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— application of theories for description and/or explanations of properties of the Universe and microcosmos;
— mathematical models and philosophical bases which touch the description of a physical reality;
— description of set-ups aimed at the realization of fundamental physical experiments and the forthcoming results;
— discussion of published materials, in particular, those questions, which still have not a correct explanation.

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Editorial Office: Zhuck N.A., RTI TTR, 3 Kolomenskaya St., Kharkov 61166, Ukraine
Tel.: +38 (0572) 19-55-77. Tel./fax: +38 (0572) 409-298; 409-594; 141-164; 141-165
E-mail: zhuck@insurance.kharkov.ua; av@vl.kharkov.ua; http://spacetime.narod.ru

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SCIENTIFIC PROGRAM

OF THE UKRAINIAN-RUSSIAN CONFERENCE "GRAVITATION, COSMOLOGY AND RELATIVISTIC ASTROPHYSICS"

(November 8-11, 2000, Kharkov, Ukraine)

Wednesday, NOVEMBER 8

11.00-13.00 — GRAVITATION AND INTEGRATED THEORIES (Chairman P.I. Fomin):

— **Vladimirov Yu.S.** GRAVITATION AND PROBLEM OF INTEGRATING OF PHYSICAL INTERACTIONS (30+5 min);
— **Krasnoholovets V.V.** Space Structure and Quantum Mechanics (30+5 min);
— **Grebeniuk M.A.**, **Ivashchuk V.D.**, **Melnikov V.N.** Multidimensional classical and quantum gravity with p-branes (20+3 min);
— **Abdildin M.M.** On the Interpretation of Einstein's equations in General Relativity (18+3 min).

13.00-14.00 — lunch break

14.00-16.00 — GRAVITATION AND INTEGRATED THEORIES (Chairman Yu.S. Vladimirov):

— **Fomin P.I.**, **Shtanov Yu.V.** FIELD THEORY IN BRANCHING SPACES (20+5 min);
— **Bezerra de Mello E.R.**, **Bezerra V.B.**, **Khusnutdinov N.R.** VACUUM POLARIZATION OF MASSLESS SPINOR FIELD IN GLOBAL MONOPOLE SPACETIME (15+5 min);
— **Gershun V.D.** T-DUALITY OF STRING MODELS IN THE BACKGROUND GRAVITY AND ANTISYMMETRIC FIELDS (15+5 min);
— **Gladush V.D.** THE BIRKHOFF THEOREM IN FIVE-DIMENSIONAL GRAVITATION AND THE KALUZA-KLEIN THEORY (15+5 min);
— **Kudrya Yu.N.** "GEOMETRICAL OPTICS" OF MASSLESS FIELDS OF A SPIN 3/2 IN GR (15+5 min);
— **Kalinin D.A.** NONCOMMUTATIVE RIEMANNIAN GEOMETRY FOR QUADRATIC ALGEBRAS (12+3 min).

16.00-16.30 — coffee break

16.30-18.30 — GRAVITATION AND INTEGRATED THEORIES (Chairman M.P. Korkina):

— **Kassandrov V.V.**, **Trishin V.N.** PENROSE TWISTOR TRANSFORM AND EINSTEIN-MAXWELL SYSTEM (20+5 min);
— **Sannikov-Proskurjakov S.S.**, **Cabbolet M.J.F.T.** Renormalized Newtonian Conctant against equivalence principle (20+5 min);
— **Kiekhoven D.** GRAVO-INERTIAL FIELD THEORY — A NEW IDEA ABOUT GRAVITATIONAL PHYSICS (15+5 min);
— **Popov A.A.**, **Sushkov S.V.** VACUUM POLARIZATION OF A SCALAR FIELD IN WORMHOLE SPACETIMES (15+5 min);
— **Kolpakov D.N.** POLARIZATION WAVES AND PROBLEM OF THE GRAVITATION (20+4 min);
— **Shil'nov Yu.I.**, **Chytov V.V.** INFLUENCE OF THE SPACE-TIME CURVATURE ON THE CHIRAL SYMMETRY BREAKING IN THE MODEL WITH A FOUR FERMIONS INTERACTION (10+1 min).

18.30-20.00 — POSTERS "GRAVITATION AND INTEGRATED THEORIES" AND GENERAL DISCUSSION:

1. Baranov A.M., Bardushko N.M. ALGEBRAIC CLASSIFICATION OF KALUZA 5D-SPACE WITH KRISHNA RAO WAVE METRIC GENERALISATION.

2. Baranov A.M., Tegai S.F. FIXED SINGULARITIES IN THE KERR-SCHILD SPACES.

3. Belousova S.A., Maksimenko N.V. THE DESCRIPTION FOR THE SPIN POLARIZABILITIES OF HADRONS BASED ON THE COVARIANT LAGRANGIAN.

4. Kurbanova V.R. POLARIZATION-TIDAL MODELS OF BIREFRINGENCE IN THE GRAVITATION FIELD.

5. Litvinov D.A. INFLUENCE OF THE OWN GRAVITATIONAL FIELD ON THE MODEL SYSTEMS WITH FERMION AND ELECTROCTATIC FIELDS.

6. Mychelkin E.G. THE EQUATIONS OF A SCALAR GRAVITATION.

7. Mychelkin E.G. THERMODYNAMICS OF A SCALAR FIELD.

8. Sharypov O.V., Pirogov E.A., Grishin S.G. RELATIVISTIC QUANTUM-GRAVITATIONAL HYPOTHESES AND SPACE-TIME STRUCTURE.

9. Shumakov F.T. THEORETICAL RESEARCHES OF A RELATIVISTIC GRAVITATION.

10. Suslikov F.G. THE DYNAMICS OF THE COLORED PARTICLES IN THE FIELD OF GRAVITATIONAL RADIATION.

11. Vergeles S.N. THE NEW APPROACHES TO QUANTIZATION OF GRAVITATION IN D = 2,4 DIMENSIONALITIES.

Thursday, NOVEMBER 9

09.00-11.00 — GRAVITATION AND INTEGRATED THEORIES (Chairman V.P. Frolov):

— **Pelykh V.A.** THE CORRELATION BETWEEN SPINOR AND TENSOR METHODS IN THE POSITIVE GRAVITATION ENERGY PROBLEM (25+5 min);

— **Khusnutdinov N.R.** GROUND STATE ENERGY OF MASSIVE SCALAR FIELD INSIDE A SPHERICAL REGION IN THE GLOBAL MONOPOLE BACKGROUND (15+2 min);

— **Sushkov S.V.** DOMAIN WALLS IN A WORMHOLE SPACETIME (15+2 min);

— **Noskov V.I.** RELATIVISTIC VARIANT OF FINSLERIAN GEOMETRY AND ELECTROMAGNETIC "RED" SHIFT AT THE MODEL OF ENCLOSED SPACES (20+3 min);

— **Rvachev V.L. and Avinash K.** QUADRATIC RED SHIFT LAW AND THE NON-ARCHIMEDEAN UNIVERSE (15+5);

— **Gladush V.D., Konoplya R.A.** ON INSTABILITY OF THE SPHERICALLY- SYMMETRIC METRIC IN THE KALUZA-KLEIN THEORY (7+1 min);

— **Sharafiddinov R.S.** ON THE GRAVITATIONAL FIELD OF THE ELECTRIC CHARGE (10+1 min).

11.00-11.30 — coffee break

11.30-13.00 — GRAVITATION AND INTEGRATED THEORIES (Chairman M.M. Abdildin):

— **Chernitskii A.A.** THE POSSIBILITY OF UNIFICATION FOR GRAVITATION AND ELECTROMAGNETISM IN NONLINEAR ELECTRODYNAMICS (20+3 min);

— **Olyeynik V.P.** SELF-CONSISTENT SYSTEMS OF MAXWELL-DIRAC-YANG-MILLS FIELDS WITH SPHERICALLY SYMMETRIC GRAVITATIONAL FIELD (15+2 min);

— **Zhuck N.A.** FIELD FORMULATION OF THE GENERAL RELATIVITY AND COSMOLOGY (25+3 min);

— **Sinitsyn K.N.** THE BINARY MODEL OF DISTRIBUTION OF THE SUBSTANCE DENSITY AND NATURE OF GRAVITY (10+1 min);

— **Parnovsky S.L., Gaydamaka A.Z.** INFLUENCE OF SCALAR FIELDS WITH THE UNUNDERLOAD RELATIONS ON TIMELIKE SINGULARITIES PROPERTIES (10+1 min).

13.00-14.00 — lunch break

14.00-16.00 — COSMOLOGY (Chairman V.P. Frolov):

— **Fomin P.I., Shtanov Yu.V., Barabash O.V.** QUASICLOSED WORLDS AND QUANTUM CREATION OF A CLOSED UNIVERSE (30+5 min);
— **Dragovich B., Neshich Lj.** ADELIC QUANTUM COSMOLOGY (20+3 min);
— **Chashihin J.V.** QUANTUM SOLUTION OF SINGULARITIES PROBLEM IN GENERAL RELATIVITY (15+5 min);
— **Chervon S.V., Zhuravlev V.M.** MODELS OF COSMOLOGICAL INFLATION SUPPOSING A NATURAL OUTPUT ON RADIATION-DOMINANT STAGE AND ERA OF A DOMINANCE OF SUBSTANCE (20+2 min);
— **Verozub L.V., Kochetov A.Y.** ACCELERATION OF THE UNIVERSE AS A CONSEQUENCE OF GRAVITY PROPERTIES (18+2 min).

16.00-16.30 — coffee break

16.30-18.30 — COSMOLOGY (Chairman P.I. Fomin):

— **Arifov L.Ya.** TO A PROBLEM ON COSMOLOGICAL ROTATION (20+3 min);
— **Zhuravlev V.M.** COSMOLOGICAL MODELS With a VARIABLE EQUATION OF SUBSTANCE STATE (20+3 min);
— **Cherny A.N.** SPACE-TIME SCALE DIFFERENCES AS ACCELERATION SOURCE OF PONDERABLE MATTER (20+3 min);
— **Korkina M.P., Turinov A.N.** MODEL OF "VOIDS" IN FRIEDMAN UNIVERSE (20+3 min);
— **Khodyachich M.F.** COSMOLOGICAL PERIODICITIES AND MODELS OF THE UNIVERSE (15+2 min);
— **Saveliev E.V., Kattzyn D.V.** CORRESPONDENCE BETWEEN SOLUTIONS OF THE EINSTEIN EQUATIONS FOR MANY-DIMENSIONAL UNIVERSE MODELS FIILED BY THE MATTER (10+1 min).

18.30-20.00 — POSTERS "COSMOLOGY AND PHILOSOPHICAL PROBLEMS" AND GENERAL DISCUSSION:

1. Guts A.K. INDETERMINACY PRINCIPLE FOR RADIUS OF THE UNIVERSE, DIFINIENDUM BY VELOCITY OF DOINGS DISORGANIZATION IN SPACE-TIME.
2. Khokhlov D.L. ON THE FLATNESS AND HORIZON PROBLEMS.
3. Klafas E.A. THE STRUCTURE OF THE COSMOS AND ANTICOSMOS AND THEIR GRAVITATIONAL COMPOSITIONS.
4. Koryukin V.M. THE NEUTRINOS OF UNIVERSE AND THE GRAVITATION INTERACTION.
5. Minakov I.V. QUANTUM COSMOLOGY: TO A METAPHYSICAL CONDITION OF KNOWLEDGE.
6. Shumakov F.T. CREATION OF THE RELATIVISTIC GRAVITATIONAL CONCEPT OF MODEL OF THE UNIVERSE.
7. Snagoschenko A.V., Bondarenko S.V. PHILOSOPHICAL PROBLEMS OF FUNDAMENTAL CONCEPTS: "PERPETUITY", "GRAVITATION".
8. Zhukova A.F., Zhelonkina N. THE UNIVERSE IS THE GRAVITATION CLOCK. 9. Gumanyuk Yu.Yu. IDEA AND GRAVITATION.
9. Gumanyuk Yu.Yu. IDEA AND GRAVITATION.

Friday, NOVEMBER 10

09.00-11.00 — COSMOLOGY (Chairman L.Ya. Arifov):

— **Burlikov V.V., Korkina M.P.** T-SOLUTIONS FOR THE SPHERICAL ANISOTROPIC FLUID IN GR (25+5 min);
— **Minakov A.A., Vakulik V.G., Vasiljev S.A.** SPATIAL AND TEMPORAL DISTORTIONS OF A SOURCE LIGHTCURVE IN PROPAGATION OF LIGHT THROUGH A GRAVITATIONAL LENS-GALAXY (25+5 min);

— **Vakulik V.G.**, **Dudinov V.N.**, **Zheleznyak A.P.**, **Konichek V.V.**, **TsvetkovaV.S.**, **Sinelnikov I.Ye.**, **Minakov A.A.**, **Artamonov B.P.**, **BruevichV.V.**, **Hamitov I.M.** PHENOMENON OF GRAVITATIONAL LENSING; INVESTIGATION OF VARIABILITY IN GRAVITATIONAL LENS SYSTEM Q2237+0305 (THE EINSTEIN CROSS) (25+5 min);

— **Alexandrov Yu.V.** TO QUECTION OF THE CONTEMPORARY EVOLUTION OF THE UNIVERSE (15+2 min).

— **Korukhov V.V.** ON THE PROBLEM OF INITIAL PARAMETERS OF UNIVERSE (12+1 min).

11.00-11.30 — coffee break

11.30-13.00 — COSMOLOGY (PHILOSOPHICAL PROBLEMS) (Chairman I.Z. Tsekhmistro):

— **Pavlenko A.N.** WHETHER IS THE COSMOLOGICAL THEORIES SCIENTIFIC FICTION (30+5 min);

— **Tsekhmistro I.Z.** ABOUT THE LOGICAL NATURE OF QUANTUM CORRELATION (25+2 min);

— **Ivanchenko G.E.** EINSTEIN POSTULATE ABOUT A CONSTANCY OF SPEED OF LIGHT AND ITS PHYSICAL CONTENTS (15+2 min);

— **Tararoev J.V.** PHILOSOPHICAL ASPECTS OF THE SPACE AND TIME PROBLEM IN QUANTUM COSMOLOGY (10+1 min).

13.00-14.00 - lunch break

14.00-16.00 — RELATIVISTIC ASTROPHYSICS (Chairman M.P. Korkina):

— **Frolov V.P.** HAWKING RADIATION FROM A FLUCTUATING BLACK HOLE (30+5 min);

— **Golubiatnikov A. N.**, **Chukin S.S.** ON THE CALCULATION OF STRONG RELATIVISTIC EXPLOSION (20+3 min);

— **Sinitsyn K.N.** "BLACK HOLES" AND NATURE OF "DARK MATTER" IN BINARY MODEL OF DISTRIBUTION OF THE SUBSTANCE DENSITY (16+2 min);

— **Grigorjev S.B.** THE STATIC SOLUTIONS With HOMOGENEOUS And ANISOTROPIC PRESSURE (10+1 min);

— **Kontorovich V.M.**, **Pasyuga V.N.** ULTRA RELATIVISTIC EXPLOSION IN A GRAVITATIONAL FIELD OF THE CENTRAL-COMPACT OBJECT AND SUPERLUMINAL RADIO JETS (10+1 min);

— **Zakharov A.V.**, **Dusakova L.R.** ON SMALL PERTURBATIONS IN THE COSMOLOGICAL PLASMA WITH COMPTON DIFFUSION (10+1 min);

— **Bannikova E.Yu.**, **Verozub L.V.** SPHERICALLY AND SYMMETRIC ACCRETION ON OBJECT WITHOUT HORIZON OF EVENTS (10+1 min).

16.00-16.30 - coffee break

18.30-20.00 — POSTERS " RELATIVISTIC ASTROPHYSICS" AND GENERAL DISCUSSION:

1. Alaverdyan G.B., **Harutyunyan A.R.**, **Vartanyan Yu.L.** ON SMALL MASS HYBRID STARS WITH QUARK CORE.

2. Baranov A.M., **Baranov D.A.** STATIC STAR MODEL AND MATHIEU FUNCTIONS.

3. Baranov A.M., **Lukonenko M.V.** EXTENSIVE CLASS OF STATIC STARS SIMULATION WITHIN ONE APPROACH.

4. Bogdanov A.S., **Guziy S.**, **Shlyapnikov A.** PROBLEM OF THE SEARCH OPTICAL CANDIDATES ON THE IDENTITY WITH GRB.

5. Guziy S., **Panko E.A.**, **Shlyapnikov A.** THE OPTICAL RESEARCHING OF 30 GRB-AREAS.

6. Kozhanov T.S., **Zhukina A.B.** TO DYNAMICS OF THE REVOLVING AND ASYMMETRICALY COMPRESSIBLE PROTOGALAXY.

7. Schetchikov P.V. NON-STATIONARY GRAVITATIONAL FIELDS AND STOCHASTIC ANOMALIES IN RELATIVISTIC KINETIC SYSTEMS.

8. Shikin I.S. EXACT SOLUTIONS OF STELLAR WIND TYPE IN RELATIVISTIC GAS DYNAMICS IN SCHWARZSCHILD'S SPACE-TIME.

9. Shumakov F.T. THE SUBSTANTIATION OF THE PULSATORY RELATIVISTIC GRAVITATIONAL CONCEPT OF A GENESIS OF ENERGY OF ASTRONOMICAL OBJECTS.

10. Zheleznyak O.A. FEATURES OF A STABILITY AND EQUILIBRIUM SELF-GRAVITATING OF CONFIGURATIONS.

11. Zykunov V.A. SPIN EFFECTS OF THE W-PRODUCTION IN HADRON-HADRON COLLISIONS.

16.00 — conference dinner

Saturday, NOVEMBER 11

09.00-11.00 — RELATIVISTIC ASTROPHYSICS (Chairman M.M. Abdildin):

— **Zhuravlev V.M.**, **Kornilov D.A.** NONUNIFORM COSMOLOGICAL MODEL WITH A CHARGED SCALAR FIELD AND IDEAL FLUID (20+3 min);

— **Chashihin J.V.** DIMINUTION OF COSMIC DISTANCES SOLVES PROBLEMS OF SUPERLUMINAL EXPANSION AND OF GALACTIC HALOS (15+5 min);

— **Vishnevskaya I.V.**, **Guziy S.**, **Zelenskaya E.A.**, **Shlyapnikov A.** RESULTS OF THE OPTICAL OBSERVATIONS X-RAY TRANSIENTS XTE J1859+226 AND XTE J1118+480 (12+1 min);

— **Kontorovich V.M.**, **Shelyag S.I.** THE GALAXY CLUSTER EVOLUTION, DEPEND ON GRAVITATIONAL INTERACTION AND MERGING OF GALAXIES IN CLUSTER (15+2 min);

— **Abdildin M.M.**, **Omarov M.S.**, **Abishev M.E.** ON THE ORBITAL STABILITY OF THE MOTION PROBLEMS IN GR (12+1 min);

— **Abdildin M.M.**, **Abishev M.E.** INTEGRATION OF THE EQUATION OF ROTATION MOTION IN PROBLEM OF TWO ROTATED BODIES IN GR (IN CASE OF INFINITE MOTION) (10+1 min).

— **Orlyansky O.Yu.** SMALL BODIES MOTION PECULIARITY IN THE ROTATION STAR SYSTEMS (10+1 min);

— **Alexandrov Yu.V.**, **Portyankina A.V.** APPROXIMATION OF ASTEROIDS GRAVITATION FIELDS BY THE GRAVITATIONAL DOUBLET (10+2).

11.00-11.30 — coffee break

11.30-13.00 — RELATIVISTIC ASTROPHYSICS (Chairman A.A. Minakov):

— **Abdildin M.M.**, **Omarov M.S.**, **Komarov A.A.** ON THE RELATIVISTIC TWO-BODY PROBLEM ACCOUNTING TIDES (20+5 min);

— **Zima I.I.**, **Bogdanov G.F.** CORONAL OF THE HOLE AND ROTOR MAGNETIC WAVES (20+5 min);

- Abdildin M.M.,**Omarov M.S.**, **Komarov A.A.** OPTIMIZATION OF CHOICE OF VECTOR ELEMENTS WITHIN THE ADIABATIC MOTION GR THEORY (20+5 min);

— **Patsera Yu.I.**, **Yemets V.M.** DRAGGING EFFECTS OF INERTIAL FRAMES OF REFERENCE-PERSPECTIVE OF GROUND-BASED EXPERIMENTS (12+3 min).

13.00-14.00 — lunch break

14.00-16.00 — GRAVITATIONAL EXPERIMENTS (Chairman Z.G. Murzakhanov):

— **Omelyanchuk A.N.** SUPERCONDUCTIVITY AND GRAVITATION (20+3 min);

— **Daishev R.A.**, **Balakin A.B.** LUNAR TEST AND ALTERNATIVE RESOLUTION IN THE THEORY OF RESPONSE OF ELECTRO-ELASTODYNAMIC DETECTOR OF GRAVITATIONAL FIELD LOW-FREQUENCY VARIATIONS (25+5 min);

— **Alexeev A.D.**, **Bronnikov K.A.**, **Kolosnitsyn N.I.**, **Konstantinov M.Yu.**, **Melnikov V.N.**, **Sanders A.J.** TEORETICAL ANALYSIS OF SEE PROJECT ON DETERMINATION OF PARAMETERS OF GRAVITATIONAL INTERACTION ON A SATTELITE BOARD (25+5 min).

— **Izmailov G.N.**, **Ozolin V.V.** LABORATORY EXPERIMENT ON CHECK OF ANISOTROPY OF LIGHT SPEED (15+5 min);

— **Gorelik I.Yu.** GRAVITY-THERMAL COIL (25+2 min).

16.00-16.30 — coffee break

16.30-18.10 — GRAVITATIONAL EXPERIMENTS (Chairman V.V. Ozolin):

— **Daishev R.A.**, **Levin S.F.**, **Murzakhanov Z.G.**, **Skochilov A.F.** PROCESSING OF RESPONSE SIGNAL OF GRAVITATION WAVE DETECTOR (20+5 min);
— **Grunskaya L.V.**, **Isakevich V.V.**, **Vinogradov D.V.** EXPERIMENTAL INVESTIGATIONS OF THE ELF VARIATIONS OF THE EARTH ELECTROMAGNETIC FIELD AND GRAVITATIONAL WAVE RADIATION (20+4 min);
— **Kolosnitsin N.I.** ABOUT PERFORMANCE OF EXPERIMENT FOR DETECTION OF NEW LONG-RANGE FORCES (15+2 min);
— **Levin S.F.** METROLOGICAL SUPPORT OF MEASURING PROBLEMS OF IDENTIFICATION FOR GRAVITATION AND OPTICAL MEASUREMENT SIGNALS (15+2 min);
— **Ozerov M.F.**, **Kochetov A.E.**, **Verozub L.V.** AABOUT GRAVITY FORCE EXPERIMENTAL TESTING IN THE METRIC-FIELD GRAVITATION EQUITIONS (15+2 min).

18.10-19.00 — POSTERS "GRAVITATIONAL EXPERIMENTS" AND GENERAL DISCUSSION:

1. Alpin T.Yu., **Balakin A.B.** GRAVITATIONAL RADIATION AND OPTICAL ACTIVITY IN THE ANISOTROPIC MEDIA.
2. Bogdanov Yu.A. CORRELATION OF GRAVITATIONAL POTENTIAL AND ELECTROMAGNETIC RADIATIONS IN PLACES OF THE EARTH'S CRUST BREAKS.
3. Chashihin J.V. AN IDEA FOR DIRECT EXPERIMENTAL MEASUREMENT OF THE SPEED OF GRAVITATIONAL INTERACTION.
4. Mizrakhy V.M. BIOGRAVITATION PHENOMENON MANIFESTED BY A HUMAN BEING.
5. Trushenev A.Ya. ABOUT AN OPPORTUNITY OF MAKING A VORTICAL ELECTROMAGNETIC FIELD FOR GENERATION OF GRAVITATIONAL WAVES.
6. Zhuck N.A. COSMOLOGICAL EFFECTS IN BULKY MICHELSON INTERFEROMETERS.

19-00 — closing of the Conference

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THE DESCRIPTION OF THE HADRON SPIN POLARIZABILITIES BY THE COVARIANT LAGRANGIAN AT LOW ENERGIES

S.A. Belousova[1]

Gomel State University, Sovetskay street, 102, Gomel, 246699, Belarus

November 8, 2000

On the basis of the correspondence principle between the relativistic moving medium electrodynamics and relativistic quantum field theory the covariant Lagrangian of the electromagnetic field interaction with the polarized spin particles have been obtained. This Lagrangian satisfies the main relativistic quantum field theory requirements and contains four independent covariant spin structures, which have particular physical meaning.

1. Introduction

In the expansion of the amplitude for Compton scattering in powers of the incident photon energy ω, the terms of $\mathcal{O}(1)$ and $\mathcal{O}(\omega)$, depend only on the mass of the nucleon m, its electric charge and the anomalous magnetic moment μ (see, for example, Refs. [1, 2]). By virtue of the low-energy theorem in the $\mathcal{O}(\omega^2)$ the amplitude for spin-0 and -1/2 hadrons depends on their internal degrees of freedom, which are determined by the fundamental parameters such as the electric (α) and magnetic (β) polarizabilities [1, 2]. In turn, at the $\mathcal{O}(\omega^3)$ the effective Lagrangian discribing the photon-nucleon interaction and, as the result the amplitude for Compton scattering are determined by gyrations, or so-called spin polarizabilities, the new electromagnetic characteristics [3, 4, 4, 6, 5, 6, 7]. These characteristics are immediately connected to the spin properties of hadrons as a composite particles.

The classic process for the investigation of these features of the photon-hadron interaction is the Compton scattering of photons whose energies are less then resonance region. Nevertheless data about spin polarizabilities can be extracted from other electrodynamic processes (see, for example Ref. [8]).

The determination of the hadron polarizability contributions to the amplitudes of QED processes is sequentially carried out by the effective Lagrangians of the electromagnetic field interaction with the hadron as a composite particle. In the nonrelativistic electrodynamics the such kind of Lagrangian is rather well determined. On the other side in the relativistic QED when hadrons look like bound states, due to the kinematic relativistic effects, the interpretation of polarizabilities is ambiguous [2, 7].

In the present report the correspondence principle between relativistic moving medium electrodynamics and relativistic quantum field theory will be sequentially used for the covariant Lagrangian construction of the electromagnetic field interaction with polarized spin hadrons.

2. The Lagrangian of the photon-hadron interaction, spin polarizabilities taking into account

In the nonrelativistic case, the Hamiltonian of the interaction of the isotropicly-gyrotropic medium looks like [9, 10]:

$$H_I = -2\pi \left(\mathbf{PE} + \mathbf{MH}\right), \tag{1}$$

In order to define the effective Lagrangian with account of the nucleon spin polarizabilities, is used Eq. (1), where polarization and magnetization vectors ($\mathbf{P}$ and $\mathbf{M}$) are determined as follows

$$\mathbf{P} = \hat{\alpha}\mathbf{E} + \hat{\gamma}'_{\mathbf{E}}\left[\nabla\mathbf{E}\right], \tag{2}$$

$$\mathbf{M} = \hat{\beta}\mathbf{H} + \hat{\gamma}'_{\mathbf{M}}\left[\nabla\mathbf{H}\right], \tag{3}$$

where $\hat{\alpha}$ and $\hat{\beta}$ are the tensors of electric and magnetic polarizabilities, $\hat{\gamma}'_M$ and $\hat{\gamma}'_E$ are the tensors of spin polarizabilities, $\mathbf{E}$ and $\mathbf{H}$ are the strengths vectors of electric and magnetic fields.

According to the relativistic moving medium electrodynamics the following Lagrangian of the electromagnetic field interaction with the moving medium is obtained:

$$L_I{}^{eff} = 2\pi\{[e_\mu \alpha^{\mu\nu} e_\nu + h_\mu \beta^{\mu\nu} h_\nu] -$$

[1] e-mail: belousova@gsu.unibel.by

$$-[(\gamma'_E)_{\mu\nu}e^\mu(U\partial)h^\nu + \\ +(\gamma'_M)_{\mu\nu}h^\mu(U\partial)e^\nu]\}, \quad (4)$$

where $(\gamma'_E)_{\mu\nu\rho}$ and $(\gamma'_M)_{\mu\nu\rho}$ are the gyration pseudotensors, $(U\partial) = U_\rho\partial^\rho$. In this expression $e_\mu = F_{\mu\nu}U^\nu$, $h_\mu = \tilde{F}_{\mu\nu}U^\nu$, $\tilde{F}_{\mu\nu} = \frac{1}{2}\varepsilon_{\mu\nu\rho\sigma}F^{\rho\sigma}$, where $F^{\mu\nu}$ and $\tilde{F}^{\mu\nu}$ are the electromagnetic field tensor and dual one respectively ($F^{0i} = -E^i, F^{ik} = -\varepsilon_{ikl}\,H^l$), $\alpha_{\mu\nu}$ and $\beta_{\mu\nu}$ are tensors, defining the polarizabilities of a medium at rest, U_μ is the 4-velocity of the medium and the Levi-Chevita antisymmetric tensor $\varepsilon_{\mu\nu\rho\sigma}$ is fixed by the condition $\varepsilon^{0123} = 1$.

If pseudotensors $(\gamma'_E)_{\mu\nu}$ and $(\gamma'_M)_{\mu\nu}$ are determined via $g_{\mu\nu}$ as $(\gamma'_{E,M})_{\mu\nu} = (\gamma'_{E,M})g_{\mu\nu}$, then it reduce to violation of the spatial parity conservation low (*i.e.* spin of a composite particle is not taken into account).

From the expression (4) it follows that the usual polarizabilities (α, β) in a rest medium and the gyration give non-zero contributions to the Lagrangian, starting with the second and the third order in povers of frequency of an external electromagnetic field respectively.

Due to the correspondence principles [12] and the expression (4), the field theory effective Lagrangian of electromagnetic field interaction with spinless hadrons will not satisfy to the parity conservation law when the components of pseudotensors $(\gamma'_E)_{\mu\nu}$ and $(\gamma'_M)_{\mu\nu}$ are not equal to zero. However, in the case of the spin particles it is easy to determine dependence of γ-structures from $(\bar{\psi}\,(\overleftrightarrow{\partial_\alpha}\overleftrightarrow{\partial_\beta})\gamma^\mu\gamma^5\psi)$ and $(F^{\alpha\nu}\overleftrightarrow{\partial^\nu}\tilde{F}_{\sigma\mu})$.

Hence, the effective field Lagrangian discribing the hadron spin polarizabilities is defined as follows:

$$\begin{aligned} L^{Sp}_{eff} &= \frac{\pi}{4m^2}(\bar{\psi}\,(\overleftrightarrow{\partial_\alpha}\overleftrightarrow{\partial_\beta} + \overleftrightarrow{\partial_\beta}\overleftrightarrow{\partial_\alpha})\gamma^\mu\gamma^5\psi) \\ &\times\{-\frac{1}{2}\,\gamma_{E_1}\cdot\,F^{\alpha\nu}\overleftrightarrow{\partial^\beta}\,\tilde{F}_{\mu\nu} \\ &+\frac{1}{2}\,\gamma_{M_1}\cdot\,\tilde{F}^{\alpha\nu}\overleftrightarrow{\partial^\beta}\,F_{\mu\nu} \\ &-\gamma_{E_2}\cdot\,(F^{\alpha\nu}\overleftarrow{\partial_\mu}\,\tilde{F}^\beta_{\ \nu} - \tilde{F}^{\alpha\nu}\overrightarrow{\partial_\nu}\,F_\mu{}^\beta) \\ &+\gamma_{M_2}\cdot\,(\tilde{F}^{\alpha\nu}\overleftarrow{\partial_\mu}\,F^\beta_{\ \nu} - F^{\alpha\nu}\overrightarrow{\partial_\nu}\,\tilde{F}_\mu{}^\beta)\}, \quad (5) \end{aligned}$$

here $\gamma^5 = -\left(\begin{smallmatrix}0 & I\\ I & 0\end{smallmatrix}\right)$.

The effective interaction Hamiltonian of the electromagnetic field and the spin-1/2 hadron follows from the Lagrangian (5) [7]

$$\begin{aligned} H^{Sp}_{eff} &= -2\pi(\gamma_{E_1}\boldsymbol{\sigma}\cdot\mathbf{E}\times\dot{\mathbf{E}} + \gamma_{M_1}\boldsymbol{\sigma}\cdot\mathbf{H}\times\dot{\mathbf{H}} \\ &-2\gamma_{E_2}E_{ij}\sigma_iH_j + 2\gamma_{M_2}H_{ij}\sigma_iE_j), \quad (6) \end{aligned}$$

where $E_{ij} = \frac{1}{2}(\partial_iE_j + \partial_jE_i)$ and $H_{ij} = \frac{1}{2}(\partial_iH_j + \partial_jH_i)$.

The effective Lagrangian (5) satisfies both the crossing symmetry and all requirements of the relativistic quantum field theory. As follows from expression (5), spin polarizabilities for the spin-1/2 hadrons give the contributions to the effective Lagrangian which are of order $\mathcal{O}(\omega^3)$.

3. Conclusion

To summarize, on the basis of the correspondence principle between the relativistic moving medium electrodynamics and relativistic quantum field theory the covariant Lagrangian of the electromagnetic field interaction with the polarized spin particles have been obtained. This Lagrangian satisfies the main relativistic quantum field theory requirements (are cross-invariant, P and T- and gauge invariant). The obtained Lagrangian can be used for description of spin polarizabilites in two-photon processes (Compton scattering, scattering of electrons on nucleones, and others).

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DIMINUTION OF COSMIC DISTANCES SOLVES PROBLEMS OF SOLAR NEUTRINOS, SUPERLUMINAL EXPANSION AND GALACTIC HALOS

Justin Chashihin[1]

Moscow institute of physics and engineering
The full article is presented in the Internet: http://www.cnt.ru/users/chas
Orehovii bulvar 21-1-53, M-563 Moscow, 115563, RUSSIA

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The purpose of this paper is to present unified solution of the problems of the solar neutrinos, superluminal expansion and galactic halos. I present facts proving that the real age of the universe is several orders less than billions years, and that its diameter is millions times less.
The intergalactic and interstellar distances were calculated before appearance of the general relativity proving that space is curved. Here I show that the relativistic correction of distances (since space is curved) very strongly influences on the calculated distance, our notion of distances very strongly depends on the curvature of space where travel the light rays we observe. The correction diminutes distances up to million times.
The theory of the young age of the universe solving the problems, very well correlates with many other facts of geophysics and astrophysics. These facts prove that the real age of the universe $\ll$ 30 million years. Some of the facts are presented in the internet on my web page http://www.cnt.ru/users/chas. Radio-isotope dating has theoretical inconsintencies and contradicts many observable facts that prove younger age of the rocks. Analysis of the theory of plate tectonics by Newtonian mechanics proves that continents drifted at deceleration by friction force just several hours, not 200 millions years. This result is presented in the web-page and also on geological conferences.

1. Introduction

Galactic astronomy has three problems: solar neutrinos, galactic halos and superluminal expansion. The subject of the present article is offering and motivation of another and unified way of solution of the paradoxes by taking into account gravitational redshift of galaxies and relativistic correction of interstellar and intergalactic distances. The way correlates with many other data proving young age of the universe.

2. Easy way of solution of the superluminal expansion problem

Paradox of superluminal expansion [1-3] is in the following: if present notion of cosmic distances were true, some objects would spread at superluminal speed, up to $v_{seeming}$ $20c$. But relativity and experiments demand that speed of all matter must be $v_{real} < c$. Therefore according to experiments proving relativity theory, we have:

$$v_{real} < c = v_{seeming}/20$$

then real distances and age are less than seeming ones:

$$d_{real} < d_{seeming}/20,$$

$$T_{real} < T_{seeming}/20 = 13 * 10^9/20 = 650 * 10^6 \ y$$

years. Only objects of very small mass - particles - can be accelerated up to relativistic speeds v c, but heavy objects cannot. This common fact is caused by momentum conservation law: p = mv = const. At same momentum (from an explosion of a star), heavy bodies can be accelerates up to smaller speeds due to their bigger inertia, mass. Star cannot travel even at relativistic speed, speeds af such very heavy bodies as stars must be $v << c$. Also dust clouds, accelerated by an explosion (causing seeming superluminal expansion) cannot travel at relativistic speeds, but their speeds must be $v << c$. Therefore

$$d_{real} << d_{seeming}/20 \qquad (1)$$

$$T_{real} << T_{seeming}/20 = 13 * 10^9/20 = 650 \ m.y.$$

i.e. the real distances (and hence, age) were very strongly overestimated, in several orders of magnitude.

[1] e-mail: chas@mail.cnt.ru

3. Gravitational redshift of galaxies

Observed redshift of galaxies can be explained by 3 possible causes:

1) gravitational redshift predicted in 1916 and experimentally found in 1960,

2) kinematic redshift - Doppler effect,

3) decrease of speed of light - this model was put forward in 1987 by Troitskii [4], and also by Norman and Setterfield [5]. Troitskii has shown [4], that redshift of galaxies and isotropy of cosmic microwave background radiation - the observations which have been used as evidence for big bang - are better explained as having resulted from decrease of speed of light. He argues [4] that decreasing of speed of light does not violate any physical laws and correlates with indirect verification.

However, big bang theorists did not took into account the gravitational redshift phenomenon neither after 1916, nor after 1960. And after 1987 they have neglected also research [4-5]. Gravitational redshift was observed in 1960, i.e. 31 years later after Hubble's work. The contribution of these effects should be considered in each tutorial on cosmology, however it is not. The observed redshift of a galaxy is really sum of gravitational redshift, decrease of speed of light, and Doppler redshift, but not only Doppler redshift. If we take into account both these effects, then Doppler redshift will be smaller than the observed redshift. Therefore because of absence of estimation of gravitational redshift, the observation of redshifts of galaxies speaks yet nothing about their speeds and, hence about distances to them. Therefore also conclusion about expansion of universe has not scientific basis. General relativity was used for construction of the big bang model, but the contribution of gravitational redshift predicted by the same general relativity was not considered.

4. Easy way of solution of the galactic halos problem

The galactic halo problem in general is exactly in disagreement between different distance calculation methods! Curve of rotation of neutral hydrogen outside of many galaxies does not become Kepler type, i.e. speed of rotation of neutral hydrogen does not fall on greater distances from the centre of galaxy. This is possible only if great masses surround galaxy. These masses were called "dark matter" and "galactic halo". However all dark matter candidates for explanation of hypothetical galactic halos were failed. Margon says that one of our scientific principles is inevitably false [6]. I think, this beloved false notion is old age.

5. Relativistic correction of distance calculation methods. Relativistic astronomy

Distances to close stars are calculated using parallax triangulation supposing Euclidean geometry. But since general relativity proves that gravitational field is Riemannian curvature of space-time, then any region of universe does have Riemannian curvature, but not Euclidean geometry. Observation of gravitational lenses [7] shows that Euclidean distance parallax calculation method is wrong in roots and is unsuitable even for calculation of distances up to nearest stars.

Distances to closest stars were calculated according to Euclidean geometry before appearance of general relativity in 1916. And even spectrum-luminosity diagram was built by them in 1913. Therefore present astronomical distances, calculated by Euclidean geometry, are pre-relativistic. After appearance of general relativity in 1916 and observations of gravitational redshift in 1960 and of gravitational lenses in 1979 [7], the former Euclidean distances of classical non-relativistic astronomy were not called in question on basis of general relativity and observations of gravitational lenses. In calculation of all interstellar and intergalactic distances in relativistic astronomy the Riemannian geometry must be took into account. Sum of angles Σ of every triangle between any 3 stars or galaxies in Riemannian geometry is always

$$\Sigma = 180^o + \alpha, \alpha > 0. \quad (2)$$

But since in classical astronomy parallaxes are calculated in Euclidean space: $\Sigma = 180^o$, then minimal parallax in relativistic astronomy is α (maximal parallactic distance is $1/\alpha$), i.e. any star or galaxy with true parallax $\approx \alpha$ has seeming Euclidean parallax $\beta \approx 0$" and *seems* as if it were billions light years far. Therefore if a star or a galaxy has seeming classical Euclidean parallax β and seems located at distance $d_E = 1/\beta$, then it's really located at distance d_R, which is essentially less than seemimg distance:

$$d_R = \frac{1}{\alpha + \beta} < \frac{1}{\beta} = d_E, \alpha > 0. \quad (3)$$

This means that real distance d_R seems as d_E to classical astronomy. Curvature factor is very strong for such great ratios, see table 1.

Distances up to far stars and galaxies are calculated with two wrong assumptions:

1) calibration on distances to close stars which are already calculated wrongly (figure 1), and

2) linear calibration wrongly assuming Euclidean geometry of curved Riemannian space.

Since all methods of distance calculation, in part, spectrum-luminosity diagram, cepheid method etc. contain these two wrong assumptions, all distances must

be recalculated according to Riemannian geometry of curved cosmic space.

Table 1. Column 1 is angle β, column 2 is seemed wrong Euclidean distance, and columns 2-5 are true real Riemannian distance, in pc, at different angles α of mean Riemannian curvature. The table shows that account of Riemannian curvature of cosmic space decreases cosmic distances and lets to solve the "galactic halo" problem. See formulas (2-3).

β	d_E	1"	0.1"	0.01"
1"	1 pc	0.5 pc	0.9 pc	1 pc
0.1"	10 pc	0.9 pc	5 pc	9.1 pc
0.01"	100 pc	0.99 pc	9 pc	50 pc
$< 10^{-6}$"	$> 10^6$ pc	1 pc	10 pc	100 pc

Observations of gravitational lenses proves that curvature of cosmic space in vicinity of a galaxy is such that $\alpha = 6''$ [7]. Therefore space in vicinities of all galaxies and inside of them has Riemannian curvature such that α is about several arc seconds. Of course, I try to make first preliminary estimation. All astronomical observations are influenced by gravitational field of our Milky Way Galaxy and all light rays detectable on Earth travel in space with Riemannian curvature of $\alpha = 1...10''$. Therefore we look at universe through curved spectacles of Riemannian curved space of Milky Way! Galaxy Milky Way is already a gravitational lens.

QSOs have big redshifts maybe because of their small radius, and, as a result, big gravitational redshift. This hypothesis of small radii of QSOs suggests that their redshifts are almost full gravitational redshift.

6. Young age of the universe

Smaller intergalactic distances suggest smaller age of the universe. And there are many phenomena that agree this.

6.1. The incorrectness of old age chronometers

Wesson [8] pointed out 72 objections to plate tectonics. Hence the theory needs radical revision. I made analysis of plate tectonics by Newtonian mechanics [9]: the basic assumption of gradualist plate tectonics that continents drifted under friction force over earth mantle at constant velocity contradicts first law of Newtonian mechanics - "every body moves at constant velocity only if sum of forces that act upon it is zero". Account of it proves that continents drifted at friction deceleration, but not at constant velocity. Second Newton's law determines this acceleration equal a=F/m=gk, where m is mass of continent, k - friction coefficient, g=9.8. The continents drifted during time

$$t = \sqrt{2d/gk},$$

where d is distance drifted by continent of mass m. This time is about several hours, but not 200 millions years. The initial velocity of drift of continents v=gkt was some hundreds meters per second. And then they have stopped and now only slightly oscillate, that causes modern earthquakes. The fundamental experiments on stratification [10-14] are closely connected to this work. Laws of physics lead to scenario: asteroid fell upon Earth and splited continent, continents-splinters drifted at friction deceleration for several hours, and then they stopped and oscillation damping began, which today has small amplitude. This explains many geological phenomena.

Age of rocks is usually defined using isotope dating methods, but they have theoretical inconsistencies [15-16] and contradict the experiments [17], e.g. lava from eruption of mt. St.Helen's in 1980 was dated at 1996 by K/Ar dating method, got age was up to 2.8 $\pm$ 0.6 millions years!

In general, old age methods - big bang, isotope dating, plate tectonics - fail.

6.2. Evidences for young age of the universe and solution of the solar neutrino problem

There are very many geophysical and astrophysical phenomena that prove a much younger age of the universe, solar system and earth. Here is a short review of some of them. A longer article is presented in the internet at my web page http://www.cnt.ru/users/chas.

Analysis of solar eclipses of years 1567, 1715 and 1979 and direct measurements for several centuries prove that diameter of the sun decreases very quickly - at up to about 0,1 percent per 100 years [18-22]. Since radius of sun was always much less than radius of the orbit of Mercury, then age of the solar system is less than 40 million years:

$$t \ll 5.68 * 10^{10} m/1400 m/y \approx 40 * 10^6 y.$$

Antique astronomers, including Cicero, Seneca and Ptolemaeus described Sirius as a very red star. While already in 11 century arabs described it as white. A riddle for astronomers here is that according to theory, burning process from red giant to white dwarf must take hundreds thousand years. But this fact indicates that stars burn quicker - in centuries. The contradiction shows that the theory of star evolution is wrong in roots and needs revision.

There is a solution of the paradox solar neutrinos [23-24]: research show that the sun is a young star where nuclear reactions (practically) do not occur or occur small, therefore sun does not form neutrino. If there are no nuclear reactions in sun, then sunlight is caused by just gravitational shrinking of sun, and this cannot be longer 30 million years [25]. Please pay attention that the assumption about nuclear reactions in-

side sun was based at faith in old age of the sun [25]. Therefore age of the solar system is less than 30 million years.

If age of solar system would be 5 billions years, then there would be a layer of dust on Moon, many meters thick. This notion existed before flight of Americans to Moon in 1969 [26]. But Americans found on the Moon just 3 centimeters thick layer of dust! This obviously indicates of a small age of Moon and Solar system.

Mobility in Saturn rings found by Voyager proves young age of the solar system [27-30]. Article "A Younger Universe is Seen in the Stars" [31] describes isotopes that have not yet decayed - plenty of thorium exists in stars, and the age is *too small to measure*! See also quick formation of stalagmites [32]. Influx of different salts to the ocean via rivers [33] shows age small age: Li - smaller than 20 million years, Sr - smaller than 19 millions, Mo - 500 thousand etc. Jupiter's moon Io has active volcanoes [34-35]. Venus is young [36-37]. Moon goes away from Earth. Earth's rotation diminutes. Comets disintegrate too quickly. Spiral galaxies - theses are also evidences for a younger age of the universe.

7. Conclusions

The conclusions are: cosmic distances are several orders less, the real age of the solar system is substantially less than 30 million years. Age of oceans is less than several million years [33]. This does not contradict to anything and solves many problems, including the paradox of solar neutrinoes [23-24]. The full article is presented in the Internet: http://www.cnt.ru/users/chas

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QUANTUM SOLUTION OF SINGULARITIES PROBLEM IN GENERAL RELATIVITY

Justin Chashihin[1]

Moscow institute of physics and engineering
The full article is presented in the Internet: http://www.cnt.ru/users/chas
Orehovii bulvar 21-1-53, M-563 Moscow, 115563, RUSSIA

November 11, 2000

Using quantum theory I suggest solutions of spacetime singularities problem in general relativity. I show that quantum gravitational collapse is not unlimited compression; for star of any big mass it stops at the stage of neutron star, without formation of event horizon and singularity because, as I show, there is utmost, maximal density of substance in quantum gravity - density of degenerate ultrarelativistic fermi-matter of the neutrons. Thanks to quantum laws, star heats up and explodes at quantum gravitational collapse. This is observed experimentally: this causes supernova explosion. I show that classical general relativity has quantum limit - it is unsuitable for correct quantum description of high densities and pressures which are achieved at gravitational collapse, where localization of quantum particles and Heisenberg's indeterminacy principle play essential role.
Conclusions got using quantum theory are: singularities do not exist; there was not "big bang" singularity.
The full article is presented in the Internet: http://www.cnt.ru/users/chas

1. Introduction

At 2000 there is no satisfactory quantum theory of gravitation (QTG) [e.g.1-15] and there is gravitational collapse (GC) problem [1-3,6,8,11,15- 19]: general relativity (GR) and assumption about full absence of pressure [20] predict spacetime singularities in black holes and at hypothetical "big bang". But "the prediction of a singularity by a physical theory indicates that the theory has broken down, i.e. it no longer provides a correct description of observations" [19]. GR also does not take into account quantum properties of particles. In this sense classical GR is not complete [1-3,8,15]. The difficulty bound with classical GC is like one bound with collapse of classical atom (thanks to radiation) [15].

The subject of the present article is pointing out and motivation of quantum way of solution of the paradox - elimination of all spacetime singularities using quantum mechanics.

2. Attentive analysis of gravitational collapse through white dwarf

It's assumed that the cause why star passes white dwarf (WD) stage is that gravitational pressure overpowers quantum one [19]. But this means that electrons are pressed into each other, i.e. many identical fermions occupy same region $\approx \lambda^3$, that contradicts Pauli principle. Hence gravitational pressure cannot overpower quantum one. Due to Pauli principle gravitational pressure cannot press the electrons into each other independently on its value, but just promotes the reaction

$$p + e^- \to n + \nu_e. \qquad (1)$$

The reaction decreases volume of star and increases its density from atomic to nuclear. Gravitational pressure decreases volume of star and therefore it promotes any reaction doing this. Thus, *due to Pauli principle independently on mass of star, gravitational pressure does not overpower quantum one, but just promotes reaction (1).*

3. Does general relativity predict singularities?

GR describes collapse of dust sphere with assumption of full absence of pressure inside of star [20]. This *non-proved assumption even in classical GR is recognized as absolutely incorrect* [20]. And exactly this absolutely incorrect [20] assumption plus GR predicts that any body of any mass collapses to singularity. Taking into account of pressure leads to limitation of this prediction. Internal pressure caused by different forces counteracts to external gravitational pressure. Atoms, nuclei and nucleons don't collapse due to 2 causes - Heisenberg's indeterminacy principle and electromagnetic and nuclear repulsion. Macroscopic bodies don't collapse due to

[1] e-mail: chas@mail.cnt.ru

electromagnetic repulsion between atoms.

Thus, *existence of singularities does not follow from GR only, but does from non-proved and absolutely incorrect [20] assumption about full absence of pressure plus GR*. As this assumption is incorrect [20], then pressure must be took into account, hence the got result will differ from singularity. Thus, account of intrastellar pressure can solve the problem of singularities:

$$\text{quantum pressure} + \text{GR} \neq \text{black hole}$$

4. Quantum solution by Heisenberg's indeterminacy principle

Heisenberg's indeterminacy principle was used for solution of classical atom collapse problem. I use it also for solution of classical GC problem.

Indeterminacy principle used for GC means that Δx is localization of particles (or average distance between them at most thick packing of them), and Δp is their momentum. GC decreases volume of star, and hence, it decreases their localization Δx. This leads to increase of momentum of its particles Δp, and hence, of their energy:

$$E \approx c\Delta p$$

Hence at quantum gravitational collapse thanks to quantum laws, star heats up. But according to energy conservation law, temperature of star cannot become infinite in the result of GC. But since

$$\Delta x = \hbar/\Delta p \approx \hbar c/E$$

then

$$\Delta x > 0$$

and hence volume of star

$$V \approx N\Delta x^3 \gg 0$$

(N is number of particles in the star) is not zero also. Hence singularity cannot be formed at quantum GC. Thus, thanks to Heisenberg's indeterminacy principle volume of star doesn't tends for zero, it tends to volume of neutron star. Therefore when *at GC the gravitational pressure of collapsar becomes greater than degeneracy quantum pressure of its neutrons, then the potential gravitational energy is spent on supernova explosion, but not on formation of black hole*. Indeed, since quantum gravitational collapse increases average energy of particles and star is powerfully heated up, then particles have to abandon the star, i.e. star explodes. Thus, *quantum GC causes supernova explosion.*

Let's consider quantum GC, i.e. GC taking into account quantum degeneracy pressure of the fermions. Gravitational pressure doesn't overpower quantum one and GC doesn't stop at WD stage because electrons are spending at reaction (1) decreasing volume of star and are not generated again.Pay attention to that neutrons can not be spend to any reaction decreasing volume of star. And even if they are spending to some reactions like

$$n + n \to X \to n + n + Y$$

(where X are baryons, Y are mesons and leptons), then

1) these reactions do not decrease volume of star because due to non-stability of X the neutrons are regenerated and quantity of neutrons remains former according to baryon number conservation law. Of course, neutrons decay to, but gravitational pressure promotes back reaction (1).

2) and neutrons are regenerated.

In contrary to the neutrons, electrons

1) are spending to (1) decreasing volume of star,

2) and are not regenerated.

Thus, at quantum GC to neutron star (NS) the gravitational pressure does not overpower quantum one and neutrons are not spent to any reaction decreasing volume of star. Hence, central areas of star cannot have density more than density of degenerate ultrarelativistic matter of the neutrons. Hence this density is maximal. Hence, collapsing NS is *incompressible independently* on value of gravitational pressure, i.e. *independently on its mass*. This leads to an important conclusion of QTG:

the singularity cannot be formed at quantum GC

independently on mass of collapsing star. (2)

Hence, independently on value of star's mass, GC is not unlimited compression. Thanks to this quantum effect there are no singularities. The only possibility for neutrons to decrease volume of NS is to leave it. Indeed, decrease of volume of collapsing star ΔV at constant density d_{max} can be made only by decrease of its mass Δm:

$$\Delta m = d_{max}\Delta V, \tag{3}$$

i.e. collapsing star throws off its shell - this leads to supernova explosion - energy of gravitational pressure spends to supernova explosion, but not to formation of black hole singularity.

According to QED, quantum particle cannot be localized less than its Compton wavelength

$$\lambda = \frac{h}{mc} \tag{4}$$

independently on its momentum [21]. Hence one spherical cell of volume $\approx \lambda^3$ cannot have more than one quantum particle of any spin with wavelength (4). And this is true for neutrons which construct NS central areas.

Momentum of particle arises from momenta of other particles colliding with it (we consider high densities of inner areas of collapsing star), i.e. its momentum arises from external forces. Hence:

quantum particles cannot have infinitesimal volume and cannot be localized in sphere of volume less than $\approx \lambda^3$ *independently on value of external localizing forces, external pressure*

In particular, *independently on value of gravitational pressure*. This fact makes quantum limit for GC. Since QED is derived from Heisenberg's indeterminacy principle, then this solution follows from indeterminacy principle.

5. Derivation of maximal density

If one quantum particle cannot be localized in volume less than λ^3 independently on external forces [21], then for N quantum particles this volume is $N\lambda^3$. Otherwise one quantum particle would be localized in volume less than λ^3, and that is impossible (chapter 6) [21]. Hence, there is maximal density for matter. For neutrons of mass m and λ

$$d_{max} \approx \frac{m}{\lambda^3} = \frac{m_n^4 c^3}{h^3} \approx 10^{18} kg/m^3. \qquad (5)$$

This explains the following fact of nuclear physics, unexplainable by previous nuclear models: dependence of radius of nucleus R on radius of nucleon r and quantity of nucleons in nucleus n, is expressed by equation

$$R = r\sqrt[3]{n}$$

The equation becomes obvious, if nuclear density is maximal density. Indeed, non-localizability of particles at $l < \lambda$ following from QED, explains why nuclear forces have repulsion at distances less than 10^{-15} m. Therefore nucleons are set at fixed distance from each other, reminding atoms in crystals. Therefore nuclear density doesn't increase with growth of N - also as atomic one.

Hence, in QTG *the further gravitational compression is limited* by wavelength of particles λ. Thanks to this quantum effect singularity cannot be formed, i.e. GC stops at NS without formation of black hole. As density of momentum

$$\mathbf{d}_{max.p} = d_{max.}\mathbf{c} \approx \frac{m\mathbf{c}}{\lambda^3} = \mathbf{c}\frac{m_n^4 c^3}{h^3}$$

cannot be infinite, then for all T_{ik} components we have:

$$T_{ik} \leq \mathbf{d}_{max} c \approx \mathbf{c}\frac{m_n^4 c^4}{h^3}; \qquad (6)$$

$$R_{ik} - \frac{1}{2} g_{ik} R = \frac{8\pi G}{c^4} T_{ik} \leq 8\pi m_n^4 \frac{G\mathbf{c}}{h^3}, \qquad (7)$$

i.e. T_{ik} and gravitational field cannot be infinite in QTG and singularity cannot be formed due to the quantum effect. In the equation (7) we can see clearly that energy momentum tensor T_{ik} can not be infinite because Planck constant is not zero.

The present quantum theory of gravitation leads to classical GR at classical limit ($h \to 0$):

$$\lim_{h\to 0} T_{ik} = \lim_{h\to 0} \mathbf{d}c = \mathbf{c} m_n^4 c^4 \lim_{h\to 0} \frac{1}{h^3} = \infty$$

$$\lim_{h\to 0}(R_{ik} - \frac{1}{2} g_{ik} R) = \frac{8\pi G}{c^4} \lim_{h\to 0} T_{ik} =$$

$$= 8\pi G \mathbf{c} m_n^4 \lim_{h\to 0} \frac{1}{h^3} = \infty$$

i.e. at $h \to 0$ we have classical GR's singularity.

Relativistic correction: in spacetime of metric g_{ik}, one should use r instead of λ

$$r = \lambda\sqrt{-g}. \qquad (8)$$

(Riemannian metric determinant $0 < -g < 1$). As at NS g_{ik} *is not singularity, then anyway the quantum solution is true and singularity is not.* (the correction is neglected in (6), (7)). So, in general case - in spacetime of metric g_{ik} the theorem is:

quantum particles cannot be localized less than (8) independently on momentum, i.e. independently on external forces.

$$T_{ik} \leq \mathbf{d}_{max} c \approx \mathbf{c}\frac{m_n^4 c^4}{h^3\sqrt{-g^3}}$$

$$R_{ik} - \frac{1}{2} g_{ik} R = \frac{8\pi G}{c^4} T_{ik} \leq \frac{8\pi m_n^4}{\sqrt{-g^3}} \frac{G\mathbf{c}}{h^3}. \qquad (9)$$

To create QTG means to write equations having all fundamental constants h, G, c, i.e. equations of gravitational field with Planck constant h, and that was reached in (7) and (9). Hence the above equations are equations of QTG. Note that maximal density (5) is several orders less than *hypothetical* Planck density $d_{Pl} \approx 10^{97} kgm^{-3}$. Therefore QTG effects are observed at distances $\lambda_n \approx 10^{-15} m$ (quantum GC and formation of NS) and $\lambda_e \approx 10^{-12} m$ (formation of WD), but not at Planck lengths and densities (10^{-35} m). Indeed, as well-known formula for maximal mass of WD (which is achieved simultaneously by quantum laws and gravitation)

$$M_{WD} \approx \frac{1}{m_n^2}\left(\sqrt{\frac{c\hbar}{G}}\right)^3 \qquad (10)$$

contains G, h, and c constants, also as (7), then formation of WD is a QTG effect.

6. Conclusions

I have shown that quantum gravitational collapse is limited by maximal density of substance d_{max} (5) - density of ultrarelativistic degenerate neutron matter, quantum GC causes SN explosion. Singularity can not be formed. Classical GR has quantum limit - it is unsuitable for correct (quantum) description of high densities and pressures - GC, where localization of quantum particles plays essential role (2). Since singularities and black holes are ruled out by the present QTG, then wormholes, primordial small black holes [22-23] and black hole radiation [24-25] also are ruled out by it. As density cannot be infinite in QTG, then hypothetical "big bang" singularity was not also. Hence it has no sense to say about "several universes" - the universe is only one. As Planck density is more than maximal one, then it cannot be achieved, hence curvature radius $\approx \lambda_{Pl}$ cannot be also. This fact gives at least a hint for incorrectness of string theory.

This is the quantum theory of gravitation because formulas (7) and (9) contain all three fundamental constants G, h, c. The formulas (2)-(3), (5)-(10) are the main statements of QTG.

Note that I solved the problem of GC in GR using quantum principles but *without use of graviton concept*. This fact shows that *graviton concept is useless for QTG*.

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AN IDEA FOR DIRECT EXPERIMENTAL MEASUREMENT OF THE SPEED OF GRAVITATIONAL INTERACTION

Justin Chashihin[1]

Moscow institute of physics and engineering
The full article is presented in the Internet: http://www.cnt.ru/users/chas
Orehovii bulvar 21-1-53, M-563 Moscow, 115563, RUSSIA

November 11, 2000

I suggest a way of direct experimental measurement of the speed of gravitational interaction. Since sunlight comes to Earth for 8 minutes, Earth is rotated at angle of 2^o of arc. Hence visual image of sun is at 2^o behind of the real location of the sun. If gravitational image of sun coincides with its real location, then speed of gravitational interaction is equal to infinity. This experiment provides *direct* measurement of the speed of gravitational interaction. Full article is presented in the internet on my web page http://www.cnt.ru/users/chas

1. The experiment I suggest

The speed of gravitational interaction was not yet measured experimentally. Therefore I suggest a way of direct experimental measurement of it. Sunlight comes to Earth for about 8 minutes 20 seconds. After these 500 seconds passed, Earth is rotated at angle

$$\alpha = 360^o \frac{500s}{24h} = 2^o 5' \; of \; arc$$

Hence visual image of the sun is at $2^o 5'$ behind of the real location of the sun. Since diameter of sun is 0.5^o, then $\alpha = 2^o 5'$ is 4 solar diameters and is easy to measure by modern gravimetric experiments. Measuring angle β between gravitational image of the sun and its real location lets to calculate the speed of gravitational interaction directly:

$$v_G = \frac{AU}{24h} \frac{360^o}{\beta}. \qquad (1)$$

AU is distance between sun and Earth, $1.5 \text{x} 10^{11}$ m. If $\beta = 2^o 5'$, then $v_G = c$, if $\beta = 1^o$, then $v_G = 2c$, if gravitational image of sun coincides with its real location, i.e. if $\beta = 0$, then speed of gravitational interaction is equal to infinity. This experiment provides *direct* measurement of the speed of gravitational interaction.

Here I present theoretical prediction for the infinite speed of the gravitational interaction.

[1] e-mail: chas@mail.cnt.ru

2. Arguments against gravitons

2.1. Solution of speed-of-light catastrophes in quantum theory of gravitation

There is a speed-of-light catastrophe [1-6] in quantum gravity: if massless particles or fields emit massless particles or fields, non-removable singularities appear. Graviton is massless [7], and massless photon emits massless graviton, hence graviton assumption leads to non-removable singularities. The authors [5] preferred to suppose as if photon massive, i.e. to break the electric charge gauge symmetry. But it would mean that speed of photon would be $v < c$. Hence, either light is not built of photons, or speed of light is not equal to c, hence speed of light is different in different reference frames. But the first conclusion contradicts QED (light is built of photons), and the second one - Michelson-Morley experiment (which proves that speed of light is same in different reference frames and is equal to c), special relativity and many experiments on relativistic colliders which prove relativity. These contradictions show that photon is massless and the way [5] is incorrect.

It was proved that the mass of graviton cannot be very small, but non-zero, it must be rigorously zero [7]. So, if massless photon emits massless graviton, non-removable singularities appear [1-6]. But since photon and graviton are strictly massless, then photon doesn't emit gravitons. Hence the present theory has no these singularities. Since massless gravitons emit massless gravitons, then there are two catastrophes, and the way [5] doesn't solve also the second catastrophe. If graviton does not exist, both catastrophes disappear.

So, graviton assumption leads to 2 types of non-

removable singularities in QTG. But "the prediction of a singularity by a physical theory indicates that the theory has broken down, i.e. it no longer provides a correct description of observations" [8]. Hence, the only way to avoid both catastrophes in quantum theory of gravitation is to abandon the graviton concept.

Analogous catastrophes occurs in QCD - when massless gluons emit massless gravitons and massless gluons.

2.2. All graviton models are non-renormalizable

Non-renormalizability of *all* models with gravitons also demonstrates their general root inconsistency, while this obvious argument against graviton is usually ignored. Non-existence of graviton easily explains why consistent QTG with gravitons is not created.

2.3. Graviton concept has no sense

Physical sense of graviton concept is not found [9], hence graviton concept is senseless.

3. Graviton cannot leave event horizon while gravitational field can

Nothing material can leave event horizon, while gravitational field can. If gravitational interaction were interchange, then energy and momentum in form of graviton could not leave event horizon, that contradicts general relativity because gravitational field does leak from under event horizon. Hence gravitational interaction is not interchange. If gravitational field can leave event horizon while graviton cannot (anything having energy cannot leave event horizon), hence gravitational field is not built of gravitons. Otherwise spacetime outside of event horizon would be Euclidean! You see that hypothesis of gravitons does not lead to Newtonian theory of gravitation in classical limit. Thus, graviton concept contradicts even Newtonian theory of gravitation!

4. Heisenberg indeterminacy principle

Often one proves existence of graviton so: "if the gravitational field were a classical field, it would be possible to determine both the position and the momentum of its sources by measuring all of its components simultaneously with arbitrary accuracy and thus violate the uncertainty principle" [10]. But you should understand that *both source and detector of the GF are matter.* All matter has indeterminacies. Therefore *independently* on nature of the GF one detects indeterminacies (quantum fluctuations of matter) - there is no "classical" detector. Therefore *indeterminacy principle doesn't prove the existence of graviton, and non- existence of gravitons doesn't contradict indeterminacy principle.*

5. Conclusion and mechanism of gravitational interaction

Thus, the arguments prove that gravitons do not exist. This means that gravitational field is not Bose-condensate of virtual gravitons, but is curvature of space-time. Geometrical non-quantum non-interchange nature of gravitational field is demonstrated here using quantum theory. Non-existence of graviton does not contradict indeterminacy principle and naturally solves two speed-of-light catastrophes in quantum gravity. Photon does not emit gravitons, gravitational field is geometrical, but not interchange, energy- momentum tensor of gravitational field is equal to zero. Therefore the speed of the gravitational interaction must be infinite. In chapter 1 I suggested an experiment that can verify this.

Thus, mechanism of gravitational interaction even in QTG looks so: a particle (with energy momentum tensor) curves spacetime here, curvature of spacetime here influences upon curvature of spacetime there, and other particles move independently and straightlinely in the curved Riemannian spacetime there.

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THE RELATION OF UNCERTAINTY FOR RADIUS OF THE UNIVERSE

Alexander K. Guts[1]

Omsk State University, Mathematical Department, 644077 Omsk, Russia

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We get the relation of uncertainty $\Delta R \Delta D \sim c_2$ connecting the mean square derivations ΔR and ΔD of radius of the Universe and velocity disorganization of event as the phenomena respectively.

In the World of events $\mathcal{M}$ we select such property as the time order. The time order contacts with such concept as a stream of time. Events are developed (unwrapped) before the observer consistently, in time. It means that for measurement of time the special measuring tool of the *duration* of the phenomenon in time and named a watch is used. With the help of watch to each event the concrete number named (time) moment of event or his(its) epoch is attributed. The time order allows to compare epoch of any events.

However the time stream due to which the phenomena consisting of events are developed (unwrapped) consistently, event behind event, is given to the person as noted philosopher Kant, a priori, from birth. In other words, time as a stream is only subjective perception (recognition) of the phenomena of the World of the events inherent to the person.

Therefore it is necessary to assume, that time can show itself in our human world, the world of human subjective representations about the World of events, absolutely differently than the time order. As a matter of fact it means, that time can find out itself as something that can *violate* time ordering in deployment of events! Hence events of which the phenomenon consists, can receive epoches with violation of the time order.

Whether means it, what time can have properties similar to a random variable? Anyway it is necessary to try to apply principles of probability theory to the description of time.

We shall accept further that the choice of the epoches (moments) of time which are attributed to events of the phenomenon with the help of some fixed watch can be casual.

Let's forget for simplicity about such concept as a place of event. In this case events in the World of events can be distinguished only with the help of the time order and formally it means that the World of events $\mathcal{M}$ is the linear ordered continuum like real straight line $\mathbb{R}$.

Let's assume that we choose watch t which allow each event x to attribute the moment of time appropriate to him, i.e. epoch τ. We shall accept that each event gets *random epoch*. It is understood as the following. So far as event is some idealization, it should occupy only an instant τ in a time-stream t. It is accepted in the theory of a relativity. But actually it *is stretched in a time-stream* t and consequently its epoch τ is absolutely precisely unknown, though must lie on some concrete segment $[\tau, \tau + \Delta\tau]$ of time t. Hence epoch τ of event x is a random variable $\tau :< X, \mathbf{S}, \mathbf{P} >\to \mathbb{R}$, where X is probability space of events, $\mathbf{S}$ is σ-algebra on X, $\mathbf{P}$ is a probability measure on X.

Identifying space of events X with the World of events $\mathcal{M}$, and considering that $\mathcal{M}$ is real straight line $\mathbb{R}$, we receive time-epoch $\tau(t)$ as a random variable given in a time-stream t.

Event in probability theory is a measurable subset of space X. In our terminology the concept of the phenomenon corresponds to concept of event in probability theory. In turn the events which consist of the phenomenon are elements of set X which in probability theory correspond to elementary events. In terminology of Minkowski events are points of the World of events $\mathcal{M}$. But it is obvious that this is simplification accepted in this theory.

So, we shall accept that property of time which is shown in "choice" of the moment of time which corresponds to event is a random variable which we shall name time-epoch.

Let $f_\tau(t)$ be a density of distribution of time-epoch τ satisfying two conditions

$$\mathbf{M}\tau = \int\limits_{-\infty}^{+\infty} t f_\tau(t) dt = 0, \quad \lim_{t\to\pm\infty} t f_\tau(t) = 0. \tag{1}$$

Let

$$D(t) = -c_1 \frac{d}{dt} \ln f_\tau(t), \tag{2}$$

[1] e-mail: guts@univer.omsk.su

where $c_1 = const$.

Let's find out sense of D defined the formula (2). As $f_\tau(t)$ is density of distribution of τ, then its sense is probability of that event will receive the epoch laying on segment $[t, t+1]$ of a time-stream, where 1 is a standard unit of measurement of time.

But then by analogy to the Boltzmann formula for entropy, it is possible to declare that $-c_1 \ln f_\tau(t)$ is entropy of time-epoch. In other words, it characterizes a measure of disorganization of event as the phenomenon. Therefore $D(t)$ characterizes *velocity of disorganization* the event-phenomenon.

As it will be shown below this velocity the is more, than temporal borders are closer for localization of the phenomenon in a stream of time.

The foolowing theorem is valid.

Theorem. *If the conditions* (1) *are held, then relation of uncertainty*

$$\Delta\tau\Delta D \geq c_1 \tag{3}$$

is true.

In cosmology a special role one play the Friedman's solutions of the form

$$ds^2 = dt^2 - R^2(t_0 + t)[d\chi^2 + S^2(\chi)d\Omega^2],$$

$$-t_0 < t < +\infty,$$

where we changed the temporal origin of the Universe: $0 \to -t_0$. Here the time parameter t is directly connected to postulation of evolution of the universe, and, hence, any varied property of the universe plays a role of hours. The $t = 0$ is moment of measurement of the Universe radius.

If to admit that the radius $R = R(\tau)$ of the universe is a random variable which is similar to time-epoch τ, and which can be calculated by means of known methods, then mean square derivation ΔR will receive through $\Delta\tau$.

For the critical dust Friedman model $R(t_0+t) = A + Bt + o(t)$. Hence in the first approximation $\Delta R = \Delta\tau$ and

$$\Delta R\Delta D \sim c_2.$$

So value of measured radius of the Universe will depend on such characteristics of the universal phenomena (events) as velocity of their becoming or destruction.

Can the moment t of measurement of the Universe radius be arbitrary? No, the law (2) is valid only for the past epoches [1, 2, 3, 4].

Basis for reception of our result was that circumstance that space-time $\mathcal{M}$ has a dual nature which was incorporated by the founder of this theory Minkowski [5]. This duality consists of that on the one hand elements of set $\mathcal{M}$ are (atomic) *events*, and by virtue of it $\mathcal{M}$ carries the name the World of events, and on the other hand $\mathcal{M}$ is *arithmetic* arena on which the World of events is realized.

This arithmetic arena is necessary for formalization of the World of events to attribute to events the coordinates as the four of real numbers, to world lines of the four of real functions etc. As a rule the researcher deals with mathematical space-time which we have named arithmetic arena.

However other side of space-time, the World of events, remained in a shadow and was not formalized! At the beginning of article we have identified $\mathcal{M}$ with probability space of events X. Given probability space X is the formalized World of events.

Above we used space-time as coordinate space that elementary event could receive epoch on "an axis of time". This epoch does not lie in "strictly allocated place" according to the "instruction" of the time order, but can occupy any place on "an axis of time" not especially caring of instructions of the mentioned time order.

Let's note one more circumstance. Time as it is found out in this work can be not only *deterministic time-stream* connected with classical representation of Newton about time as about duration and, accordingly, with concept of the time order, but can be *stochastic time-epoch*, having such characteristic as *density* probability.

The last sets in the certain sense intensity of display (demonstration) of events of the phenomenon on a segment of uniformly (current) time-stream. Here it would be pertinent to recollect that N.A.Kozyrev wrote about *density of time* describing its intensity in his articles [6]. And though in our case the question is stochastic properties of time nevertheless it is possible to be surprised the intuition of Pulkov astronomer.

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CONFORMITY IN THE SOLUTIONS OF EINSTEIN EQUATIONS FOR MODELS OF THE MULTIVARIATE UNIVERSE, FILLED WITH SUBSTANCE

D.V. Kattzyn[1] and E.V. Saveljev

Krasnoyarsk State University, Depatment of Theoretical Physics, Svobodny av. 79, Krasnoyarsk, 660041, Russia

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In operation the blanket property of cross conformity of the Einstein equations solutions is considered for models of the homogeneous isotropic Universe of arbitrary measurings number, featured by the generalized Robertson-Wolker metric. The sectional conformity is featured through the performances of conformal-evclidian space filled with substance associated with this. One of consequences also is erected the Einstein equations for a s ectional case allowing in some cases much to facilitate examination of the exact solutions.

1. Introduction

The successes of the geometrical multivariate approach in integrating of fundamental interactions give in an idea, that the dimensionality of space - time by and large should be shown in physical quantities describing the Universe. On the other hand, the description of evolution of the Universe from the point of view of an equation of state of a substance can represent the completely special approach naturally pairing in To physical and geometrical aspects of the theory. And we shall try to establish, in what consequences will give change of dimensionality of space - time within the framework of model of the homogeneous isotropic Universe, not concretizing, whether is it unclosed whether or not.

The metric of N-space-time can be chosen by different expedients. We, following ideology of the theories such as Kaluttza-Klain's, shall write down it as

$$ds^2 = e^{w(t)}\left(dt^2 - \frac{dr^2}{1-kr^2} - r^2 d\Omega_N^2\right), \qquad (1)$$

Where $d\Omega_N^2 = d\Theta^2 + sin^2\Theta d\varphi^2 + sin^2\Theta sin^2\varphi d\psi^2 + \ldots$ — an angular part. Equation of a gravitational field is postulated as

$$G_{\mu\nu} = -æ[(p+\varepsilon)u_\mu u_\nu - p g_\mu \nu], \qquad (2)$$

Where $G_\mu\nu$ — a tensor constructed from the metric similar to a tensor of an einstein of the 4-world; $u_\mu = (g_{00}^{1/2}, 0\ldots, 0)$ — N-velocity in To attendant frame of reference; ε — density of energy; p — pressure. A state of a substance we shall spot as $\beta = p/\varepsilon$.

[1] e-mail: kattzyn@krw.ru

1.1. (4+1)-worlds

In a case (4+1) worlds we have:

$$G_{00} = -\frac{3e^{-w}}{2}(\dot{w}^2 + 4k), \qquad (3)$$

$$G_{jj} = -e^{-w} g_{jj} F, \qquad (4)$$

where $F = (3/4)(2\ddot{w} + \dot{w}^2 + 4k)$, $j = 1..4$. The Einstein equations after procedure of (4+1)-splits look like

$$\frac{3e^{-w}}{(\dot{w}^2 + 4k)} = æ\varepsilon, \qquad (5)$$

$$3e^{-w}(2\ddot{w} + \dot{w}^2 + 4k) = -4æp, \qquad (6)$$

Whence

$$\ddot{w} = \frac{-æe^w}{3}(2p + \varepsilon). \qquad (7)$$

At once it is possible to allocate, at least, three remarkable properties of the sectional equation:

— First, it does not depend on parameter of curvature and reflects by that most universal in relation to isolation of the Universe connection between the metric and substance;

— Secondly, the equation does not contain obviously first derivative $\dot{w}$;

— And, at last, it depends only on a particular combination of density of energy and pressure.

The "allocated" state of a substance in this case is $\beta^* = -1/2$, that corresponds to a case $\ddot{w} = 0$.

If to treat function $w(t)$ as an original generalized coordinate, That gain opportunity to interpret sectional equation as Newton equation for one-dimensional motion of a particle under activity of "force" $f(w, 3p+\varepsilon)$.

Let's note, that "strength function" can depends and from velocity $\dot{w}$. The most simple case meeting in a classical particle mechanics, — a motion of a particle in Potential field:

$$\ddot{w} = -\frac{d}{dw}U(w, \dot{w}, t). \tag{8}$$

Thus, there is an opportunity of model operation of evolution of the Universe by a motion of a mechanical particle in a force field. It allows to apply methods of a classical mechanics and gives original presentation of evolution " as a whole ". A question on concrete interpretation of one- dimensional space ∞ we shall leave in the leg, having satisfied convenience and transparence of our conformity of cosmological and mechanical problems [1-4].

1.2. (5+1)-worlds

. Figuring N=6, we have

$$G_{00} = -\frac{5e^{-w}}{2}(\dot{w}^2 + 4k), \tag{9}$$

$$G_{jj} = -e^{-w}g_{jj}Q, \tag{10}$$

Where $Q = (1/2)(4\ddot{w} + 3\dot{w}^2 + 12k)$, $j = 1..5$. The equations of an Einstein

$$\frac{5e^{-w}}{2}(\dot{w}^2 + 4k) = æ\varepsilon, \tag{11}$$

$$\frac{5e^{-w}}{2}(4\ddot{w} + 3\dot{w}^2 + 12k) = -5æp. \tag{12}$$

Whence

$$\ddot{w} = -æ\frac{e^w}{10}(5p + 3\varepsilon). \tag{13}$$

1.3. Case of arbitrary number of measurings.

In case of arbitrary number of measurings the relation takes place

$$w = -\frac{2æe^w}{(N-1)(N-2)}\left((N-3)\varepsilon + (N-1)p\right) =$$

$$= -\frac{2æe^w}{n(n-1)}(m-2)\varepsilon, \tag{14}$$

where N — complete dimensionality of space - time, $n = N-1$ — dimensionality of spatial - similar section, $m = n(\beta+1)$. In particular, $\ddot{w} = 0$, if $\beta = \beta^* = -1+2/n$ (the case $n = 0$, obviously, is empty from the point of view of space - time).

Converts on itself attention that fact, that in a case of the ∞-World by a state relevant " to a motion on inertia ", is physical the empty space. Let's note also that in the 2-world $(n = 1)$, apparently, to be implemented unique state $\beta = +1 = \beta^*$. Applying to the sectional equation a potential hypothesis, we shall find, that for Potential well medial value of a function of state, as well as in a case (3+1) worlds, $< \beta >= \beta^*$ and for a symmetric hole on an interval $-w_0 \le w \le w_0$ $-1 \le \beta \le 1 + 2\beta^* = -1 + 4/n$, so at Unbounded growth $n \quad \beta \to \beta^* \to -1$! From told, taking into account, that $-1 \le \beta \le 1$, we shall receive important the guess: in the ∞-Universe featured by a motion of a classical particle in a symmetric potential well, can implement a unique state $\beta = -1$. At the present moment it is difficult to tell, whether the sectional statement is blanket, irrespective of that, we accept enunciated variant of a potential hypothesis or at all we do not determine any model potentials. However that at transition from space-time of the underload possible dimensionality $N = 2$ to peak N, we transverse all permissible values of function states, and in these extreme points the state is supposed strictly fixed as peak ($\beta = +1$ at $n = 2$) and underload ($\beta = -1$ at $n = \infty$), causes major interest. The particular conformity between can be set by the $(n+1)$-Universe, filled substance in a state β, and evclidian or is conformal-evclidian by m-space. In particular, at Constant equation of state the conservation law takes place

$$Const = \varepsilon \cdot (e^{w/2})^m = \varepsilon \cdot e^{nw(\beta+1)/2}, \tag{15}$$

So density of energy of a substance with a state β in $(n+1)$ the world Wanes as density of energy of a dust in evclidian m-space. The treatment m as dimensionalities of some space puts integer values of this quantity in the special standing. In this case for m at fixed value n, we shall receive for everyone n equally $2n+1$ of rational values of a function of state: $\beta_m = m/n - 1,\ m = 0, 1, \ldots 2n$.

It is wonderful, that in 3th a line the interpretive states enter only: a perfect vacuum, domain walls, relativistic strings, an incoherent dust, equilibrium radiation, nonrelativistic gas, a superstrong state. The column 2 contains all states β^*. in general, all states which are taking place in one column, are featured by the same solution $w = w(t)$. In other words, all states of a substance with One m are somewhat physically

Table 1: The β^*-state of the matter for n.

n	1	2	3	4	5	6	7	∞
β^*	1	0	-1/3	-1/2	-3/5	-2/3	-5/7	-1

Table 2: Dim. of spacelike part (n) and m.

n^m	0	1	2	3	4	5	6
1	(-1)	(0)	1	-	-	-	-
2	-1	-1/2	0	1/2	1	-	-
3	-1	-2/3	-1/3	0	1/3	2/3	1

equivalent. This guess becomes even more proved in a view following of result: for anyone $n_1, \beta_1, n_2, \beta_2$ and sectional $w(t)$ takes place

$$m_1 = n_1(1+\beta_1) = n_2(1+\beta_2) = m_2. \qquad (16)$$

Let's underline, that the speech goes about an equation of state $p = \beta\varepsilon$ with arbitrary behaviour $\beta = \beta(\dot{w}^2, \ddot{w})$. For instance, at $n = 3$ ((3+1)-world)

$${}^4\beta(\dot{w}^2, \ddot{w}) = -\frac{1}{3}\left(1 + \frac{4\ddot{w}}{\dot{w}^2 + 4k}\right); \qquad (17)$$

At $n = 4$ ((4+1)-world)

$${}^5\beta(\dot{w}^2, \ddot{w}) = -\frac{1}{2}\left(1 + \frac{2\ddot{w}}{\dot{w}^2 + 4k}\right), \qquad (18)$$

The specified relation, obviously, is executed. In particular, known Result, according to which solution featuring 5-dust $({}^5\beta = 0)$, Precisely corresponds to the solution featuring 4-radiation $({}^4\beta = 1/3)$, at once is predicted within the framework of developed representations [5-8].

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ON THE FLATNESS AND HORIZON PROBLEMS

D.L. Khokhlov[1]

Sumy State University, R.-Korsakov St. 2, Sumy 40007, Ukraine

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It is considered the close universe in the laboratory system. The total mass of the universe in the laboratory system is equal to zero. Therefore the gravity does not define the evolution of the universe. The size of the universe is defined by the size of the horizon $a = ct$. The mass of the matter in the universe is equal to its selfgravity. From this it follows that the scale of mass grows with time $m = c^2a/G = c^3t/G$. Then the universe avoids the flatness and horizon problems.

As known [1, 2], the Friedmann model of the universe has fundamental difficulties such as the flatness and horizon problems. The horizon problem is restricted in that the universe observable at present consisted of $\sim 10^6$ causally disconnected regions at the moment of recombination $z_{rec} \sim 10^3$ that is inconsistent with the high isotropy of the cosmic microwave background radiation $\Delta T/T \sim 10^{-5}$. The horizon problem is caused by the slow growth of the scale factor of the universe $a \sim t^{1/2}$ in case of the relativistic gas or $a \sim t^{2/3}$ in case of the dust-like matter in comparison with the growth of the size of the horizon $h \sim t$. In the Friedmann model, two points being within the horizon at present were beyond the horizon in the past. So the Friedmann model describes the non-causal universe. In the causal universe, the scale factor of the universe must be of the size of the horizon $a \sim h \sim t$.

One of the manifestation of the flatness problem is connected with too much mass of the matter at present $m_0 \sim a_0^3\rho_0 \sim 10^{55}$ g in comparison with the Planck mass $m_{Pl} \sim 10^{-5}g$ at the Planck time $t_{Pl} \sim 10^{-43}$ s. Another manifestation of the flatness problem is that starting from the modern size of the universe $a_0 \sim 10^{28}$ cm following the evolution law $a \sim t^{1/2}$ one obtains the value $a_{Pl} \sim 10^{-2}$ cm at the Planck time that much more than the Planck length $l_{Pl} \sim 10^{-33}$ cm.

To resolve the problems of the Friedmann model including the flatness and horizon problems an inflationary episode in the early universe is introduced [1, 2]. In the inflation model, the scale factor grows as $a \sim exp(t)$ that is faster than the growth of the horizon. Two points being within the horizon at present will be beyond the horizon in the future. So, like the Friedmann model, the inflation model describes the non-causal universe.

In the Friedmann model [3], the universe is considered in the system accompanying to the matter of the universe. However the scales of length, mass and time as well as the constants c, G and $\hbar$ which underline the physics of the universe are defined in the local laboratory system. Therefore it is natural to consider the universe in the laboratory system.

Let us consider the close universe in the laboratory system. The total mass of the close universe in the laboratory system is equal to zero

$$m_{tot} \equiv m + m_g = 0 \tag{1}$$

where m is the mass of the matter, m_g is the energy of selfgravity. Hence, when considering the close universe in the laboratory system, the gravity (matter) of the universe does not define the evolution of the universe.

Let the scale of length of the universe be equal to the size of the horizon at every moment of time

$$a = ct. \tag{2}$$

For the close universe the mass of the matter is equal to the energy of selfgravity

$$mc^2 = \frac{Gm^2}{a}. \tag{3}$$

From this substituting Eq. (2) it follows that the scale of mass grows with time

$$m = \frac{c^2}{G}a = \frac{c^3}{G}t. \tag{4}$$

Consider the flatness and horizon problems within the presented model of the universe. In view of Eq. (2), the size of the universe (the scale factor of the universe) coincides with the size of the horizon during all the evolution of the universe. Hence the presented model avoids the horizon problem. The size of the universe changes from the Plankian value at the Planck time to the value $a_0 = ct_0 \sim 10^{28}$ cm at the modern time $t_0 \sim 10^{18}$ s. In view of Eq. (4), the scale of mass changes from the Plankian value at the Planck time to the value $m_0 = c^3t_0/G \sim 10^{56}$ g at the modern time. Hence the flatness problem is absent in the presented model. So

[1] e-mail: khokhlov@cafe.sumy.ua

using the laboratory system for describing the universe rather than the system accompanying to the matter one avoids the flatness and horizon problems. This may be considered as a support for using the laboratory system for describing the universe.

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GRAVO-INERTIAL FIELD THEORY

Doris Kiekhöven[1]

Leibniz-Arbeitskreis Berline. V., Am Graben 3, D-15732 Eichwalde, Germany

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Inertia is defined axiomatically. The gravitational field is caused by the flow of intergalactic masses. Origin of space and time are connected with fields. The cosmos is bounded by inertia and gravitation, which is the sequence of existence of two fields, the inertial field and the gravic field as a vortex field.Gravic and inertial field combine to a unit, the gravo-inertial field. The separation in gravic and inertial components depend on the coordinate system of motion.

1. Historical

Well known models like "steady state theory", Einstein cosmos, Friedman cosmos are although the last expanding, "static" models, strong determined by geometry or rigid attemptions. The gravitational field is given, but no created. The deforming of space and time is necessary because given at the beginning. This may be the analog and appropriate way with a mathematical method describe a physical problem. We tried to explain background with considering the results of the mechanics of H. Hertz, V. Fock and the the epistemological considerations of G. W. Leibniz We will outline in condensed summary our investigations about gravitation and inertia.

2. Axiomatic

1. Law of inertia mass
2. Conservation law
3. Special theory of relativity
4. Continuity principle
5. Creation of time and space by field and vice versa
6. Gravo-inertial field equations

The priciples 1, 2 and 3 are well proved. We outline 5 and 6 considering 3. Starting point are the existence of mass and inertia. Mass is existent by space (extent) and time (motion).M otion and density change is influenced by two fields, first ($\vec{\mathbf{K}}$) arised by inertia, second ($\vec{\mathbf{G}}$) by gravitation, the later conditioned by motion and density change (enlargement).

[1] e-mail: dkiekh.leibniz-arbeitskreis@t-online.de

3. Experimentaly

The cosmos is at present expanding with definit velocity and accelleration. The equality of gravitational and inertial mass is assumed proved. The background radiation is a characteristic of an earlier state. The present state is a result of development. Gravitation can assumed as an effect of higher order. There is a strange numeric relation between electricity and gravitation of the electron. The repulsion of two electrons is 1040 times of the attraction as the result of gravitation, the rules are similar.

4. Gravo-inertial field equations

The gravo-inertial field equations can be written in MKS-System as

$$\nabla \cdot \vec{\mathbf{K}} = -\frac{\partial \varrho}{\partial \mathbf{t}} + \cdots \tag{1}$$

$$\nabla \cdot \vec{\mathbf{G}} = \mathbf{0} \tag{2}$$

$$c^2 \nabla \times \vec{\mathbf{G}} = -\frac{\partial \vec{\mathbf{j}}}{\partial \mathbf{t}} + \cdots \tag{3}$$

$$\nabla \times \vec{\mathbf{K}} = -\frac{\partial \vec{\mathbf{G}}}{\partial \mathbf{t}} \tag{4}$$

where
$\vec{j}$ [kg/m^2s] mass flow (in an isotropic world radial to the reference system)

ρ mass density [kg/cm^3]
$\vec{\mathbf{K}} \sim \vec{\mathbf{j}}$ [kg/m^2s] inertial field strength
$\vec{\mathbf{G}}$ [kg/m^3] gravic field strength

Equations (1)- (4) represents a linear partial differential equation system. The fields are created not by existence but by changing of mass density and mass

flow by space and time.In this formal sense the gravo-inertial field equations have an analogy in electromagnetics (Maxwell equations).
The gravic field $\vec{\mathbf{G}}$ and the gravitational force $\vec{\mathbf{F}}$ of a test particle is proportional to its mass m. If we imaginate to stop the cosmos expansion, then the gravic field vanishes. Therefore there is a gravic field around the particle as result of changed density of the world by flow and there is a global attraction of all particles to each other.

$$\vec{\mathbf{G}}(\mathbf{x}) = \frac{\mathbf{1}}{\mathbf{c^2}} \int_{\mathbf{0}}^{\mathbf{c}} \mathbf{d}\vec{\mathbf{v}} \times \vec{\mathbf{K}} \tag{5}$$

From this force results the gravitational force (in analogy to Lorentz force) from the rotational field strength $\vec{\mathbf{G}}$, which is proportional to the mass of the particle

$$d\vec{\mathbf{F}} = \mathbf{m} \cdot \tau \cdot (\mathbf{d}\vec{\mathbf{v}} \times \vec{\mathbf{G}}) \tag{6}$$

with
$\tau\,[m^4/\mathrm{skg}]$ as an appropriate constant
$\vec{\mathbf{F}}$ gravitational force
$\vec{\mathbf{v}}$ the velocity of cosmical masses summed by all masses in all directions
τ a cosmological time dependent constant.

Because the masses are moved relatively to a particle on x it suffers a force perpendicular to the velocity $\vec{\mathbf{v}}$. The system is rotational-symmetric, homogeneous and isotropic.
If all masses unmoved, then $\vec{\mathbf{G}} = \mathbf{0}$.
The inertial field $\vec{\mathbf{K}}$ cause a gravitational field $\vec{\mathbf{G}}$, on the other hand $\vec{\mathbf{G}}$ arises $\vec{\mathbf{K}}$.
We can introduce the common potentials φ and $\vec{\mathbf{A}}$

$$\vec{\mathbf{K}} = -\nabla\varphi - \tfrac{\partial \vec{\mathbf{A}}}{\partial \mathbf{t}}$$

and build the wave equations

$$\nabla^2\varphi - \frac{1}{c^2}\frac{\partial^2\varphi}{\partial t^2} = -\frac{\partial \varrho}{\partial t} \tag{7}$$

$$\nabla^2\vec{\mathbf{A}} - \frac{\mathbf{1}}{\mathbf{c^2}}\frac{\partial^2\vec{\mathbf{A}}}{\partial \mathbf{t^2}} = -\frac{\partial \vec{\mathbf{j}}}{\partial \mathbf{t}} \tag{8}$$

If the cosmos expands then there is the energy concentrated in the moved masses and give rise to the term on the right of equation 1. From the expanding space and time and the mass flow change by time follows the creation of a field that contradict the expansion (equation 3). Both fields are connectes by the equation 3 und 4. The analogy to Maxwell theory is obviously. In analog way we assume the separation in gravic and inertial part by four dimensional vector. We obtain a force action. The Lorentz force correspond the gravitational force $\vec{\mathbf{F}}$. We recognize the gravitational field as

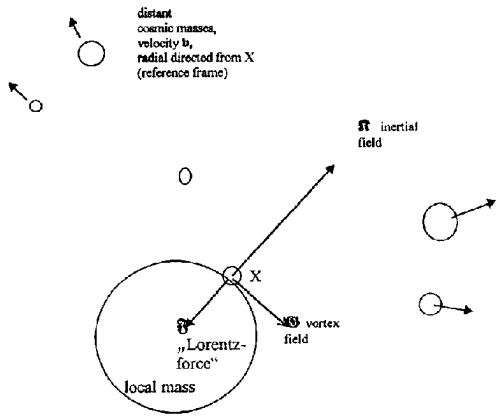

Figure 1: Gravo-inertial "coupled" fields

consequequence of relativiy principle. In this way the gravic field on point x is a relativistic effect and local transformable. In common sense the field can only removed by stopping (transforming) of all cosmic masses in rest reference system. If the cosmos contract then the gravitation is directed away from the masses. Corresponding principle of continuity the cosmos is oscillating. The expanding masses are creating space, time and gravitation. Gravitational and inertial mass are identically, one is the cause of the other.

5. Conclusion

The creation of space and time are connected with fields, only the masses and the rule of inertia are given. All processes in nature are determinded by interacting fields or particles, by two energy forms or in common in twofold way. This state of cosmos is an instantaneous value which is determined by interaction. Gravitation is not determined by masses but is in a sense the result of expanding and creating space and time. In this process is created inertial field strength $\vec{\mathbf{K}}$ connected with a gravitational field strength $\vec{\mathbf{G}}$. Because the density change is cause for creation of gravitational field, the force on particles is proportional to ist masses. The drifting masses produce a "guiding field" which is with expansion or contraction radial directed.

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SPACE STRUCTURE AND QUANTUM MECHANICS

Volodymyr Krasnoholovets[1]

Institute of Physics, National Academy of Sciences, Prospect Nauky 46, UA-03028 Kyïv, Ukraine
http://inerton.cjb.net

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A new concept of constitution of nature is proposed. The constructed submicroscopic quantum mechanics is deterministic and is characterised by elementary excitations of the space net that is treated as the tesselation of balls, or superparticles. Said excitations called "inertons" accompany any canonical particle when it moves. It is shown theoretically that the introduction of inertons obviates all conceptual difficulties of orthodox quantum mechanics. The theory has been verified experimentally. It is argued that just inertons play the role of real carriers in the gravitational interaction.

Key words: space, gravitation, inertons, quantum mechanics

PACS index numbers: 03.65.Bz Foundations, theory of measurement, miscellaneous theories – 03.75.-b Matter waves – 04.60.-m Quantum gravity

1. Introduction

Sometimes this or that science one may treat from not typical standpoints. For instance, in the mid-20th century Arnold Toynbee [1] investigated historical studies considering people history as a circulation of local civilizations, which replace one another. 120 years ago Polish linguist Michal Krasuski [2] was interested in the origin of numerals: one, two, tree, ..., ten, hundred, thousand, etc. The study came him to the unexpected deduction: names of numerals were associated with the every day fingers activity and names of fingers in Ukrainian language. Thus he concluded that names of numerals could be understood only from Ukrainian which, there fore, is the most ancient language among all Aryan ones including Sanscrit, Greek, Latin, etc.

Such kinds of studies are rather cognitive. But may quantum physics be explored in a similar way? Probably it may since quantum physics is based on some initial notions (mass, particle, quantization, particle energy $E = h\nu$, de Broglie wavelength $\lambda = h/p$ and the matter waves, wave ψ-function and long-range action, Compton wavelength $\lambda_{\rm Com} = h/mc$, spin, fundamental constants, and so on), which all together have never been treated in detail so far. A viewpoint of this type has something in common with Louis de Broglie's, who used to say that it is useful to reconsider the foundations of physics from time to time. It is obvious that conducting such an analysis one will touch both the foundations of quantum mechanics and the foundations of quantum gravity since these two to be descent from the same submicroscopic scale [3].

2. The theory and results

We would start from the Dirac's note [4] that the objections to an aether posed by relativity were removed by quantum mechanics. This means that a vague vacuum, or an empty space of general relativity should make way for a substrate. The substrate cannot directly be associated with an uncertain Higgs condensate of models of grand unification of interactions (the condensate is not constructed in a real 3D space). None the less the models of grand unification basing on experimental results allow the calculation of evolutions of three constants $\alpha_{\rm el.-magn.}$, $\alpha_{\rm weak}$, and $\alpha_{\rm strong}$ as functions of distance r. All the constants come together at $r \approx 10^{-28}$ cm (Fig. 1).

At the same time modern concepts of gravitational interaction do not permit any similar analysis in principle. But why? It is apparent that the main reason of such a distinguish of the behaviour of gravitational interaction from the other fundamental ones is caused by its initial phenomenological basis while the detailed behaviour of the three other interactions were constructed many years later resting on already well-developed quantum mechanics. Those three interactions, electromagnetic, weak, and strong are characterised by their own carriers, namely photons, $W^{\pm}$ and Z bosons, and gluons, respectively. Hence we may conclude that if someone tries to construct the gravitational interaction starting from quantum mechanics, he may also come to certain carriers, which will effect the direct interaction

[1] e-mail: krasnoh@iop.kiev.ua

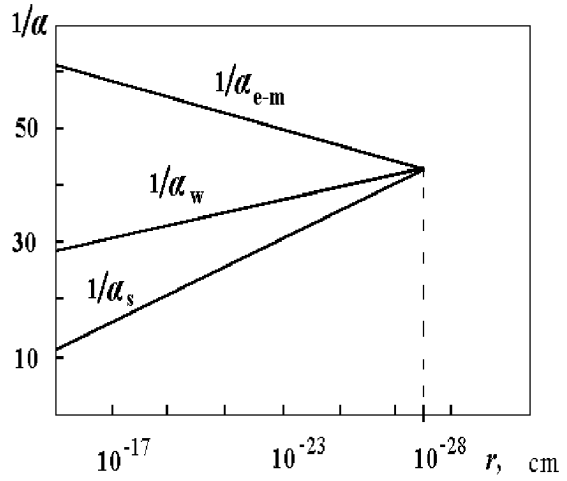

Figure 1: Evolutional lines describing changes of the interaction constants with distance.

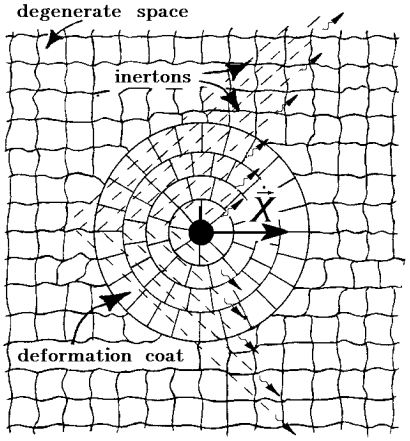

Figure 2: The motion of a canonical particle in the degenerate space net.

between massive objects.

High energy physics has greatly advanced our knowledge about the microstructure of real space and the structure of particles. Specifically, unified models have proposed an abstract "superparticle" whose different states are quarks, electron, muon, neutrino, and others. Taking into account the facts mentioned above a researcher whose specialty is condensed matter physics may suggest that just those superparticles form a world substrate, which shares discrete and continual properties. The introduction of such a substrate in fundamental physics automatically implies that both the relativity and the concept of unification of interactions require a radical revision: 1) the gravitational interaction will immediately be endowed by carriers, i.e., special elementary excitations of the substrate; 2) the three other interactions may not be elementary, particularly the weak and strong ones – they might result from the renormalisation of some kinds of more fundamental excitations of the substrate (such as photons and inertons introduced below).

Let us construct a real space packing of superparticles leaning on concepts and ideas used in condensed media physics. TSuch a construction is in agreement with requirements of a mathematical space [5]. The conceivable size of a superparticle may be equal to 10^{-28} cm. Let superparticles being elastic densely put to each other forming an entire substrate (quantum aether). The substrate may be thought of as the degenerate space net. In the theory proposed in papers [6-8] a local deformation of the space net, i.e., a stable change of the initial volume of a superparticle in the degenerate space net is associated with the creation of a particle in it (Fig. 2).

Unstable deformations constitute spatial excitations, or quasi-particles, called "inertons" [6]. Any particle created in the space net features its deformation coat (or singularity region, or aether/space crystallite) which plays the role of a screen shielding the particle from the degenerate space. The size of the crystallite is equal to the Compton wavelength $\lambda_{\rm Com} = h/Mc$ of the particle. Superparticles are characterised by mass within this region and therefore possess some properties typical for a solid crystal, for instance such as collective vibrations. When the particle begins to move it experiences friction striking superparticles. As a result of the interaction with coming superparticles, the particle should emit and then absorb elementary excitations, i.e. inertons [6-8]. Once the particle moves running between fluctuating superparticles, inertons migrate as typical quasi-particles, i.e., they carry bits of space deformation hopping from superparticle to superparticle by relay mechanism. The moving particle pulls its deformation coat, or crystallite, since superparticles surrounding the particle along all its path have time to be adjusted to the particle organizing the coat.

The Lagrangian that characterises the motion of a particle is the following [6]

$$L = \frac{1}{2} g_{ij} \dot{X}^i(t) \dot{X}^j(t) + \frac{1}{2} \sum_{l=0}^{N-1} \tilde{g}_{ij}^{(l)} \dot{x}^i_{(l)}(t_{(l)}) \dot{x}^j_{(l)}(t_{(l)}) - \sum_{l}^{N} [X^i \dot{x}^j_{(l)} + v_0 \delta_{ij} x^j_{(l)}] \delta_{t-\Delta t_{(l)}, t_{(l)}} \frac{\pi}{T_l}. \quad (1)$$

Here, the first term describes the particle, the second term describes the ensemble of inertons and the third one depicts the interaction between the particle and inertons. v_0 is the initial velocity of the particle, π/T_l is the frequency of collisions of the particle with inertons.

In the relativistic case we start from the Lagrangian

$$L_{\rm rel.} = -M_0 c^2 \sqrt{1 - v_0^2/c^2} \quad (2)$$

in which the following transformation is made [7]

$$v_0^2 \longrightarrow [g_{ij}\dot{X}^i\dot{X}^j + U(X, x, \dot{x})]/g \qquad (3)$$

where the function U is similar to the second and third terms in expression (1).

The solution of the equations of motion has shown that the particle oscillates along the trajectory: the particle velocity changes periodically from v_0 to 0 and then from 0 to v_0 in the interval of de Broglie wavelength λ. So from the submicroscopic viewpoint the value $\lambda = h/Mv_0$ may be remoulded as the spatial period of the oscillatory moving particle. The time period of the particle oscillations is $T = \lambda/v_0$. A similar relation is true for the inerton cloud enclosing the particle. The cloud oscillations are specified by amplitude $\Lambda = cT$ where c is the velocity of inertons in the degenerate space net, which might be equal to the velocity of light. The amplitude Λ is connected with the de Broglie wavelength by the relationship [6]

$$\Lambda = \lambda c/v_0. \qquad (4)$$

It is proved that the motion of the particle is deterministic and features the relationships

$$E = h\nu, \qquad \lambda = h/Mv_0 \qquad (5)$$

where $E = Mv_0^2/2$ and $M = M_0/\sqrt{1 - v_0^2/c^2}$. As known [9] just the availability of relationships (5) allows the introduction of the Schrödinger formalism, which due to relationship (4) is correct in the region covered by the distance Λ from the particle. Thus the introduction of inertons automatically removes lang-range action from any quantum system restricting the effect of the Schrödinger formalism by the value of amplitude Λ.

The problem of spin is solved [8] by the introduction of one more degree of freedom in expression (3), i.e., we add a new matrix form function U_α (where $\alpha = \uparrow, \downarrow$) to the function U. The matrix describes two possible pulsations of the particle: ahead ($\uparrow$) and back ($\downarrow$) in relation to the vector of particle's motion velocity. This sheds light [8] on the inner reason of transformation of the total Hamiltonian of a particle

$$H^{\text{part.tot}} = \sqrt{c^2\vec{p}^{\,2} + c^2\vec{\pi}^2_{\uparrow(\downarrow)} + M_0^2c^4} \qquad (6)$$

to the Dirac Hamiltonian operator

$$\hat{H}_{\text{Dirac}} = c\hat{\vec{\alpha}}\hat{\vec{p}} + \hat{\varrho}_3 M_0 c^2. \qquad (7)$$

The theory developed yields the very interesting relationship [8], namely it groups together the amplitude of inerton cloud with the Compton wavelength

$$\Lambda = \tilde{\lambda}_{\text{Com}} c^2/v_0^2. \qquad (8)$$

With $v_0^2/c^2 << 1$, the inerton cloud amplitude $\Lambda >> \lambda_{\text{Com}}$ and the inerton cloud governs the motion of the particle, as already at a distance of Λ from the particle the cloud undergoes obstacles and passes the corresponding information to the particle. This is the de Broglie "motion by guidance" and the utilization of the Schrödinger formalism is quite correct in this case.

In the approximation $v_0 \to c$, $\Lambda \approx \lambda_{\text{Com}}$ and therefore the cloud of inertons completely closed in the crystallite surrounding the particle. This case exceptionally falls under the Dirac formalism.

Thus inertons surrounding a moving particle make up a substructure of the matter waves, which so far have been treated only in the framework of the wave ψ-function probabilistic formalism and any physical interpretation has not been taken into account.

3. Experimental corroboration

The theory of submicroscopic quantum mechanics has been verified. Paper [10] demonstrates how inerton cloud expanded around moving electrons manifest themselves in numerous experiments. The paper deals with experimental and theoretical results available when laser-induced gas ionisation phenomena and photoemission from a laser-irradiated metal take place.

In work [11] the impact of inertons on the collective behaviour of atoms in a solid has theoretically been treated and then experimentally approved in metal specimens. It has been derived that the force matrix $W_{\alpha\beta}$ that determines three branches of acoustic vibrations in the crystal lattice consists of two components

$$W_{\alpha\beta}(\vec{k}) = \tilde{V}_{\alpha\beta}(\vec{k}) + \tilde{\tau}^{-1}_{\alpha\beta}\sum_{\alpha'}\tilde{\tau}^{-1}_{\alpha'\beta}(\vec{k})\frac{e_{\alpha'}}{e_\beta} \qquad (9)$$

Here, $\tilde{V}_{\alpha\beta}$ is the usual term caused by the elastic electromagnetic interaction of atoms and the second term is originated from the overlapping of inerton clouds of adjacent atoms. The availability of the second term means that an outside inerton field is able to influence the crystal lattice increasing amplitudes of vibrating atoms. The experiment which assumes the presence of the hypothetical inerton field has been performed. The terrestrial globe has been considered as a source of inertons. The expected changes in the structure of test metal specimens caused by the Earth inerton field in fact have been convincingly fixed in electron micrographs [11].

Moreover just recently the theory has been tested for truth in the experiment on the hydrogen atoms clustering in the δ-$KIO_3 \cdot HIO_3$ crystal [12]. We have considered the cluster formation of atoms in a model when the potentials of attraction and repulsion are parted from one another. Proceeding from submicroscopic quantum mechanics we come to the following form of two parts of the Lennard-Jones potential

$$V_{\text{att}}(r) = -\epsilon\Big(\frac{g}{r}\Big)^6 + \frac{1}{2}\gamma r^2; \qquad V_{\text{rep}}(r) = \epsilon\Big(\frac{g}{r}\Big)^{12}. \qquad (10)$$

Here, the small correction $\gamma r^2/2$ is stipulated by an elastic response of the space net on the motion of acoustic excitations, i.e. phonons, in the crystal lattice. The calculated number of hydrogen atoms in a cluster equals

$$\mathcal{N} \simeq \left(\frac{3}{4}\frac{\epsilon}{\gamma g^2}\right)^{3/5} \tag{11}$$

where ϵ and g are the bound energy and the length of O-H bond respectively and γ in the inerton elasticity constant of the cluster. The IR spectra obtained yield the reliable evidence of the cluster formation in the crystal studied ($\mathcal{N} = 24$, the number of cooperated hydrogen atoms [12]).

4. Conclusion

Summarizing we can infer that just the inerton field, **a new physical field**, whose carriers – inertons – make up a substructure of the matter waves, generates the quantum mechanics formalism in the region from 10^{-28} cm to the atom size. The radius of action of the field of a particle is limited by the amplitude Λ (4) of particle's inerton cloud. This also signifies that the gravitational radius of a particle is restricted by the same distance Λ since any piece of information about the particle cannot be found beyond the bounds of its inerton cloud. Thus the dynamic inerton field becomes a real candidate for the understanding the gravitation phenomenon and yet the research conducted denies an option of the existence of gravitons of general relativity without any doubt. The inerton field is capable also to account for macroscopic phenomena trespassing upon the range traditionally describing by general relativity. This means that general relativity loses its monopole rights of the all-embracing theory: the static relativity should be replaced for a dynamic theory based on the inerton field that realizes the direct interaction between massive objects. However this is the other problem which is still waiting for the solution.

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ON THE GRAVITATIONAL FIELD OF THE ELECTRIC CHARGE

Rasulkhozha S. Sharafiddinov[1]

Institute of Nuclear Physics, Uzbekistan Academy of Sciences, Tashkent, 702132 Ulugbek, Uzbekistan

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The idea has been speaked out that any of Dirac and Pauli form factors of leptonic current includes in self both normal and anomalous components. From this point of view, with the use of cross sections of elastic scattering of unpolarized and longitudinal polarized electrons and their neutrinos by spinless nuclei the dependence of independent parts of charge and magnetic moment is established. Some considerations of a connection between the mass of a particle and its electromagnetic nature are listed which can explain also the appearance of gravitational field of a Coulomb interaction. All they state that a massive four - component neutrino similarly to the electron must have the normal as well as the anomalous electric charge.

Owing to the Dirac nature of mass, the neutrino can interacts with all gauge bosons which plays an important part in establishing the physical picture of massive fermions. Here the processes on the nuclear targets are particularly interesting, because they give the possibility to investigate of compound structure of an incoming particle [1, 2] as well as of the unified system of hadrons [3] themselves.

The interaction of light leptons ($l = e, \nu_e$) with the virtual photon strongly depends on the two scalar functions $F_{1l}(q^2)$ and $F_{2l}(q^2)$ are the Dirac and Pauli form factors of vector current. Of them $F_{1l}(0)$ defines the electric charge: $F_{1l}(0) = e_l$. It appears that $F_{2l}(0)$ gives only the anomalous magnetic moment [4], and a particle full magnetic moment will have [5] the estimate [6] of $\mu_l^{full} = (F_{1l}(0)/2m_l) + F_{2l}(0)$.

We assuume that each of existing types of magnetic moments must arise as a consequence of the availability of a kind of charge. From this point of view, the functions $F_{il}(q^2)$ may written as

$$F_{il}(q^2) = f_{il}(0) + A_{il}(\vec{q^2}) + ..., \tag{1}$$

where $f_{il}(0)$ are the normal charge and moment:
$f_{1l}(0) = e_l^{norm}$, $f_{2l}(0) = \mu_l^{norm}$.

The terms $A_{il}(\vec{q^2})$ characterize the anomalous behaviour of form factors and in the low energy limit ($\vec{q^2} = 0$) have the size $A_{1l}(0) = e_l^{anom}$, $A_{2l}(0) = \mu_l^{anom}$. Such a sight to the interaction nature can also explain the fact that $F_{1l}(0)$ and $F_{2l}(0)$ give the full static values of a Dirac particle electric charge and magnetic moment:

$$F_{1l}(0) = e_l^{full} = e_l^{norm} + e_l^{anom} + ..., \tag{2}$$

$$F_{2l}(0) = \mu_l^{full} = \mu_l^{norm} + \mu_l^{anom} + ... \tag{3}$$

According to the hypothesis of field mass based on the classic theory of an extensive electron [7], a particle all mass is strictly electromagnetic. Therefore, from point of view of compound structure of form factors, it should be expected that any non - zero component of the electric charge implies the existence of a kind of mass. In other words, the lepton mass m_l contains as well as the normal m_l^{norm} and anomalous m_l^{anom} parts:

$$m_l = m_l^E = m_l^{norm} + m_l^{anom} + ... \tag{4}$$

The purpose of our article is to refine the vector picture of massive neutrinos investigating the elastic scattering of unpolarized and longitudinal polarized electrons and their neutrinos on a spinless nucleus going through the interactions of charge and magnetic moment of light leptons with field of emission of virtual photons.

The correspondence principle states that in the case of one - photon exchange only the currents independent components are responsible for this process. Insofar as $A_{il}(\vec{q^2})$ are concerned, the inclusion of such terms in the discussion will require the account of the second Born approximation.

At these conditions, the scattering amplitude in the normal limit has the following structure:

$$M_{fi}^{em} = \frac{4\pi\alpha}{q^2}\overline{u}(p', s')[\gamma_\mu f_{1l}(0) - i\sigma_{\mu\lambda}q_\lambda f_{2l}(0)]\times$$

$$\times u(p, s) < f|J_\mu^\gamma(q)|i > . \tag{5}$$

Here $l = e_{L,R}$ or $\nu = \nu_{L,R} = \nu_{eL,R}$, $\sigma_{\mu\lambda} = [\gamma_\mu, \gamma_\lambda]/2$, $q = p - p'$, $p(p')$ and $s(s')$ are the four

[1] e-mail: rasulkhozha@mail.suninp.tashkent.su

- momentum (helicities) of a particle before and after the interaction, J_μ^γ is the nuclear vector current [8].

The cross sections of the studied processes on the basis of (5) one can present as

$$\frac{d\sigma_{em}^{V_l}(\theta_l,s,s')}{d\Omega}=\frac{1}{2}\sigma_o^l(1-\eta_l^2)^{-1}\{(1+ss')f_{1l}^2+$$

$$+\eta_l^2(1-ss')[f_{1l}^2+4(m_l^{norm})^2\times$$

$$\times(1-\eta_l^{-2})^2f_{2l}^2]tg^2\frac{\theta_l}{2}\}F_E^2(q^2), \qquad (6)$$

where we must have in view of that

$$\sigma_o^l=\frac{\alpha^2cos^2\frac{\theta_l}{2}}{4E_l^2(1-\eta_l^2)sin^4\frac{\theta_l}{2}},\quad \eta_l=\frac{m_l^{norm}}{E_l},$$

$$E_l=\sqrt{p^2+(m_l^{norm})^2},\quad F_E(q^2)=ZF_c(q^2).$$

Here θ_l is the scattering angle, $F_E(q^2)$ is the nucleus electric ($F_E(0)=Z$) form factor, E_l and m_l^{norm} are the fermion normal mass and energy, and the presence of V_l implies the absence of the current axial - vector part.

Taking into account that (6) describes such interactions as conserving ($s'=s$) and nonconserving ($s'=-s$) the left ($s=-1$) - and right (s=+1) - handed neutrinos helicities, we may rewritte its in the form

$$d\sigma_{em}^{V_l}(\theta_l,s)=d\sigma_{em}^{V_l}(\theta_l,f_{1l},s)+d\sigma_{em}^{V_l}(\theta_l,f_{2l},s), \qquad (7)$$

$$\frac{d\sigma_{em}^{V_l}(\theta_l,f_{1l},s)}{d\Omega}=\frac{d\sigma_{em}^{V_l}(\theta_l,f_{1l},s'=s)}{d\Omega}+$$

$$+\frac{d\sigma_{em}^{V_l}(\theta_l,f_{1l},s'=-s)}{d\Omega}=$$

$$=\sigma_o^l(1-\eta_l^2)^{-1}(1+\eta_l^2tg^2\frac{\theta_l}{2})f_{1l}^2F_E^2(q^2), \qquad (8)$$

$$\frac{d\sigma_{em}^{V_l}(\theta_l,f_{2l},s)}{d\Omega}=\frac{d\sigma_{em}^{V_l}(\theta_l,f_{2l},s'=-s)}{d\Omega}=$$

$$=4(m_l^{norm})^2\sigma_o^l(1-\eta_l^2)\eta_l^{-2}f_{2l}^2F_E^2(q^2)tg^2\frac{\theta_l}{2}. \qquad (9)$$

As seen from (8) and (9), in the case of massive neutrinos, the charge is responsible for the scattering either with or without flip of spin. Insofar as the magnetic moment is concerned, it changes a particle helicity.

Averaging over s and summing over s', the cross section (6) one can reduce to the following:

$$d\sigma_{em}^{V_l}(\theta_l)=d\sigma_{em}^{V_l}(\theta_l,f_{1l})+d\sigma_{em}^{V_l}(\theta_l,f_{2l}), \qquad (10)$$

$$\frac{d\sigma_{em}^{V_l}(\theta_l,f_{1l})}{d\Omega}=\sigma_o^l(1-\eta_l^2)^{-1}(1+\eta_l^2tg^2\frac{\theta_l}{2})\times$$

$$\times f_{1l}^2F_E^2(q^2), \qquad (11)$$

$$\frac{d\sigma_{em}^{V_l}(\theta_l,f_{2l})}{d\Omega}=4(m_l^{norm})^2\sigma_o^l(1-\eta_l^2)\eta_l^{-2}\times$$

$$\times f_{2l}^2F_E^2(q^2)tg^2\frac{\theta_l}{2}. \qquad (12)$$

Comparison of (7) and (10) shows clearly that

$$\frac{d\sigma_{em}^{V_l}(\theta_l,s)}{d\sigma_{em}^{V_l}(\theta_l)}=1, \qquad (13)$$

which leads to the system of the six the most diverse equations.

For our purposes it is desirable to choose only two of them:

$$\frac{d\sigma_{em}^{V_l}(\theta_l,f_{2l},s)}{d\sigma_{em}^{V_l}(\theta_l,f_{1l},s)}=1, \qquad (14)$$

$$\frac{d\sigma_{em}^{V_l}(\theta_l,f_{2l})}{d\sigma_{em}^{V_l}(\theta_l,f_{1l})}=1. \qquad (15)$$

The basis for such a statement is that both numerator and denominator in (14) and (15) there exist simultaneously.

According to our description, the neutrino spin flip proceeding in the Coulomb field is observed because of an intimate connection between the mass of the neutrino and its electromagnetic nature [1]. At the same time a question of the structure and properties of mass responsibled for conservation as well as change of a particle helicity requires the special investigation.

But here we can use of (15), so as it gives the possibility to establish the corresponding picture of the interaction regardless of spin polarization. Indeed, inserting (11) and (12) in (15), it is easy to observe the following dependence of form factors

$$4(m_l^{norm})^2\frac{f_{2l}^2(0)}{f_{1l}^2(0)}=\frac{\eta_l^2(1+\eta_l^2tg^2\frac{\theta_l}{2})}{(1-\eta_l^2)^2tg^2\frac{\theta_l}{2}}. \qquad (16)$$

Furthermore, if neutrinos are of low energies ($E_l\to m_l^{norm}$) then

$$lim_{\eta_l\to 1}\frac{\eta_l^2(1+\eta_l^2tg^2\frac{\theta_l}{2})}{(1-\eta_l^2)^2tg^2\frac{\theta_l}{2}}=1,$$

and the relation (16) is reduced to the form

$$2m_l^{norm}\frac{f_{2l}(0)}{f_{1l}(0)}=\pm 1. \qquad (17)$$

Using (17) for the electron with charge $f_{1e}(0)=-e_e^{norm}$, we find that

$$f_{2e}(0)=\mp\frac{e_e^{norm}}{2m_e^{norm}}. \qquad (18)$$

In the framework of the standard model of electroweak interactions, the neutrino anomalous magnetic

moment arises as a consequence of the availability of tne neutrino non - zero rest mass [9]. It is of course not excluded that if start from this connection, the function $A_{2\nu}(0)$ must have the form

$$A_{2\nu}(0) = \mu_\nu^{anom} = \frac{3eG_F m_\nu^{anom}}{8\pi^2\sqrt{2}}, \quad e = |e_e^{norm}|. \quad (19)$$

Turning to (4) and (19), for the normal part of the neutrino magnetic moment, we get

$$f_{2\nu}(0) = \mu_\nu^{norm} = \frac{3eG_F m_\nu^{norm}}{8\pi^2\sqrt{2}}, \quad (20)$$

and therefore, the solution of equation (17) may behaves as

$$f_{1\nu}(0) = e_\nu^{norm} = -\frac{3eG_F (m_\nu^{norm})^2}{4\pi^2\sqrt{2}}. \quad (21)$$

Insofar as the neutrino anomalous electric charge, with the aid of (4) one can find from (21) that

$$A_{1\nu}(0) = e_\nu^{anom} = -\frac{3eG_F (m_\nu^{anom})^2}{4\pi^2\sqrt{2}}. \quad (22)$$

Insertion of (19) - (22) in (2) (3) defines the full static size of the neutrino electric charge and magnetic moment. Their general structure at the account of (4) have the form

$$e_\nu = e_\nu^{full} = -\frac{3eG_F m_\nu^2}{4\pi^2\sqrt{2}}, \quad (23)$$

$$\mu_\nu = \mu_\nu^{full} = \frac{3eG_F m_\nu}{8\pi^2\sqrt{2}}. \quad (24)$$

The availability of a connection between μ_ν and m_ν can also confirm the existence of gravitational field of magnetic moment [10]. Of course, such a mass dependence and testify of that the electric mass and charge of a particle correspond to two form of the unified regularity of its physical nature [11]. Owing to this, becomes possible move from the Newton law of gravity to the Coulomb law and vice versa.

These forces for two neutrinos can be expressed in the form

$$F_N = G_N \frac{m_\nu^2}{R^2}, \quad F_C = \frac{1}{4\pi\epsilon_0}\frac{e_\nu^2}{R^2}, \quad (25)$$

G_N is the constant of gravitational field.

Comparing (23) with (25), taking [12] $G_N = 6,70916 \cdot 10^{-39} GeV^{-2}$ and having in view of the inequality $F_C > F_N$, we are led to the implication that

$$m_\nu > \frac{4\pi^2\sqrt{2}}{3G_F}\left(\frac{G_N}{\alpha}\right)^{1/2} = 1,53 \cdot 10^{-3} eV, \quad (26)$$

$$e_\nu > \frac{4\pi^2\sqrt{2}}{3G_F}\left(\frac{G_N}{\alpha}\right) e = 1,46 \cdot 10^{-30} e. \quad (27)$$

Finally, insofar as the steadity of the distribution of a massive particle electric charge, gauge invariance and charge conservation and quantization law are concerned, all they together with some aspects of compound structure of the neutrino mass will be presented in the separate work.

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THE "BLACK HOLES" AND NATURE OF "DARK MATTER" IN THE BINARY MODEL OF DISTRIBUTION OF THE DENSITY SUBSTANCE AND NATURE OF GRAVITY

K.N. Sinitsyn[1]

Department of Communication, Special Engineering and Automation
Tulskaya St., 70, Kaluga 248023, Russia

November 10, 2000

This report is continue of presentation for applications the binary model in relativistic astrophysics. It is based on exact decision for perturbation of density substance. It is show that this decisions well agreement with data of some experiments and gives ability to overcomings problem with "middle-weight" of "black holes" and simple meaning of a phenomena, which know in astrophysics as a "dark matter".

1. Introduction

The modern data of observations in gamma-range of radiation gives minimum for mass of primary "black holes" in early Universe

$$5x10^{11} < M_{PBH} < 10^{14}\ kg \tag{1}$$

on peak of perturbation spectrum appropriates to mass of its horizont about half of mass Sun (C.R.Evans and J.S.Coleman, Phys. Rev. Lett., 1994; J.Yokoyama, Phys. Rev., 1998; J.C.Niemeyer, 1998). But if we shall take into account error of experimental data its boundary value is reduced up to

$$10^{-4}M_{SUN} < M_{PBH,h} < 0,03M_{SUN} \tag{2}$$

The observation of accretion substance near super "black holes" inside of galaxies with instability cores gives upper limit its mass to some billions of Sun mass.

The amount mass of astrophysical objects now is approximated to values of 5 - 10 percent from total mass of surveyed Universe. The rest of mass corresponds to "dark matter" (R.Sanders et al., D.Savage et al., 2000).

In other side the modern theory predicts value of mass for middle-weight of "black hole" about some thousands of Sun mass. In the meantime two groups of scientists were found so "black hole" with weight about 460 mass of our Sun (Ptak and Griffith for data of galaxy M82, Colbert and Mushotzky for spectrum of 21 galaxies). In the binary model this problem is decided (see also fig.1, fig.2).

[1]e-mail: koscmp@kaluga.ru

2. A some papameters of static character limit and horizont "black holes"

In the binary model these parameters are at calculations for lengths of electromagnetic waves of spectrum substance which has got in areas actions of "black holes". Such approach allows calculates very exact mass of "black holes" for different regions and algorithm of calculations is uniform.
The general equation for the binary model (see also [22]) gives decisions for limit of static character "black holes" as system of equations

$$\rho_{lsc} = \frac{(c_m)^2}{2,35V_{effM}(\lambda_{el})^4} \tag{3}$$

$$c_m = \sqrt{\frac{hc}{G}} \tag{4}$$

$$\rho_{el} = \frac{h}{2,35c(\lambda_{el})^4} \tag{5}$$

$$R_i = \sqrt{\frac{V_{effM}}{\rho_i}} \tag{6}$$

$$M_i = K_f R_i V_{effM} \tag{7}$$

$$\rho_{lsc} << \rho_{max} : {v_{lsc}}^2 = c^2(\frac{\rho_{el}}{\rho_{lsc}} - 2\sqrt{\frac{\rho_{el}}{\rho_{max}}}) \tag{8}$$

In the final these equations gives exact decisions for kind for length of waves and mass of regions "black holes"

$${\lambda_{el}}^{lsc} = [1,16x10^{-4}; 3,15x10^{-12}]\ m; \tag{9}$$

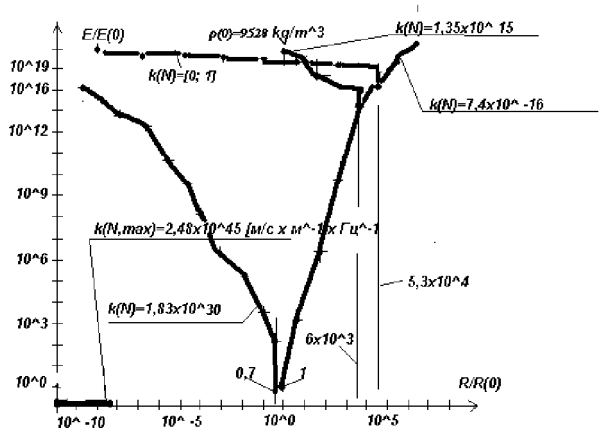

Figure 1: Perturbations of density substance in the binary model depending upon coefficient of rotation

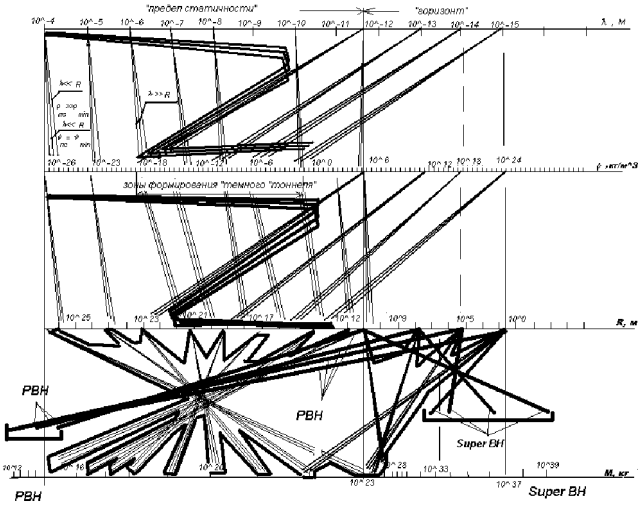

Figure 2: Perturbations of density substance in the binary model depending upon coefficient of rotation (continue for black hole)

$$\lambda_{el}{}^{h} = [3,15x10^{-12}; 1,56x10^{-15}]\ m; \quad (10)$$

$$M_h = \frac{c_m V_{effM}}{2,35\lambda_{em}\rho_h R_h} = [1,3x10^{22}; 1,2x10^{27}]\ kg; \quad (11)$$

$$M_{PBH} = \frac{cc_m}{2,35\nu_{PBH}\lambda_{el}} =$$

$$= [1,4x10^{12}; 2,8x10^{15}]\ kg; \quad (12)$$

$$M_{BH} = 2,35R_{BH}V_{effM} =$$

$$= [2,9x10^{32}; 1,2x10^{39}]\ kg. \quad (13)$$

We can see that all values well agree with data of experiments which was announced in beginning of this report. On the fig.1, fig.2 we can see also the graphical decisions for perturbations of density substance, lengths and masses "black holes" depend upon values of coefficient of rotation for general equation in the binary model.

At last, the forming of "black holes" is a reason for forming masses of quick and slow gravitons (see also [22]). Due to it occurs concentration of gravitational field action on the borders of groups density substance for static character limit of "black holes" (and possibility in region of its horizont) and in result the density of substance here increase to nearest peak. The intergroups diffusion is reason for increase mass of quick gravitons and at last it results to undifference of energy for quick and slow gravitons. Thus the gradient of density of substance itself becomes extremely small by forming in area of "dark tunnel".

The substance from space gets inside this area and its velocity relative region of "dark tunnel" becomes equal zero. Due to such substance ceases to radiate but occurs acceleration of substance because velocity change in steps on the borders of groups in the binary model. The value of acceleration, its length and time of forming can be calculated in next formulas

$$\Delta l = \sqrt{\frac{V_{effM}}{\rho_{dt}}} \quad (14)$$

$$\Delta\tau = \sqrt{\frac{V_{effM}}{\rho_{sub}v_{sub}^2}} \quad (15)$$

$$a_{dt}{}^{sub} = \frac{(c - v_{sub})\Delta\tau + \Delta l}{\Delta\tau_{dt}{}^2} \quad (16)$$

3. The nature of "dark matter" in the binary model

The nature of "dark matter" in the binary model present a intergroups diffusion on the its borders. The value of mass which occurs in result of the diffusion equal constant and not depend upon value of length of borders. Thus amount of additional mass in unit of time due to intergroups diffusion equal

$$\frac{M_{DM}}{t} = K_f R_i V_{effM}\sqrt{G\rho_i} \quad (17)$$

In summary during to all time for our Universe this additional mass equal

$$M_{\sum DM} = K_f R_{OU} V_{effM} = M_{OU} = 1,6x10^{54}(kg) \quad (18)$$

but ratio of barionic and critical density depends relation common and "dark" matter in Universe. In the binary model equal

$$\rho_b = (3,8 + -0,4)10^{-28}(\frac{kg}{m^3}) \quad (19)$$

Burles-Tytler, 1998; Tytler, 1999.

$$\rho_{crit} = (5,2 + -2,6)10^{-27}\ kg \cdot m^{-3} \tag{20}$$

calculation in the binary model.

In result

$$M_{DM} = 92,7^{-5,8}_{+1,9}, \quad M_b = 7,3^{+5,8}_{-1,9} \tag{21}$$

4. Conclusions

1. The amount of mass in horizont "black holes" with taking into account error well agrees with data of some experiments (see MACHO'S, COBE, etc).

2. The limit of mass for supermassive and primary "black holes" is inside range which predicts from modern models. But "effect of dark tunnel" probably requires decrease upper limit of its mass.

3. The static character limit with large scale of velocity corresponds to regions with low (superlow) density of substance for primary forming of "black holes" in the binary model. In opposite case the binary model predicts large scale of density substance for primary forming of "black holes".

4. The primary forming for quick rotation inside regions of "black holes" corresponds regions of space with relatively high average density of substance. In opposite case the binary model predicts slow rotation inside regions of "black holes".

5. The value of gradient density substance in area between static character limit and horizont can forming at influence of shock waves from regions of "dark tunnels". This influence is necessary to take into account during formation region of ergosphere "black holes".

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THE BINARY MODEL OF DISTRIBUTION OF THE DENSITY SUBSTANCE AND NATURE OF GRAVITY

K.N. Sinitsyn[1]

Department of Communication, Special Engineering and Automation Tulskaya St., 70, Kaluga 248023, Russia

November 9, 2000

This is a presentation for new model that named binary. It is based on differentiation of all values of the density substance on average arithmetic and actually is dividing on the degree of digit two. The density of substance, velocity, space and time are terms of space-time operator in the binary model. It allows to determinate every parameter of modern physics or cosmology in such approach. Thus the binary model of distribution of the density substance is more universal than other and very suitable for computer simulations. In addition it gives simple algorithm for calculation of values of a parameters which well agree with data of some experiments.

1. Introduction

It is well-known that the exact decisions gives very powerful tool for research Universe and for fundamental physics. But it's a problem of modern science that exact decisions are more difficult as strongly depends on assumptions inside of Einstein's equations. The binary model of distribution of the density substance are neither decisions of Einstein's equations no their consequences. But in fact it allows make these decisions very exact if we shall redefine known parameters in terms of the binary model. Such way is real because terms in space-time operator of the binary model are density of substance, velocity of disribution, length and time. For example, we can see below a some exact decisions for density of substance if we shall define the conception of effective potential mass as a maximum of weight in unit of space

$$V_{effm} = \frac{c^2}{G} = 1,35x10^{27}(\frac{kg}{m}) \tag{1}$$

$$d\rho = \frac{1}{GRt}dv; d\rho = \frac{1}{GRt^2}dr; d\rho = \frac{cV_{effm}}{R^2\lambda}dt \tag{2}$$

where G - the Newton's gravity constant, c - velocity of distribution of the electromagnetic waves in space.

In common case all terms are grouped in matrix of the fourth order. These exact decisions inside of the binary model allows to estimate more efficiently a physical parameters, because every decision have way which avoid uncertainties.

[1] e-mail: koscmp@kaluga.ru

2. A some general parameters of the binary model

In general view the main equation for dividing of density substance in the binary model is dinamic decision

$$\rho_{i,sub} =$$

$$(\rho_{max,sub} + \rho_{min,sub}(k_{spin}+1)(1+\sum_{i=1,i<N}^{N-1} 2^i)2^{-N} \tag{3}$$

where i - variable from 1 to *N-1.*

Thus in general case we have 5 different components

$$\frac{\rho_{max,sub}}{2^N} \sim \Omega_M\,, \rho_{min,sub} \sim \Omega_\Lambda\,, \tag{4}$$

$$k_N\rho_{min,sub} \sim \Omega_J\,, \sum_{i=1,i<N}^{N-2} 2^i(k_N - k_{N-1}) \sim d\Omega_j\,, \tag{5}$$

$$\sum_{i=N,i<N}^{N-1} (2^i)\rho_{min,sub} \sim d\Omega_\Lambda \tag{6}$$

and curvature of space change in two cases (see fig.1)

$$\frac{\rho_{max,sub}}{2^N} < \rho_{min,sub}(k_N+1)\sum_{i=1,i<N}^{N-1} 2^i \tag{7}$$

or

$$\frac{\rho_{max,sub}}{2^N} < \rho_{min,sub}(k_{N-1}-k_N)\sum_{i=1,i<N}^{N-2} 2^i \tag{8}$$

All interval of the density substance in the binary model divides by groups. Diffusion of substance exist on the borders of these groups and not depend from

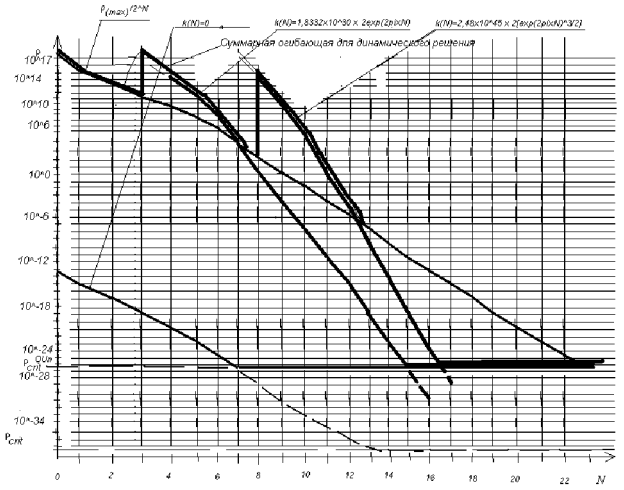

Figure 1: Change curvature of space in the binary model of distribution of density substance

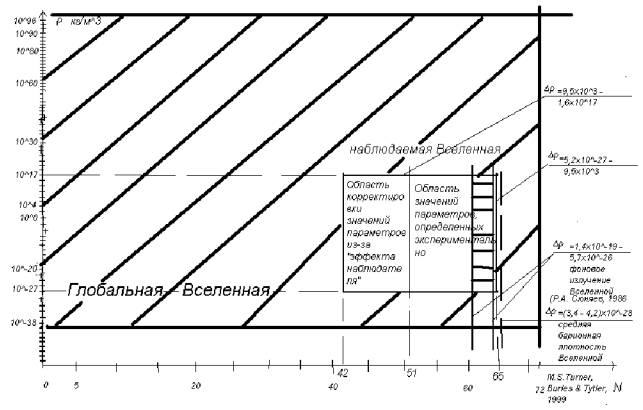

Figure 2: Global Universe in the binary model

border's parameters. This constant process is defined at the parameter that calculating a ratio the Planck's constant and Newton's gravity constant

$$C_M = \sqrt{\frac{hc}{G}} \tag{9}$$

Such approach allows calculate value of density substance for any group and make model of obtainable Universe in different epoch of evoluiton (see fig.2). But other side, value of density substance defines behaviour all of physical parameters. One of interest case is signal observation which was researched on the Earth. If this signal was distributed to us through space with density substance less than border, it will not be distorted. But otherwise the binary model predicts "effect of observer" that requires really take into account ratio for specrum frequencies and gradient of velocities. This ratio equal 3/2 and requires updating values of surveyed parameters. In the binary model the boundary value of density

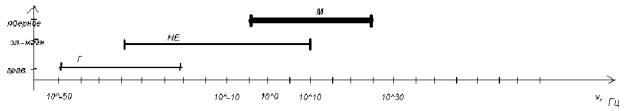

Figure 3: The graphical decision for matrix of frequency in the binary model

substance for "effect of observer" equal

$$\rho_{bn,OU} = 9,53x10^3(\frac{kg}{m^3}) \tag{10}$$

It corresponds to the top limit for the first 16 groups. But all obtainable Universe in the binary model divided on the 23 groups and "effect of observer" works in 7 top groups (see fig.2,3). Thus the both parameters in equations (1) and (9) are very important and these defines amount additional mass and maximum of mass in unit of space.

In the binary model deduced matrix of frequency as a function variable of density substance. It allows to consider various types of interactions. On common spectral areas the cases are considered when one type of interaction induces other. The formulas for calculation frequency of spectrum for strong, electromagnetic and gravitational interactions are given below

$$\nu_{str,max} = \frac{c\rho_{max,bn}}{\sqrt{\rho_{min,sub}V_{effM}}} \tag{11}$$

$$\nu_{str,min} = \nu_{el,max} = c\sqrt{\frac{\rho_{max,bn}}{V_{effM}}} \tag{12}$$

$$\nu_{el,min} = \nu_{gr,max} = \frac{c\rho_{min,sub}}{\sqrt{\rho_{max,bn}V_{effM}}} \tag{13}$$

$$\nu_{gr,min} = c\frac{\rho_{min,sub}}{\rho_{max,bn}}\sqrt{\frac{\rho_{min,sub}}{V_{effM}}} \tag{14}$$

3. The nature of gravity in binary model

The nature of gravity is a one of possible application for algorithm of the binary model with exact decisions. It present as a property of density substance in last scattering surface. Such approach gives the gravity constant as function of critical density and maximum of "time of life" for last scattering surface in a corresponding group.

$$G = \frac{1}{\rho_{min,sub,ls}\tau^2} \tag{15}$$

The gravitational signal is formed from two components. First is a "slow" gravitons which defines acceleration of substance and second is a "quick" gravitons

which defines attraction of substance. The both components are primary formed in a gradient of the density substance during intergroup diffusion. The secondary formation "slow" and "quick" gravitons occurs in immediate proximity from astrophysical objects.

The mass and energy parameters for these both components we can see below in inuts of mass of a astrophysical objects and full Einstein's energy

$$M_{qk,g} = MR\frac{\rho_{sub}}{\sqrt{\rho_{max,bn}V_{effM}}} \quad (16)$$

$$E_{qk,g} = Mc^2R\frac{\rho^2_{sub}}{\sqrt{\rho^3_{max,bn}V_{effM}}} \quad (17)$$

$$M_{sl,g} = MR\sqrt{\frac{\rho_{sub}\rho_{env}}{\rho_{max,bn}V_{effM}}} \quad (18)$$

$$E_{sl,g} = Mc^2R\sqrt{\frac{\rho^3_{env}}{\rho_{sub}\rho_{max,bn}V_{effM}}} \quad (19)$$

The basic conclusions concerning nature of gravity in the binary model.

1. The fractal region of Universe with large scale gradient always has accelerated expansion, because here "quick" gravitons are formed faster than "slow" gravitons. In such approach accelerated expansion obtainable Universe may be occur due to additional pressure which is formed superseded substance from fractal area to it last scattering surface (see eq. (16),(17)).

2. The large scale of Universe with homogeneous distributed substance always has slow down of the expansion velocity because here "slow" gravitons are formed faster than "quick" gravitons. Such approach in the binary model allows accept the point of view about isolation of large scale Universe (see eq. (18),(19)).

3. As we see now in the binary model accelerated expansion of Universe is temporary stage of Universe evolution. The modern measurements for spectrum of cosmic background radiation anisotropy are more and more improved. It gives the basis to assumptions that component of matter for parameter "Omega" comes nearer to 30 percents and that cosmological constant is positive (see also Astrophys. J., 1999, A.D. Miller et al, astro-ph/9906421 and A. Melchiorri et al, astro-ph/9911445).

4. The two- component gravitational wave has amplitude on 4-5 orders less than it is accepted to consider now. If it true, such conlusion requires increase of sensitivity for ground-based detectors of gravitational waves up to value

$$\frac{E_g}{Mc^2} = \frac{10^{-30}}{2} \quad (20)$$

5. As the compact objects have a significant component of rotation it is possible that the found out gravitational signals from these objects content components with the induced electromagnetic waves (see eq. (11)...(14)).

4. Discussion

It is one a very interesting question: what for is necessary one more model? There are some answers concerning the binary model.

1. Good interpretation for results of calculation. For example, comparison with articles of other authors (J.B.Zel'dovich and L.P.Grishuk, Usp.Phys.Nauk.,1986; Hrvoje Nikolic, Shinsuke Kawai, Alexander Kuzenko, Allesandro Melchiorri, etc., 1999) allows to make explanation for curvature of space, properties of time and metric with use of ratio for density of substance in the binary model. From here we deduce the system of equations for case of static decision (without the account of rotation) which defines borders of its applicability. But the situation for rotating vector of density substance gradient can be interpreted for dynamic decision on anyone scale in cosmology.

2. The simple algorithm of calculations. There is no necessity for exact positioning of mass or maintenance for iteration of density substance function for avoidance of instability in simulations. On other side the binary model for some cases gives well agreement with standart theory. For example, the calculation for singulation in spherical dust gives

$$\Delta = \rho_0[2,8878; 8,6634] \quad (21)$$

for standart Einstein's equation (see Sukratu Barve et al., 1999)

$$\Delta = \rho_0[1,4375; 8,8244] \quad (22)$$

for binary model

3. Novelty. The process of formation for mass at expansion of Universe is examined other authors. But effect they not considered of latent mass made in effective potensial of mass and additional mass due to intergroup diffusion. It for the first time occurs only in the binary model.

4. It is additional ability for explanations of experiments data. Key to mistery of "dark matter", deficiency of gravity in galaxies clusters, prediction for updationg the "red shift", explanation within the framework of one model for various values of sigma parameter for cluster data and pecular velocity

$$\sigma_{8,clus} = (0,5 - 0,6), \sigma_{8,pecr} = (0,85 + -0,02) \quad (23)$$

The data of observations for Large Magelanic Cloud already today allow make conclusion about updating "red shift" on 12 percent for it. (see also Krzysztof Stanek, Peter Garnavich et al, 2000).

5. It last, the binary model gives real conception for searching a reasons which gives key to explanation various behaviour of gravitational signal on various frequencies (see fig.4, fig.5).

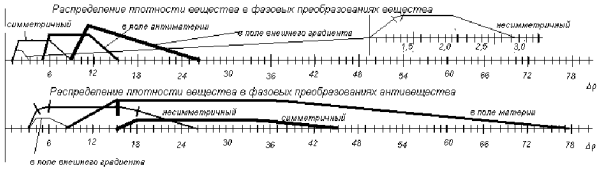

Figure 4: The graphical decision for matrix of frequency in the binary model (continue)

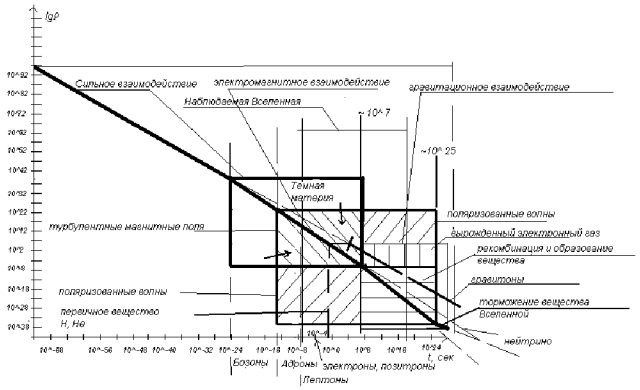

Figure 5: Global Universe in binary model (continue)

5. Conclusions

1. The binary model of distribution of the density substance well agree with modern model and can have many applications. Thus the binary model can be used as the additional tool for simulations of a various processes.

2. The nature of gravity in the binary model supposes necessity of increase for sensitivity of ground-based gravitational detectors on 4-5 orders.

3. In the binary model accelerated expansion of Universe is temporary stage of Universe evolution. And data of last experiments are proofs for it (see also fig.3).

4. Existance "effect of observer" in the binary model can result in necessity updating a some of parameters for cosmology.

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FIELD FORMULATION OF THE GENERAL RELATIVITY AND COSMOLOGY

N.A. Zhuck[1]

Research and Technological Institute of Transcription, Translation and Replication, JSC
Box 589, 3 Kolomenskaya St., Kharkov 61166, Ukraine

November 9, 2000

It is shown, that the Einstein equations with the cosmological term describe only the flat and static Universe. They are conversed to the field shape and are simplified under these requirements. The solution of these equations is found in the shape of the Yukawa potential, which contains the constant called as the gravitational interactions radius. The concept of a gravitational interactions area of a material body with the Universe is defined according to the constant. It is shown, that the given area changes its location in the space at acceleration or retarding of the body action. It is accompanied by energy change of the body gravitational connections with the Universe. The identity of inertial and gravitational masses is proved unambiguous at definition of the character and quantity of these changes according to the Mach principle. It shown that the redshift grows out of such interrelation, and microwave background radiation is equilibrium radiation of all objects of the Universe. Gravitational viscosity and geodetic curvature of the Universe, and also screening properties of a substance are detected.

1. Introduction

Cosmology is the general part of mathematics, physics, astronomy and philosophy, which deals with origin, structure and development of the Universe as a whole. It is a unified concept of the Universe that puts cosmology in a position specific towards other sciences.

Really, if any other science can investigate its object from different directions and in full, only a part of the Universe is accessible to cosmology, i. e. a part of its object of investigation (to say the more, only from inside, as a cognising subject is inseparable from the object of investigation). As the whole possesses such properties which are not characteristic for its part, - and these are the properties which as a matter of fact distinguish the whole from its parts, then it makes clear enough the availability of all these drawbacks, which cosmology always experienced.

The essence of these drawbacks has always come to the one: no physical theory could to a full extent explain the observed properties of the Universe. If the theory somehow was adapted to some properties of the Universe, then the stemming effects either did not correlate with its other known properties or overstepped the limits of common sense. The situation is getting worse through the fact that four-dimension space-time by the General Theory of Relativity (GTR) is described by ten variables, as the theory itself only suggests six independent equations. That is why it is not that surprising that nobody has ever managed to build the objective picture of the world only with the GTR equations.

To study the whole by its part, it is important to have continuous integration of notions on the subject of the investigation from different points of view at every stage of its investigation and continuous coordination of outcomes of the theory under development with the objective reality. Non-observance of the principle of conformity, occurrence of internal contradictions, singularities and paradoxes while applying the given theory for the description of the whole indicates to the falsity of the way taken by the investigators. It is the very situation, which has developed in cosmology nowadays, its official theoretic ground being based on the idea of Big Bang.

2. The speed of light is the tensor

Any observer can not simultaneously be in several systems of readout. This fact guesses viewing all the natural phenomena only in one inertial system of readout. Thus there is a problem what is the speed of light of rather propellent objects.

Correctly to answer this problem, we shall consider two inertial readout systems and bound with them two rulers.

Let at that moment, when the kickoffs of rulers coincide with each other, the bulb in the kickoff of the fixed ruler. In time t light will reach a some point on this ruler. For the same time the relative frame ruler will move and on the contrary this point there

[1] e-mail: zhuck@insurance.kharkov.ua

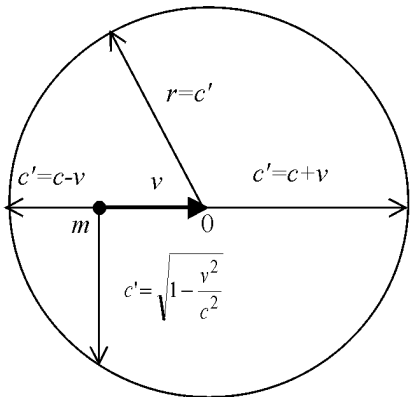

Figure 1: The tensor of the light speed

will be the other point. Thus distance, which light has passed along a relative frame ruler on quantity vt will be less than distance which it has passed on a fixed ruler. Hence, observer who is taking place in the kick-off of the fixed readout system on the gauges of space and time should make a deduction, that the front of a light wave catches up the point along the propellent ruler with velocity $c' = c - v$. At a motion in the opposite direction will be received $c' = c + v$ (see Fig. 1).

All above-stated does not contradict a postulate of the Special Theory of Relativity, as the speed of light is constant only in inertial systems of readout, but c' is a speed of light in one inertial system of readout measured on gauges of space and time of other inertial system of readout. Let's term it as a local light velocity.

Thus, from this point of view the local velocity of light represents a tensor of the second rank (naturally, in three-dimensional space) which all builders by the ends contour a ball of radius, equal to speed of light, displaced in relation to propellent object forward on quantity of velocity v of its motion. This ball is a geometrical fashion of a tensor of a local light velocity [1].

3. The law of universal gravitation

As it is known, Einstein has offered two views of the equations of GTR which differ from each other on an addend with the cosmological term λ:

$$R_{ik} - \frac{1}{2}Rg_{ik} = -æT_{ik}, \tag{1}$$

$$R_{ik} - \frac{1}{2}Rg_{ik} - \lambda g_{ik} = -æT_{ik}. \tag{2}$$

where R_{ik} is the Ricci tensor, convolution of the Riman-Cristoffel curvature tensorm R^l_{ijk}; T_{ik} is the energy-momentum tensor of a substance without a substance of a gravitational field; g_{ik} is the metric tensor of four-dimension spacetime; R is the curvature scalar, convolution of the Ricci tensor; $æ = 8\pi G/c^4$ is Einstein's constant; c is light speed; G is Newton's gravitational constant; $i, j, k, l = 0, 1, 2, 3$.

For a unique select of the equations it is necessary to take into account some performance of the Universe. Such performance is global flatness of the Universe which mathematical expression is equality

$$R^l_{ijk} = R_{ik} = R = 0. \tag{3}$$

As for the actual Universe filled with substance with deflection density, $æT_{ik} \neq 0$, with the account (3) the fact of omission of equality (1) becomes obvious. Thus, the flat in global gauges Universe can be featured only with the equations (2). And, the diversions from flat space-time under activity of material masses can be presented precisely only in a composition of the total which corresponds to the assignment of a tensor gravitational field h^{ik} on a background of the flat material world in arbitrary coordinates with the metric γ^{ik} [2–4]:

$$\sqrt{-g}g^{ik} = \sqrt{-g}(\gamma^{ik} + h^{ik}). \tag{4}$$

The other, not less important property of the Universe is its homogeneity and isotropy in great gauges. Mathematicaly this property can be reflected as equality to zero of a covariant derivative of tensor density $\sqrt{-g}g^{ik}$ and corollaries of this equality (in Lorentz's coordinates):

$$(\sqrt{-g}g^{ik})_{,i} = (\sqrt{-g}g^{ik})_{,i} = (\sqrt{-g}h^{ik})_{,i} = 0, \tag{5}$$

where the point with comma designates a covariant derivative, and the comma is usual derivative.

After that the equations (2) with the help of transformation (4) and requirement (5) are given in the field equations of GTR

$$\Box h_{ik} - \frac{2}{3}\lambda h_{ik} = 2æT'_{ik}, \tag{6}$$

where T'_{ik} is an energy-momentum tensor of a substance together with a substance of a gravitational field which is oozed from the left-hand part of the Einstein's equations. Under the same requirements the identity of Lagrangians for a deduction of the equations (2) and (6) is proved in the publications [1–4].

Taking into account homogeneity and isotropy of the Universe (that is symmetry of a problem), for a spherical-symmetrical material body of mass m the equations (6) give the exterior solution as the Yukawa potential

$$\varphi = -G\frac{m}{r}\,\mathrm{e}^{-r/R_0}. \tag{7}$$

The constant R_0 is termed as a radius of gravitational interactions and is determined under the formula (ρ_0 is a medial density of the Universe)

$$R_0 = c\sqrt{\frac{3}{4\pi G\rho_0}}. \tag{8}$$

For two of material bodies with masses m_1 and m_2 the following law of gravitation is gained

$$F = G\frac{m_1 m_2}{r^2}\,\mathrm{e}^{-r/R_0}\left(1-\frac{r^2}{R_0^2}\right). \tag{9}$$

From the analysis of the obtained law follows that in the actual Universe all the material bodies (planets, stars, galaxies) interreact with each other more feebler than it follows from the law of Newton gravitation.

4. Identity of inertial and gravitational masses

It is necessary to note that in linear approach the actual law of gravitation (9) becomes:

$$F \approx G\frac{m_1 m_2}{r^2}\left(1-\frac{r^2}{R_0^2}\right), \tag{10}$$

which shows, that all material bodies in the Universe interreact with each other practically only in limits of radius of gravitational interactions equal approximately 10^{26} m (or 20 billions of light years).

On the other hand, if to compare an actual law of gravitation and the law of Newton gravitation, it appears that the area under a curve of force of the actual law on an interval from 0 up to ∞ is precisely equal the areas under a curve of the gravitation law of Newton on an interval from 0 up to R_0. Hence, law of gravitation (9) valid for the actual Universe, from the energy point of view by the law of Newton gravitation can be replaced restricting radius of activity of forces by quantity R_0. The given approach allows to decide a series of remarkable problems promptly and obviously.

In view of above-stated we shall analyse, how the area of interaction of a material point of mass m with the Universe will vary at its dispersal up to velocity v and in what all this will give. It is to show that the new area of interaction of a point with medium also will represent a ball of radius R_0, but moved forward on a course of its motion on quantity r (as in expression for R_0 it is necessary to substitute c'). It is possible also to show that the relation is valid

$$r = \frac{v}{c}R_0. \tag{11}$$

Thus, the area of interaction of a propellent mass point displaces forward on a course of a motion proportionally velocities of its motion. In a limit, that is when the velocity of a motion is equal to speed of light the propellent point should be on a back surface of its area of interactions. But it just and probably only for light.

At dispersal the point m loses gravitational connection with masses of area a behind itself and enters gravitational connection with masses of area b ahead itself (Fig. 2). The sizes of areas both are identical

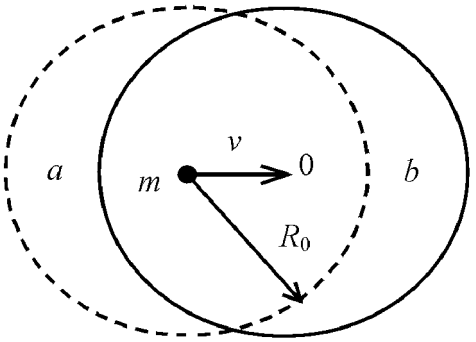

Figure 2: Change of the interactions area at dispersal of a material point

and depend only on velocity v, but the location of a point m concerning them is asymmetrical. Hence, the aggregate operation on overcoming forces of the area a gravitation and forces of the area b gravitation is not equal to zero.

The author managed to find receptions of definition of this operation. If to take into account a probable initial velocity v_0 a material point, for low speeds the operation has appeared to equal quantity

$$A = \frac{mv^2}{2} - \frac{mv_0^2}{2}. \tag{12}$$

Thus, we have received, known from mechanics the theorem, of change of a kinetic energy of a body. If the obtained expression to differentiate on velocity and on time, the second Newton's law will be received. All this is valid in a relativistic case.

Charakteristic feature of the obtained results is that both in the theorem of change of a kinetic energy, and in the second Newton's law not inertial, but gravitational mass enters so long as only such mass considered from the very beginning. So the identity of inertial and gravitational masses spirit of the Mach principle is proved and the mechanism of interaction of material bodies with the Universe is uncovered.

5. Gravitational viscosity and geodetic curvature of the Universe

After dispersal (cancellation of local force) of material body along coordinate X its free motion is featured by the equation

$$\frac{d^2X}{dt^2} + H\frac{dX}{dt} = 0,\ H = \sqrt{\frac{4\pi G\rho_0}{3}}, \tag{13}$$

where H is Hubble constant which has absolutely other physical sense, as it is accepted in a conventional cosmology.

By presence of the second (dissipative) addend the new law of a free motion differs from the first Newton law. As a whole one of the most prime statements of this law can be such: if the local forces do not act on a body, the standing of its interaction area from the Universe (on the level R_0) in due course does not vary, and it aims asymptotically to the centre of this area.

The new property of the Universe is termed as the gravitational viscosity. As the Hubble constant has the order $10^{-18}\ c^{-1}$, the gravitational viscosity practically has no an effect for local processes (for example, in gauges of Solar system). In a distance equal to half of medial distance between galaxies the forces of the gravitational viscosity become comparable with the centrifugal forces and answer for shaping of the medial-gauge structure of the Universe, that is for shaping of galaxies.

The concept of the gravitational viscosity of the Universe adjoins by a tight fashion to the concepts of affinities (parallel transport of vector) in a non-Euclidean geometry of multivariate spaces. For a motion of the nonconservative systems — that is in the general view — there is a relation for the curvature of space

$$K^j(t) = \frac{d^2X^j}{dt^2} + \Gamma^j_{ik}\frac{dX^j}{dt}\frac{dX^k}{dt} = \phi(t)\frac{dX^j}{dt}. \qquad (14)$$

The medial addend with Christoffel's symbols of the first kind (affine compendency) Γ^j_{ik} indicates a degree of normal curvature of space (we shall term it as geometrical curvature) in which the parallel transport of vector and the letter on change of the length of the vector, that is on the existence of a dissipation of energy. It determines so-called geodetic curvature of space

$$K = \sqrt{g_{ij}K^i(t)K^j(t)}. \qquad (15)$$

For the actual Universe the geodetic curvature is equal

$$K = K_0\sqrt{1 - \frac{v^2}{c^2}}, \qquad (16)$$

where $K_0 = Hc$ is the Universe constant equal approximately $10^{-10}\ m/s^2$.

In the whole the analysis of all the results shows that the motion concerning the Universe has a character of a terrain clearance motion, but on activity of the local physical laws it cannot be noted (except for inertia and redshift in spectrums of radiation of other galaxies).

6. The law of distribution of light and the Hubble diagram

The analysis of interaction of light with the Universe has shown that gravitational potential $-c^2$ acts on it,

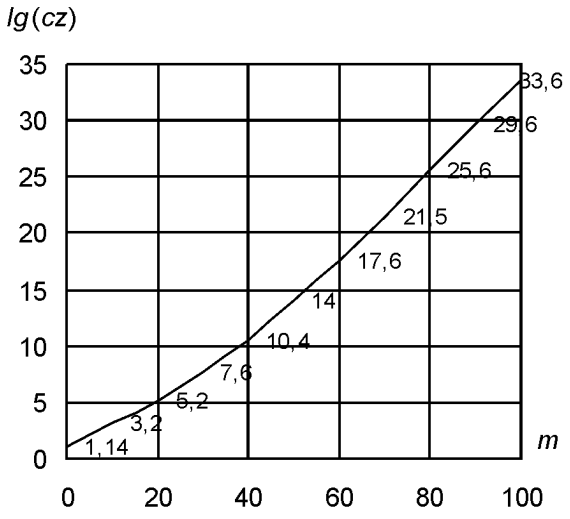

Figure 3: The Hubble diagram

giving power loss and, as a corollary, change frequency ν in relation to initial ν_0 under the law

$$\nu = \nu_0\,\mathrm{e}^{-r/R_0}. \qquad (17)$$

The given law completely permits photometer paradox, explains a nature of redshift in spectrums of radiation of other galaxies without engaging a Doppler effect and gives a new formula of definition of distances up to galaxies

$$L = R_0\ln(1+z), \qquad (18)$$

where z is a parameter of redshift of light frequency.

In view of the new law of distribution of light dependence "visual stellar magnitude m — redshift z" (the Hubble diagram) gains a view:

$$m = 5\lg\left[\sqrt{1+z}\ln(1+z)\right] + 21{,}68. \qquad (19)$$

In a gamut of apparent values of stellar magnitudes the given dependence practically is linear and completely coincides experimental datas (Fig. 3).

The law (17) completely explains a nature, numerical performances and character of allocation of background microwave radiation. Actually, it is not a relic of the Big Bang, and aggregate radiation of all radiants of electromagnetic radiation (stars, galaxies etc.) of the Universe. If to integrate the whole radiation impinging on a single site on space from zero to infinitum the temperature of this radiation will be determined by the formula

$$T_0 = \sqrt[4]{\frac{L_S\rho_0 R_0}{4\sigma M_S}}, \qquad (20)$$

where M_S, L_S is medial mass and complete radiation flow of a medial star (or galaxy); σ is Stefan-Boltzmann constant.

The evaluations show, that temperature of integrated radiation is equal to several degrees above terrain clearance zero (more precisely to calculate it is impossible), as it is observed actually. And its spectrum corresponds to a radiation spectrum of an absolute black body.

7. Large-scale structure of the Universe

The actual law of gravitation has a series of pleasant features. So, the evaluation of a binding energy of a material body of mass m from the Universe gives quantity

$$E_0 = -mc^2, \tag{21}$$

which is equal precision to an internal energy of a body taken with an inverse. In contrast to it, the law of Newton gravitation gives a minus perpetuity. That is why with application of a Newton's laws to the infinite Universe the gravitational paradox also has appeared. In the actual Universe with the actual law of gravitation such paradox does not exist, and the mass appears a measure of connection of the given material body with the whole Universe.

The actual law of gravitation gives one more important corollary: with mass shown in interactions with a material body depends on a relation of radius of a body R to radius of gravitational interactions R_0

$$M = \frac{R^2 c^2}{2GR_0}\left(1 - e^{-2R/R_0}\right). \tag{22}$$

At $R \ll R_0$ the mass of a body is proportional to its volume, and at $R \gg R_0$ (or that is the same when $R \to \infty$) to surface area of a body. It gives in a deduction about ability of a substance to create screen effect. It is capable to explain virial paradox and existence of gravitational-makes of areas of the Universe.

On the other hand, in classical physics there is a special theorem proving that inside a spherical-symmetrical material shell the gravitational field misses or, more precisely, that resultant of force, all the gravitational forces is equal to zero. Using of the actual law of gravitation it has appeared that the closer point is to a shell the stronger it is attracted to it. Differently, any spontaneous obturating of a material medium of the Universe as a shell conducts to the further shaping of such shell. That is why the Universe has cellular structure in major gauges where the aggregations of galaxies are in thin walls of these meshes and superaggregation and on crosses of meshes.

It is necessary to note, that Karlsson [5] has found out for the first time a cyclic change of a spectral radiant density of quasars proportional argument $\ln(1+z)$, where z is the redshift of their spectrums. Such allocation of quasars correlates with allocation of galaxies forming in the Universe homogeneous thin-walled aggregations as meshes.

In view of the formula (18) cyclic changes of a spectral radiant density of quasars are conversed to cyclic dependence of allocation of quasars on distances indicating homogeneity of the Universe not only in space, but also in time, that is on its stationarity for the last a minimum of 30 billions years (so much time the electromagnetic waves went to us from the farthest quasars).

8. Conclusion

Thus, the author has designed the new stationary model of the Universe which approximately on 30 parameters is compounded with the properties of the actual Universe and has the same right on existence as well as model of Big Bang.

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SPIN EFFECTS OF THE W-PRODUCTION IN HADRON-HADRON COLLISIONS

V.A. Zykunov[1]

Gomel State Technical University, Gomel, Belarus

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The processes of the single W-production in hadron-hadron collisions are suggested for investigation of the nucleon spin. An approach is proposed for the determination quark spin densities at low x.

1. Introduction

The spin crisis [1] induced a number of new experiments to investigate in more details the longitudinal spin structure of the nucleon by measuring polarization asymmetry in lepton-nucleon deep inelastic scattering (DIS). Nevertheless, it has to be mentioned that purely inclusive measurements determining the longitudinal spin structure functions $g_1(x,Q^2)$ for nucleons and deuteron are unfortunately restricted to probe only certain combinations of the polarized parton contributions to the nucleon spin. A full analysis would require additional inputs from other measurements to separate the different components.

Some new combinations of the polarized parton contributions can be obtain from experimental data on single spin asymmetries, when the polarized target is used in conjunction with an (un)polarized proton beam. Such possibility is offered by an planning experiment HERA-$\vec{N}$ [2] utilizing an internal polarized nucleon target in the $820GeV$ HERA proton beam. Such experiments could be done in some far future, after the original program of HERA-B is finished, using that detector, but by then most interesting questions will possible have already been answered by dedicated RHIC spin program at BNL [3] which is supposed to start in the near future. Besides, there are prospects on acceleration of the polarized protons to $1TeV$ at Fermilab Tevatron [4] and these would lead to similar physics, which will be accessible to the HERA-$\vec{N}$ and RHIC.

In this paper we are concerned with experiments which may provide direct measurements of new independent combination of the quark densities in polarized nucleon. We will focus on inclusive single W-boson production in hadron-hadron interactions with one longitudinally polarized beam

$$N + \vec{N} \to W^{\pm} + X \to l^{\pm} + X. \qquad (1)$$

[1] e-mail: zykunov@ggtu.belpak.gomel.by

2. Born cross section and single asymmetries

The process of the single W-boson production at hadron-hadron collision could be described by two pair of quark-antiquark subprocess. Our notations are the following: p_1 is 4-momenta of first unpolarized (anti)quark with flavour i and mass m_1; p_2 is 4-momenta of second (anti)quark with flavour i', mass m_2 and polarization vector η_2; k_1 is 4-momenta of final charged lepton l^- or l^+ (m); k_2 is 4-momenta of (anti)neutrino. We use the standard set of Mandelstam invariants for the partonic elastic scattering

$$s = (p_1 + p_2)^2,\ t = (p_1 - k_1)^2,\ u = (k_1 - p_2)^2. \qquad (2)$$

Squaring the matrix element of partonic subprocess we get the invariant parton-parton cross section in the Breit-Wigner form. Then according QPM we substitute $p_{1(2)} \to x_{1(2)}P_{1(2)}$, where $P_{1(2)}$ is 4-momenta of initial nucleons with masses m_N, $x_{1(2)}$ is the fraction of the first(second) nucleon momentum that is carried by the incoming quarks. We shall denote this procedure by operator "hat". Then we multiply on parton densities of first and second hadrons, sum over helicity of quarks (we use the covariant expression for the polarization vector of i' parton from [5]).

Let's introduce the Mandelstam variables for hadronic reaction (1)

$$S = 2P_1P_2,\ T = -2P_1k_1,\ U = -2P_2k_1,$$

and integrate over 4-momenta of unobservable neutrino. We can see that in this case

$$x_2 = x_2^0 \equiv -(x_1(T + m_N^2) + m_l^2)/D,$$

$(D = x_1S + U + m_N^2)$ and this substitution corresponds to born kinematics and we denote this by subscript "0".

In the hadron-hadron collisions the center of parton-parton masses frame has an undetermined motion along the beam direction. Therefore we use standard in this

case variables: centre-of-mass energy ($\sqrt{S}$), component of 4-vector of the detected particle transverse to the beam direction ($|k_{1\perp}|$), and rapidity (y). Integrating over azimuth Φ we have phase space $d^3k_1/k_{10} \Rightarrow \pi dy dk_{1\perp}^2$, and hence

$$\frac{d\sigma_{N\vec{N}\to l^{\pm}X}}{dydk_{1\perp}^2} = \sigma^{\pm} = \sum_{i,i'} \int dx_1 f_i(x_1, Q^2)\Sigma_0, \qquad (3)$$

where

$$\Sigma_0 = \Sigma|_{x_2=x_2^0} = \frac{\pi\alpha^2}{4N_c s_w^4} \frac{|V_{ii'}|^2 \hat{B}_{ii'} F_{i'}^{(2)}|_{x_2=x_2^0}}{\hat{s}((\hat{s}-m_W^2)^2 + m_W^2\Gamma_W^2)D},$$

where $1/N_c = 1/3$ is the color factor, $V_{ii'}$ is CKM mixing matrix, $B_{ii'} = u^2(t^2)$ for $d\bar{u}, \bar{d}u(u\bar{d}, \bar{u}d)$–types of quark subprocesses, $s_w = \sqrt{1-c_w^2}$ is the sine of the weak mixing angle, $c_w = m_W/m_Z$, m_Z is the Z-boson mass, Γ_W is the W-boson width, the summation runs over all types of quark and antiquarks both of initial hadrons, the combination of quark densities for second nucleon has the form

$$F_{i'}^{(2)} = f_{i'}^{+}(x_2) - c_{i'} p_{N_2} f_{i'}^{-}(x_2),$$

$f_i^{+(-)}(x)$ are spin averaged (longitudinally polarized) quark densities, $c_{i'} = -1(+1)$ for quark(antiquark), p_{N_2} is the degree of longitudinal polarization of second hadron.

Supposing that CKM matrix $V_{ii'} = \delta_{ii'}$ and neglecting the contributions of the heavy quarks (c,b,t) the single asymmetries (the ratio of polarization cross section part to unpolarization one) can be written as

$$A_{l\pm} = \frac{\Delta\sigma^{\pm}}{\bar{\sigma}^{\pm}}, \; A_{l-} = A_{l+}(u \leftrightarrow d), \qquad (4)$$

$$A_{l+} = -\frac{\int dx_1(u'(x_1)\Delta\bar{d}(x_2^0) - \bar{d}'(x_1)\Delta u(x_2^0))}{\int dx_1(u'(x_1)\bar{d}(x_2^0) + \bar{d}'(x_1)u(x_2^0))}, \qquad (5)$$

Here $u'(x_1) = K_t u(x_1)$, $\bar{u}'(x_1) = K_t\bar{u}(x_1)$, $d'(x_1) = K_u d(x_1)$, $\bar{d}'(x_1) = K_u\bar{d}(x_1)$,

$$K_{t(u)} = \frac{\hat{t}^2(\hat{u}^2)}{\hat{s}((\hat{s}-m_W^2)^2 + m_W^2\Gamma_W^2)D}|_{x_2=x_2^0}.$$

The physically allowed region of x_1 is given by

$$-\frac{U + m_N^2 - m_l^2}{S + T + m_N^2} \le x_1 \le 1.$$

Let's remark that in the region of large x_1 and small $|k_{1\perp}|/\sqrt{S}$ the expression x_2^0 do not depend on x_1 ($x_2^0 \approx -T/S$) and we can remove polarized parton densities $\Delta q(-T/S)$ from the integral. For verification of this we have estimated numerically the ratio

$$\frac{\int_{-1.2}^{1.2} dy \Delta\sigma^{+}(x_1 > x_1^*, x_2^0 = -T/S)}{\int_{-1.2}^{1.2} dy \Delta\sigma^{+}(x_1 > x_1^*, x_2^0 = -x_1 T/(x_1 S + U))}$$

in the vicinity of W-resonance and using spin-averaged and polarized quark densities from ref. [6]. The analysis has shown that this ratio equals ~ 1.2 for $x_1^* = 0.2$ and is not large then 1.06 for $x_1^* = 0.5$. Dividing the region of integration in (5) by parameter x_1^* (we can choose such value of x_1^* in order to have well defined polarized quarks densities in the region $x_1 > x_1^*$) we obtain the expression

$$\Delta u(x_2^0)\int_{x_1^*}^1 dx_1\bar{d}'(x_1) - \Delta\bar{d}(x_2^0)\int_{x_1^*}^1 dx_1 u'(x_1) = \qquad (6)$$

$$= A_{l+}\int_{x_1^{min}}^1 dx_1(u'(x_1)\bar{d}(x_2^0) + \bar{d}'(x_1)u(x_2^0))$$

$$-\int_{x_1^{min}}^{x_1^*} dx_1(\Delta u(x_2^0)\bar{d}'(x_1) - \Delta\bar{d}(x_2^0)u'(x_1))$$

and analogical one for A_{l-} by replacing $u \leftrightarrow d$.

The expression x_2^0 in conditions of collider experiment can reach very small values, so using, for example Tevatron kinematics point $\sqrt{S} = 1.8TeV$, $|k_{1\perp}| = 25GeV$, $y = 1.2$ we can see that x_2^0 do not exceed 0.005. It gives possibility to use equations (6) for the investigation the polarized quark densities in the region of very small x.

3. Conclusion

So, equations (6) connect the polarized quark densities in the region of small x with the observable single asymmetries, combination of unpolarized quarks densities (which is proportional to spin averaged part of cross section $\bar{\sigma}$ of process (1)) and polarized quark densities in the region where they are well defined. If three of the supplementary measurable quantities (for example double asymmetries $A_{\pm}(x,y)$ from [7] and QPM-expression for $g_1(x)$) are used, equations (6) allow to determine the low-x behavior of all polarized quark and antiquark distributions in nucleon.

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