature by structure laws valid always and everywhere. A thrown stone is, from this point of view, a changing field, where the states of greatest field intensity travel through space with the velocity of the stone. There would be no place, in our new physics, for both field and matter, field being the only reality. This new view is suggested by the great achievements of field physics, by our success in expressing the laws of electricity, magnetism, gravitation in the form of structure laws, and finally by the equivalence of mass and energy. Our ultimate problem would be to modify our field laws in such a way that they would not break down for regions in which the energy is enormously concentrated."

Thanks



for understanding
of Descartes-Mie-
Einstein-Infeld nondual
physics of pure fields
without black holes



ЭЛЕМЕНТЫ МИРОУСТРОЙСТВА ПО НЬЮТОНУ

- координатное пространство неподвижно и нематериально
- материальные тела локализованы, движутся относительно пространства и друг друга
- источник силового поля – материальная точечная частица
- нематериалные координатные поля заполняют все неподвижное пространство непрерывно (дуализм полей и частиц)
- постоянство инерционной массы и электрического заряда у частиц, нет уравнений для состояния элементарного источника

ЭЛЕМЕНТЫ МИРОУСТРОЙСТВА ПО ДЕКАРТУ

- частица – неоднородный вихрь плотностей
- только круговые движения плотностей материи
- все тела протяженные, напрямую контактируют друг с другом
- нет пустого пространства, допускается геометризация сплошного материального пространства и его движение
- нет инерциальных систем отсчета
- заряды и инерция частиц переменны, описываются уравнениями для источников