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Physics and Space Science

Universal Gravitation Arise

Pulse Laser Deposition Technique

Highlights

Extreme State of Dark Energy

Semi-Analytical Established Factors

Discovering Thoughts, Inventing Future

VOLUME 19 ISSUE 9 VERSION 1.0

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Dark Matter is an Extreme State of Dark Energy (Fifth Interaction)

By Stanislav Konstantinov
Russian State Pedagogical University

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Strictly as per the compliance and regulations of:

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I. Introduction

In 2013, under the auspices of Rosatom in Russia, the Higher School of Physics was created to train and educate scientists of the new generation in the field of theoretical and experimental physics. The lecture "The Physics of Extreme States of Matter," President of RAS V.E. Fortov opened a series of lectures by outstanding scientists for this school [1]. The choice of their topic, of course, was not accidental. The physics of extreme states of matter underlies the modern understanding of the evolution and structure of the Universe. In connection with the importance of the topic, as well as responding to the words of Fortov: "The author will be grateful to readers for the critical comments, suggestions, and additions that are inevitable when presenting such a rapidly developing field as the physics of extreme states" I wrote this article. Perhaps the questions raised in it will interest readers, and their responses will provide scientists with food for thought about new approaches to the physics of extreme states of matter in Universe.

II. Cosmo Physics of the Universe

The science of the laws of the behavior of matter under extreme conditions and Cosmo physics are closely related and intertwined. The universe is as a source of unique information. In astrophysical objects, the time of existence of extreme states may vary from milliseconds to billions of years, which allows for their detailed observation and measurement using space probes, orbital and ground-based telescopes at different wavelength ranges. Comparison of space observations with laboratory results demonstrates deep analogies that testify, at a minimum, about the unity of the physical principles of substance behavior in a wide range of densities (approximately 42 orders of magnitude) and temperatures (10^{13}K). The information is about hydrodynamic mixing of highly radiating relativistic and magnetized streams and jets, solitons, etc. With an increase in the energy density (ρ and T), the substance acquires an increasingly universal structure, its properties are simplified.

An increase in pressure and temperature destroys molecular complexes; they form atomic states, which then lose the external electrons responsible for the chemical individuality of the substance, due to the ionization temperature and/or pressure ionization [1]. Unfortunately V.E. Fortov in his lecture could not (or did not want) to approach as dialectically as he approached the development of astrophysical objects, to the development of the Universe as a whole, including galactic and intergalactic space environment (dark matter and dark energy). Dark matter in astronomy and cosmology, as well as in theoretical physics, is a hypothetical form that does not emit electromagnetic radiation and does not directly interact with it. This property of dark matter even makes impossible its direct observation. The conclusion about the existence of dark matter is based on numerous, consistent with each other, but indirect signs of the behavior of astrophysical objects and the gravitational effects created by them. Clarifying the nature of dark matter will help solve the problem of hidden mass, which, in particular, lies in the anomalously high speed of rotation of the outer regions of galaxies. Of particular interest among astronomers was the Andromeda nebula, in which the speed of rotation of stars around its center does not decrease, as the celestial mechanics predicts, inversely proportional to the distance to the center of R, but remains almost constant. It may mean that the galaxy throughout its length contains a significant mass of dark matter ("galactic halo"). If dark matter attracts, possesses gravity, then anti-gravity is inherent in dark energy in a certain sense. It causes the universe to expand rapidly. Dark energy in the standard cosmological model (ΛCDM) is a hypothetical type of energy introduced into the mathematical model of the Universe for the sake of explaining its observed expansion with acceleration. In the standard cosmological model, dark energy is a cosmological constant Λ - a constant energy density that uniformly fills the space of the Universe (in other

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words, non-zero energy and vacuum pressure are postulated).

According to the observational data from the Planck space observatory published in March 2013, the total mass-energy of the observed Universe consists of:

- Dark energy (68.3%);
- Dark matter (26.8%);
- "Ordinary" (baryonic) matter (4.9%) [2].

Of the remaining 5% of baryonic matter, 4/5 of the mass falls on the interstellar medium, and only 0.5% of the average density of the Universe is concentrated in stars. It is with this 0.5% of the substance that the lectures of V. Fortov are dedicated, and the remaining 99.5% of the substance of the Universe remained practically not considered. The reason for this should be sought not in the absence of astronomical observations, but the absence of a coherent concept of the physical nature of the space environment (the ether). It is believed that astrophysics of the 20th century completely and irrevocably buried the notion of ether. The annihilating statement of the pillars of modern physics by A.Einstein and D.Neiman 1940 within the walls of the Priston Institute of Higher Studies that Tesla is trying to galvanize the long-decaying corpse of the ether substance still kills of a new cosmology. The title of the report delivered 2013 by President of the Russian Academy of Sciences V.E. Fortov within the framework of the 40th Astrophysical Assembly of COSPAR - "Back to the Future" is symbolic. The reference points for cosmology of the 21st century are of Einstein's General Theory of Relativity (GTR), a wonderful phenomenon of our Universe as a result of the Big Bang and unrestrained expansion the Universe under the influence of anti-gravity forces up to its destruction. Therefore, V.E. Fortov concluded his report words: "we can say that by doing this science and moving forward, we are going backward and getting younger in time" - but not in science [2].

III. Dark matter and Dark Energy are Extreme States of the Space Environment

I suggest in the theory of local expansion and contraction of the Universe on the basis of dark energy, dark matter and of baryonic matter, which rejecting the theory a cyclic universe with a time-variable Hubble parameter and the "Big Bang" theory. The dark matter is born in contact with the vortexes of dark energy in the strong magnetic and gravitational fields[3]. Several possible mechanisms for generating dark matter and baryon asymmetry have been proposed in the literature, which allow us to compare the energy density (mass) of baryons and dark matter particles ($\rho b,_{0} \sim \rho dm,_{0}$), however, no natural explanation of this fact. An international group of astronomers under the general direction of Sylvia Garbari of the University of Zurich (Switzerland) in 2019 conducted a simulation of various possibilities for the distribution of dark matter in the vicinity of the Sun. It turned out that even in the most moderate variant; its amount is comparable with the amount of baryon (ordinary) matter. New data on the dynamics of the 2,000 orange dwarfs of the spectral class K closest to our star were used to determine the density of dark matter in the vicinity of the Solar System. As a result, it turned out that the density of such matter in the vicinity of the Sun is 0.022 solar masses per cubic parsec, or 0.85 GeV/cm^3 $\sim 12\times10^{-25}$ g/cm^3. In this case, the density of baryonic matter in the same area is estimated by the authors at 0.098 solar masses per cubic parsec, or 3.8 GeV/cm^3 $\sim 50\times10^{-25}$ g/cm^3. Dark energy is distributed more evenly throughout the Universe, and its density is measured with an accuracy of a few percent $\rho_v = (0.721 \pm 0.025)10^{-29}$ g/cm^3 [4]. In the article, I propose a "natural" mechanism for the generation of dark matter and baryonic matter based on deep analogies with the behavior of a superfluid medium ^{3}He-B. The formation of significant masses in the vortices of dark energy, much larger than the mass of the medium, explains the mechanism of the phase transition of dark energy into dark matter. Dark matter gathers into bunches, is attracted to galaxies and forms halos around them, which extend to several galactic radii. These halos predict the observed dark matter distribution in galaxies and are derived from observations using modern radio telescopes. So, the statement of V.E. Fortov that with an increase in the energy density (ρ and T) the substance acquires an increasingly universal structure, the properties of the substance are simplified due to the destruction of molecular complexes and atomic states, it is necessary to add the conclusion that manifested during astronomical observations. This conclusion becomes logical as soon as we recognize that the transformation of baryonic matter in extreme conditions of Cosmos continues until the formation of the galactic and intergalactic medium and the reverse transformation. V.E. Fortov, in his studies of extreme states of matter, stopped a step away from creating a theory of the space environment. Further development of the theory of superfluid media made it possible to consider phase transitions in models of the physical vacuum, similarly to phase transitions in superfluid ^{3}He-B [5]. L.B. Boldyreva, in her model of superfluid physical vacuum (SPV), significantly expanded the analogy between the properties of superfluid ^{3}He-B and the space environment (dark energy and dark matter) mainly by taking into account the properties of the vortices: spin and electric polarization of the medium in the vortices, inertial properties of vortices, and superfluid spin currents between them [6]. That Maxwell himself endowed the light-carrying environment in which vortex

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electric fields and currents of displacement, necessary for him to derive the famous equations of electrodynamics, with properties surprisingly close to the properties of a superfluid quantum vacuum, have arisen [7]. Here are these properties:

1) The rotation of the particles of the medium, which, according to the quantum vacuum model, is comparable with the presence of spin in quantum forming the dark energy;
2) The translational motion of particles of the medium without friction between themselves and without loss of energy, which can be interpreted as the absence of shear viscosity and superfluidity in the dark energy;
3) The rotation of the particles of the quantum vacuum without slipping, which, essentially, is the rotational viscosity;
4) The formation of vortices during the propagation of electromagnetic waves, which fully coincides with the conclusions of the quantum vacuum model;
5) Dielectric properties of the light-carrying environment the quantum vacuum. Maxwell called the component (dE / dt) in his equations "bias current", bearing in mind that an electric field is created in a luminiferous ether when excited due to the relative motion of its differently charged particles that form a dipole. In quantum electrodynamics (QED), this phenomenon the polarization is characterized by the production of electron and positron pairs in a physical vacuum (dark energy and dark matter) [8];
6) The formation of a significant mass in the dipoles, a much larger mass of particles of the medium, which is identical to the property of the vortices in the dark matter.

The last property of the quantum vacuum explains the mechanism of the phase transition of dark energy into dark matter, during the formation of massive domains in the gravitational and magnetic fields of galaxies.

Tesla, refers to the work of Maxwell, wrote: "Almost thirty-three years ago, Maxwell, continuing the promising experience of Faraday 1845, developed an ideally simple theory that combined light, heat rays and the phenomenon of electricity, explaining their origin with vibrations of a hypothetical fluid of an incomprehensible thin structure called ether …" [9].

Most galaxies rotate so fast that they should break apart, but the invisible "halo" of dark matter should hold them together. The author of the local theory of the expansion of the Universe, a professor at Moscow State University A. Chernin, argues that in intergalactic space, where there is no gravity mass and magnetic field of large cosmic formations (galaxies) acting on dark energy, neither dark matter nor baryonic matter exists, but one dark energy [10].In intergalactic space around galaxies RZG is the radius of zero gravity where the force of gravity and repulsion are equal. When R <RZG predominant attraction, with R> RZG - repulsion. The paper A.Chernin calculated "the value of the radius around the local group $(\mathrm{RZG}) = 1.4$Mpk. The local group this gravitationally bound quasi-stationary system with a total mass $M=(2\text{-}3)\times10^{12}\ M_{\theta}$" [10]. This mass constitute the "normal" (baryonic) matter of stars and interstellar medium, and dark matter, which is about five times more. Assuming that dark matter can be considered as an analogue of the spontaneously ferromagnetic β-phase of the superfluid ^{3}He-B, then in the space defined by the radius RZG, the physical cause of formation of domains of dark matter may be due to spin polarization of dark energy vortices in the powerful magnetic field of the galaxy, that is, by the effect Einstein - de Haas. Effect of Einstein - de Haas: this rotation liquid volume during magnetization. Since the magnetization of the atoms ^{3}He does signify their spin polarization, then the Einstein-de Haas effect is the rotation of the volume of the liquid at $dS/dt \neq 0$ where S is the total spin of the extracted volume of the liquid. It can be assumed that many polarization physical phenomena in baryonic matter and dark energy must have the same nature and proceed identically. The formation of significant domains in the form of quantum spinors in the vortices of dark energy, much larger than the mass of the medium, explains of the phase transition of dark energy into dark matter. The presence of additional gravitating masses of dark matter in near-Earth space was discovered during experiments with artificial earth satellites (AES) equipped with magnetometers. With the help of magnetometers, it was possible to detect moving vortex formations of dark matter in the near-earth medium having the form of tangential cylinders, with axes parallel to the axis of rotation of the Earth [11]. The velocity of the satellite relative to dark matter was determined from the change the intensity of the magnetic field. The experiments were conducted in the A.F. Mozhaysky Military-Space Academy in the 90s of the 20th century, under the leadership of the Deputy Head of the Academy for Scientific Work, Professor V.Fateev. Head of the Department is Colonel V.L. Groshev published the results of dark matter detection in his book [11]. Academy staff found that in areas of tectonic faults, where there is intense electromagnetic and gravitational energy interaction between the liquid magma of the Earth and the cosmic dark matter, are formed toroidal luminous vortices with sizes ranging from micro particles to tens of meters (rotators, spinors, hadrons) [11]. It is interesting that the quantum spinors of dark matter in the form of tangential cylinders with axes parallel to the axis of rotation of the Earth are found not only in near-earth space, but also in the molten magma of the earth's core [12] The mechanism of the formation of halo from dark matter with a radius (RZG) in space around

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galaxies may be similar to the mechanism that causes the formation of stars from interstellar matter - the Jeans gravitational instability. J. Jeans (1902) for the first time showed that the initially homogeneous gravitating medium with density ρ is unstable with respect to small density perturbations [13]. If there is a condensation in the medium, then the gravitational forces will tend to increase it, and the elastic forces will tend to expand the medium and return it to its original state. Under the action of these oppositely directed forces, the medium will either come into an oscillatory motion, or will experience a monotonous motion. The nature of the movement depends on the relationship between the wavelength of the perturbation and some critical magnitude, called the Jeans scale:

$$L = cs\,[\pi /(G\rho)]^{1/2} \qquad (1)$$

The value the Jeans scale (L) depends on environmental parameters: velocity of acoustic vibrations in a medium (the speed of the longitudinal wave) cs, density ρ, and gravitational constant G. It defines the minimum scale perturbations, from which the elastic force of the not able to withstand the forces of gravity. It leads to the gravitational instability of the medium [13]. In this small-size random packing, medium grows in time if they cover an area of linear size $L > L_J$. Perturbations with scales smaller than the Jeans length $L < L_J$ are acoustic vibrations. For today, one is reliably known the existence of four fundamental interactions (excluding the Higgs field): the gravitational interaction; the electromagnetic interaction; the strong interaction; the weak interaction. Analysis of experimental data associated with the investigation of the anisotropy of physical space allows us to assume the existence of a fifth interaction (of fifth force) [14]. 2019, the Space Telescope of the European Space Agency Gaia monitors the active stellar flow S1, moving at a speed of 310 m/s, relative to the solar system. The author of the study, Pierre Sakivi, suggests identifying wimps, candidates for the role of the main component of cold dark matter and a new interaction force (fifth force), which sets in motion the stellar flows. Hungarian physicists discover new evidence that hints at the fifth fundamental force of nature. Attila Krasznahorkay and his group at the Hungarian Academy of Sciences' Institute for Nuclear Research in Debrecen, Hungary, initially published their new discovery in January 2016 in the journal Physical Review Letters. Protons were aimed at lithium-7, a collision that created unstable beryllium-8 nuclei, which then decayed into pairs of electrons and positrons. At about 140 degrees, the number of these pairs increased, creating a little bump before dropping off again at higher angles. According to Krasznahorkay and his team, this ‘bump’ was evidence of a new particle. They calculated that the mass of this new particle would be around 17 MeV, which isn’t what was expected for the ‘dark photon’, but could be evidence of something else entirely. The end result was a new boson particle that was only 34 times heavier than an electron [15]. The graph shows (Fig. 1) that deviations are observed only for two values of the energy of incident protons Ep=1.10 MeV and Ep=1.04 MeV, while other energy indices do not. For protons with the energy lower than the Ep=1.04-1.10 MeV the bump, evidence of the decay of a new particle, not been observed Ep=0.80 MeV. However, the bump has neither been observed and for protons with Ep=1.20 MeV. This says of a fact of the resonant interaction between protons and the new particle the dark matter. Skeptical of the discovery the professors Attila Krasznahorkay, doctor of physical Andrei Rostovtsev. He said: “Deviations are observed only at two values of the energy of the incident protons, with other energy indicators this is not. The proton energy was slightly changed - and the “burst” disappeared. This usually happens when certain experimental difficulties arise.” [16]. It seems to me that Rostovtsev’s statement is not convincing enough since he ignores the role of resonance in of production the beryllium, and of electron-positron pairs at of the decay of a new particle the dark matter. The role of resonances in the occurrence of fluctuations and the birth of particles in the space environment is undeniable [17]. For proton energy Ep=1.00 MeV I identified the frequency and wavelength for the new particle the dark matter as follows:

$$\nu = Ep / h \text{ or } \quad \omega = Ep / \hbar \quad \text{and} \quad \lambda = 2\pi c / \omega \qquad (2)$$

where Ep - the proton energy

h - Planck constant $h = 6.6260 \cdot 10^{-34}$ J / Hz

$\hbar = h / (2\pi)$ $\hbar = 1.0546 \cdot 10^{-34}$ J / Hz

c - the speed of light $c = 299792458$ m / s

$$Ep_r = 1 MeV = 1.6493 \cdot 10^{-13} J; \ \nu d = 2.4891 \cdot 10^{20} Hz; \ \omega d = 1.4945 \cdot 10^{21} Hz; \ \lambda d = 1.23 \cdot 10^{-12} m \quad (3)$$

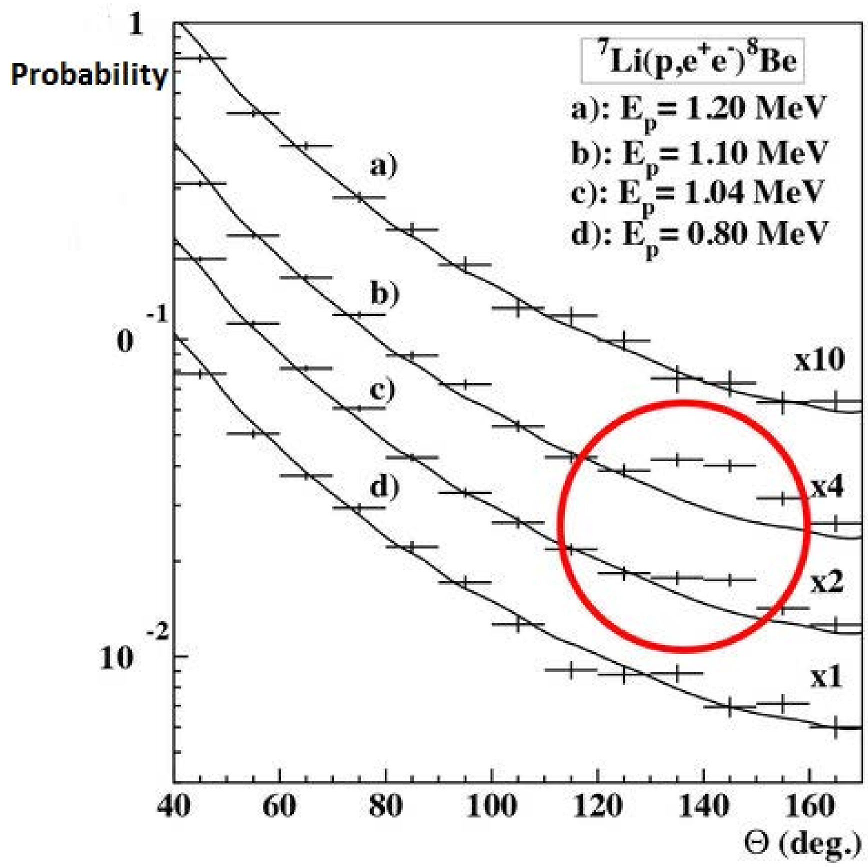

Figure 1: The probability of interaction of protons with a new dark matter particle (fifth interaction)

In quantum electrodynamics (QED), the vacuum polarization (dark matter) consists in the formation of virtual electron-positron pairs under the influence primary high-energy electrons and protons, of a quantum of the electromagnetic field of a photon or under the influence of a peak electric field. The experimentally established the initial boundary of the polarization of vacuum (dark matter) corresponds to a photon with energy Wphot ≥1 Mev = $1.6493 \cdot 10^{-13}$ J [8].

$$W = h \cdot \nu = e_0 \cdot E \cdot d \quad (4)$$

where h is the Planck constant;

ν is the proton frequency;

e_0 is the electron-positron pair charge (dipole);

E is the electric field strength;

d is strain value the dark matter

Please note that red "photo effect" boundary for a photon energy value coincides with the proton energy value in the experiments the Hungarian physicists at of production the beryllium and of electron-positron pairs at of the decay of a new particle the dark matter. With the polarization of the vacuum and its transformation into the matter, the change in the energy of the vacuum w can be represented as a sum:

$$w = w^p + w^e \quad (5)$$

where w^p is the vacuum polarization, $w^p << E^2 / 8\pi$;

w^e is the change in the energy of the substance at the production of particles

$$w^e = eET\varkappa, \quad \varkappa = \frac{e^2E^2T}{4\pi^3} \exp(-\pi \frac{m^2}{\hbar E})$$

The creation of particles is the main reason for the change in the energy of the vacuum. The small value of the reverse reaction w^p implies the limitation on the electric field strength for a given time T (Es ≈ 10^{16} V·cm^{-1} is the critical Schwinger's field) [18].

From expressions (4) and (5) we find the strain value (sizes) the new particle the dark matter in the experiments the Hungarian physicists:

$$d = \frac{Ep_r}{Es \cdot e_0} \ d = \frac{1.6493 \cdot 10^{-13} N \cdot m^{-1} (J)}{10^{14} V \cdot m^{-1} (N \cdot C^{-1}) \cdot 1.602172 \cdot 10^{-19} C} \approx 1.03 \cdot 10^{-18} m \quad (6)$$

Today scientists at the Large Hadron Collider at CERN think that they may have discovered a new particle, the decay of which gives rise to muon pairs in a narrow peak of the energy of colliding protons strictly defined at 28 GeV, but it is too early to draw final conclusions. Among physicists, this particle causes not

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only excitement but also an alarm. Unlike the Higgs boson, predicted by the theory of elementary particles in the framework of the simplest version of the Standard Model (SM), the new particle can threaten the CM. The new result - consisting of a mysterious bump in the data at 28 GeV - has been published as a preprint on ArXiv and Roger Barlow's article was published as an on November 13, 2018 [19]. The LHC collaborations have very strict internal review procedures, and we can be sure that the authors have done the amounts correctly when they report "4.2 standard deviation value". This means that the probability of obtaining the peak of this large randomly generated noise in the data, rather than a real particle, is only 0.0013%. In a way, it seems that this should be a real event, not a random noise. If this particle really exists, then it should be outside the standard model, where no one expected it. In most cases, pairs of muons come from different sources from two different events, and not from the decay of a single particle. If you try to calculate the parent mass in such cases, it will spread over a wide range of energies, rather than creating a narrow peak. In the new experiment, the CMS detector detected a large number of pairs of muons and, after analyzing their energies and directions, found that these pairs originate from the decay of one parent particle. You can look at Figure 2 and judge for yourself. Is this a real peak or is it just a statistical wobble due to random scatter of points in the background (dashed curve)? If it is real, it means that some of these pairs of muons are really descended from a large maternal particle the dark matter which decayed, emitting muons - and none of these particles have ever been seen before.

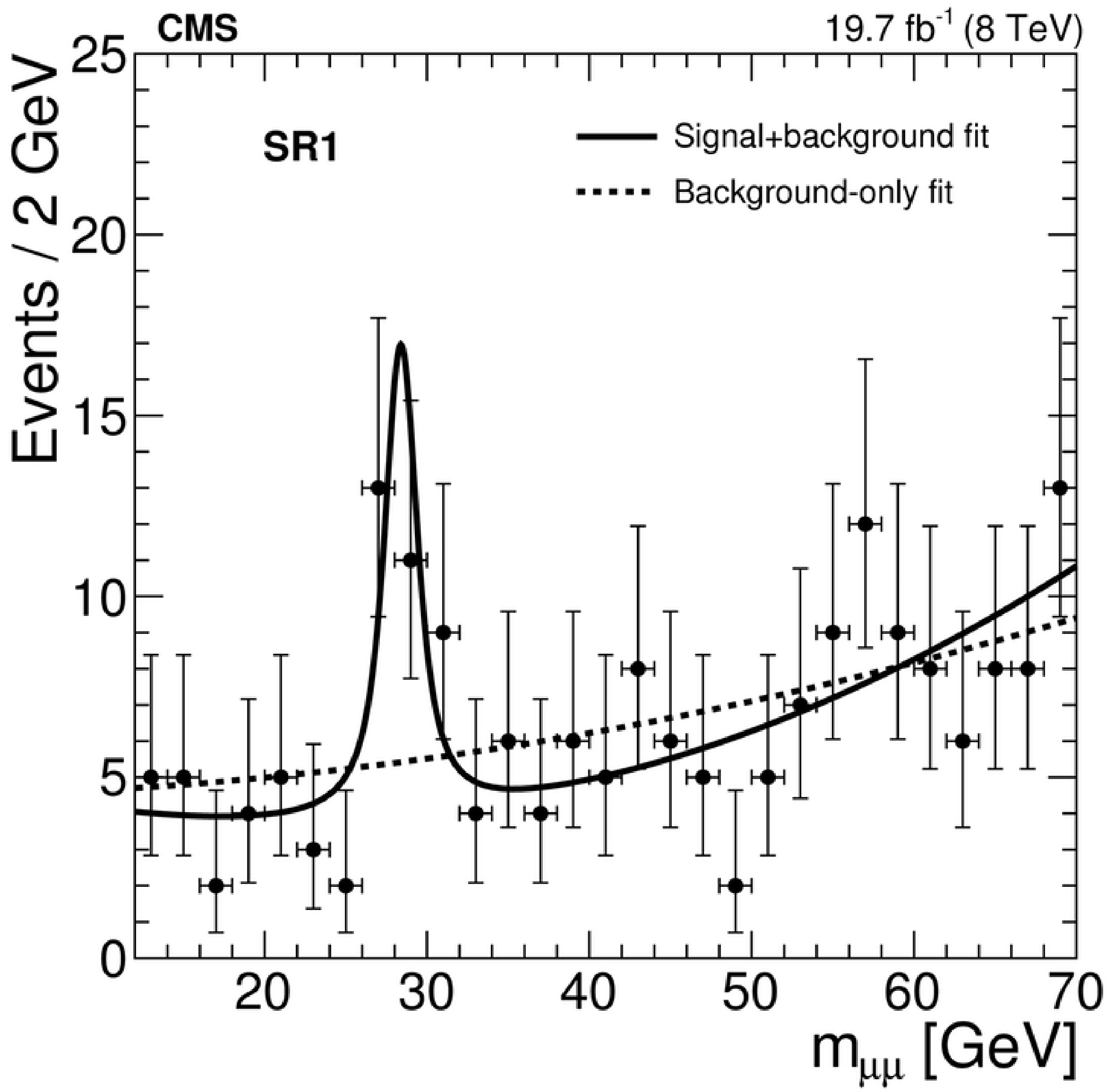

Figure 2: Of interaction of protons with a new dark matter particle (fifth interaction) in the LHC (Peak of energy at 28GeV)

I should note that the direct experimental determination of the resonance dependence of the production of elementary particles and antiparticles under the action of the frequency ν of external radiation and relativistic protons in a quantum vacuum (dark matter) is almost completely rejected by modern physics. Following the deceptive logic the modern theory, this dependence is drawn in the form of a monotonously increasing curve, which contradicts the experimental discoveries made recently in the LHC and in near-Earth space using the PAMELA and AMS-2 space spectrometers [20]. The US team, led by the lead author of the arXiv report, Dr. Jonathan Feng from the University of California, Irvine, showed that the data Dr. Krasznahorkay didn't conflict with previous experiments, and established that it could be evidence for a fifth fundamental force. Jonathan Feng in a press release in 2017 said: "For decades, we've known of four fundamental forces: gravitation, electromagnetism, and the strong and weak nuclear forces. Discovery of a possible fifth force would completely change our understanding of the universe, with consequences for the unification of fifth force and dark matter. Dispensing with the dark photon, the physicists posit a "protophobic X boson." The X-boson of dark matter makes it possible to explain a number of experiments in which the anomalous magnetic moment of the muon is observed and is associated with the fifth interaction". According to the head of the group Jonathan Feng, if in the future experiments the fifth force is confirmed, this will completely change our view of the universe. Estimated the X-boson lifetime may be 10^{-14}s. [21].

There are amazing data catalytic decomposition $H_2S = H_2\uparrow + S\uparrow$ with exothermic catalytic reaction and $H_2 + S = H_2S$ also generate heat. Both of these reactions do not require energy. But this is a direct violation of the Law of Conservation of Energy in terms of thermodynamics! A catalyst for the modern definition, does not introduce additional energy into the process which it catalyzes. However, practice shows - the catalyst brings extra energy! The only reasonable explanation for this the participation of dark matter in the exothermic reactions of catalysis and revision of the Law of Conservation of Energy in terms of thermodynamics! That's exactly what did in 1999 the scientist, Randell Mills, of the United States, when opened a new, virtually inexhaustible source of cheap energy associated with the transfer of hydrogen to a new, previously unknown, low-energy state called "hydrino" [22].

Figure 3: Solar cell power company BrLP named its device called SunCell ("solar cell"). (General form)

According to Mills, the energy is released when hydrogen atoms go to a newly discovered state—are transformed into hydrino and their electrons transfer to lower energy levels. The hydrino concept explains how solar perturbations involving dark matter collect more energy than it is able to transmit as light. According to the results of experiments at company BrLP, confirmed by external observers, when a megawatt of radiant

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energy was issued, the energy consumption of the unit, called SunCell, was only 8 kW. The main fuel for the reaction is ordinary water. Hydrino-hydrogen released, being lighter than air, rises into the high layers of the atmosphere and from there into outer space. According to BrLP, the powerful radiation arising during the reaction is concentrated in areas of $\lambda d = (20\text{-}170) \cdot 10^{-9}$ meter waves, which are widely present in space.

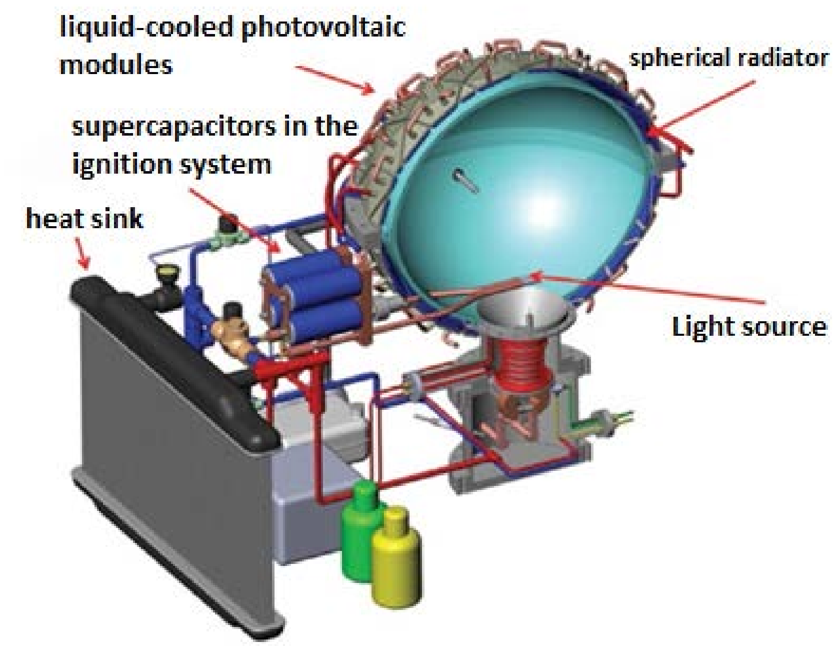

Figure 4: Sun Cell device diagram ("solar cell")

BLP is currently testing a device called the SunCell in which hydrogen (from splitting water) and an oxide catalyst are introduced into a spherical carbon reactor along with dual streams of molten silver. An electric current applied to the silver ignites a hydrino-forming plasma reaction. Energy from the reaction is then trapped by the carbon, which acts as a "blackbody radiator." When the carbon heats up to thousands of degrees, it reemits the energy as visible light that is captured by photovoltaic cells, which convert the light to electricity.

Based on the results of the above experiments, it can be argued that under extreme conditions baryonic matter can turn into the dark matter with energy release and dark matter into baryonic matter (electron-positron pairs in a quantum vacuum) with energy absorption. From this point of view the quantum vacuum (dark matter), by definition, is in the lowest energy state.

Phase state characterizing dark energy, are considered in the model as analogous the superconducting α-phase ^{3}He-B. Consider the antigravity mechanism inherent in dark energy. Similarly to the interaction of vortices in superfluid ^{3}He-B, vortices in the environment of dark energy should also interact. In ^{3}He-B, the magnetization of vortex cores takes place along the axis of the vortex, that is, there is a spin polarization of the superfluid liquid. Thus, the space environment in the turbulent region can be characterized by the state of "all-round stretching"[3]. In the framework of the hydrodynamic model, the effect of a superfluid fluid on the vortex core can be mathematically described by the introduction of pressure P at the boundary of the vortex core. The sign of pressure depends on the nature of the internal stresses in the medium. If these the internal stresses in the dark energy have the character of "all-round stretching", then the pressure will be negative. That is all the dynamic characteristics will have a sign opposite to that which they would have had for the usual ideal incompressible fluid with the same kinematic properties [23]. This behavior of the system is similar to the presence of a negative mass. Strength Fp - a repulsive force acting on the space environment (dark energy):

$$Fp = -\int_{S'} Pn\,ds, \quad (7)$$

where n - external normal to the surface S'

ds - an infinitesimal element of the surface

Fp has the effect of anti-gravitation and may cause the accelerated expansion of the universe[3]. Einstein's antigravitation obeys the linear dependence of the force on the distance:

$$F_e = (c^2/3) \cdot \Lambda \cdot R, \quad (8)$$

where Λ is the Einstein's cosmological constant.

The cosmological constant Λ in equation (8) describes the elastic properties of the medium, and the formula itself (8) in accordance with Hooke's law describes the repulsive forces between the structural

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elements forming dark energy. For a homogeneous isotropic the dark energy the generalized vector Lame wave equation is valid. This equation is equivalent to two simpler wave equations, which describe elastic waves of two types: longitudinal waves that propagate with phase velocity Vp and transverse waves with phase velocity Vs. It can be gravitational, electromagnetic and torsion waves. The speed of propagation of longitudinal waves is higher than the transverse. Gravitational waves can be attributed to the longitudinal waves since according to the calculations of Laplace, their speed should exceed the transverse electromagnetic waves at least 7000000 times [24]. In 1994, when July 16, 1994, the great nucleus of the comet Shoemaker-Levy collided with Jupiter gas sphere, radial oscillations gave rise to the surface gravity waves, instantly resulted in fluctuations in several geodetic satellite command-measuring complex of Russia. Speed, formed by the collision of a comet with Jupiter, gravitational waves significantly exceeded the velocity of electromagnetic waves (light spreads from Jupiter to Earth is about 1 hour). The model of the quantum vacuum as an analog of superfluid ^{3}He-B clearly shows how microscopic processes studied only by quantum mechanics manifest themselves in macroscopic processes. This situation fundamentally changes the traditional understanding of the relationship between the microscopic level, described in terms of particles and the macroscopic level, described in terms of concentrations, densities, and volumes.

IV. Conclusion

In the article, I touched upon only some issues of the physical nature of extreme states of matter in the cosmic environment (dark energy and dark matter), which were not adequately reflected in the lecture by the Academician V.E. Fortov "The physics of Extreme States of Matter" [1]. I would like, based on analogies between the quantum vacuum of Universe and superfluid ^{3}He-B, to offer a new look at extreme states of matter, including the dark matter and to wish the higher school of physics to overcome the dominant today the unsolved problems of Einstein's General Relativity when considering cosmology of the Universe.

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References Références Referencias

1. Fortov V.E., *Lectures on the physics of extreme states of matter*, - Moscow: Ed. House MEI, (2013).
2. Jean – Loup Puget, *The sight on the relic background*, - Scientific American, No.9, 2014
3. Konstantinov S.I., *The cosmological constant and dark energy: theory, experiments and computer simulations*,- Global Journals Inc. (US) GJSFR-A, Volume 16, Issue 5, (2016).
4. Hinshaw G et al., arXiv: 1212.5226
5. Eltsov V.B., Kibble T.W., Krusius M., Ruutu V.M., and Volovik G.M., *Composito defect extends analogy between cosmology and ^{3}He,* - Physical Review Letters 85 (22) (27 Nov 2000).
6. Boldyreva L.B., *What does physics granting physical vacuum properties of superfluid ^{3}He-B*, - Moscow: URSS, (2011).
7. Maxwell J.C.: *On Physical Lines of Force*. Philosophical Magazine and Journal of Science, [4 series] 21 No. 139 (March 1861), pp. 281-291 and No. 141 (May 1861), p. 338.
8. Stanislav Konstantinov *Polarization of Vacuum* - Open Access Journal of Physics, Volume 2, Issue 3, (2018), PP 15-24
9. Nikola Tesla, *Problems of increasing the energy of mankind*, - "The Century" Monthly Illustrated Magazine, June, (1900)
10. Chernin A.D. *Dark energy in the nearby Universe: HST data, nonlinear theory and computer simulation,*- Physics – Uspekhi, Vol.56, No.7, (2013).
11. Groshev V.L. *From gravity – through hadron, the Tunguska phenomenon, Chernobyl and Sasovo – up to lithospheric disasters*-, St. Petersburg: MSA, (2002)
12. Litasov K.D., Shatskiy A.F. *Composition and constitution of the Earth's core* – Novosibirsk Publishing House of the Siberian Branch of the RAS, 2016, p.90
13. Jeans, J. H. *The Stability of a Spherical Nebula*, - Philosophical Transactions of the Royal Society A. 199: 1–53. Bibcode:1902RSPTA.199....1J. doi:10.1098/rsta.1902.0012. JSTOR 90845 (1902)
14. Yu.A. Baurov, Yu.G. Sobolev, F. Meneguzzo, *Fundamental experiments on the detection of the anisotropy of physical space and their possible interpretation,* - M: Bulletin of the Russian Academy of Sciences: Physics ISSN, Vol.79, No.7, pp.1047-1052, (2015)
15. Attila Krasznahorkay other, *Observation of Anomalous Internal Pair Creation in 8Be: A Possible Signature of a Light, Neutral Boson* - Phys. Rev. Lett. 116, 042501 (2016)
16. Sources, *Hungarian physicists discovered the fifth power of nature?* -Newspaper.Ru, 05/26/2016
17. Konstantinov S.I. *The Higgs boson and the resonances at the Large Hadron Collider* - Physics & Astronomy International Journal, Volume 2 Issue 5 (2018)
18. Adornov T.K., Gavrilov S.P., Gitman D.M., Ferreira R., Peculiarities of the production of particle pairs in a peak electric field, - M: Russian Physics Journal, Vol. 60, N3, (2017)

19. Roger Barlow, *The Conversation- Has CERN discovered a particle that 'threatens our understanding of reality'?* -Science & Technology, November 13, (2018)
20. Konstantinov S.I., *Generation of secondary electrons and positrons in the near-Earth space environment from the data of experiments PAMELA, FERMI and AMS (2006-2016),*- Global Journals Inc. (US) GJSFR-A, Volume 17, Issue 2, (2017)
21. Jonathan L. Feng, *Protophobic Fifth Force Interpretation of the Observed Anomaly in 8Be Nuclear Transitions* -arXiv: 1604.07411v2 [hep-ph] 15 Aug. (2016)
22. R. Mills and P. Ray, "Extreme ultraviolet spectroscopy of helium-hydrogen Plasma," J.Phys. D 36 (2003) 1535
23. Sedov L.I. *Continuum mechanics*,- Moscow: Science, (1994)
24. Laplace PS // *Statement of the system of the world*. -L .: Science, (1982).

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Compendium of Near-Wall Interaction Problem and Boundary Conditions on Smooth Solid Boundaries in Dynamics Problems of Continuous Fluid Media

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Abstract- Specific aspects of wall laws and, especially, two-phase smooth-wall dynamic interaction of continuous fluid medium with solid fragments of fixed boundaries in investigated area of its motion are discussed in concise form.

Boundary conditions for boundary value problems of macro-thermo-mechanics in conditions of fluid philicity and fluid phobicity effects occurrence, as well as of processes of conductive and radiative energy transfer through contact layers of solid and fluid binary interacting phases are presented.

Keywords: continuous fluid media, dynamics, contact surfaces, wall laws, adhesion, cohesion, slipping, boundary conditions, energy exchange, heat transfer, conductive, radiative.

GJSFR-A Classification: *FOR Code: 040499*

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I. Introduction

The topic of this study is characterized by high *complexity* and deficit in the degree of validity of our understandings of physical essence of phenomena considered here, as well as theoretical and applied *topicality* of problems discussed in the paper.

The difficulty stems from the fact that the extremely wide class of internal (channels) and external (flow around bodies) problems of macro-thermo-mechanics includes fragmentarily solid borders with inevitable appearance of force and thermal interactions of contact molecular-atomic layers of respective phases. These processes are accompanied by effects of fluid phase adhesion (or anti-adhesion) to wall (from wall) requiring, as it will follow from subsequent stipulations, *additional studying*.

Here it is reasonable to clarify: prefix *"macro-"* in the term of *"macro-thermo-mechanics"* means that in this theory the scales of macro-motions are defined by topology of *physical point*, and micro-, meso-, nano- and molecular-atomic motions (hereinafter, simply, micro-motions) – by characteristic inter-corpuscle distances (liquid) or mean free paths of these monads (gases). The expressed qualitatively corresponds to Knudsen numbers $Kn < 10^{-2}$ for dropping liquids and $Kn < 10^{-3}$ for sufficiently dense gases [1, 2].

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Topicality is associated with at least two principally important circumstances.

- Boundary conditions, including those on walls, shall extrapolate the corresponding to phenomena physics solutions of respective closed model systems of integral-differential equations of dynamics of medium inside $\overline{V}$ area, i.e. in $S \rightarrow V$ direction (Fig. 1, notations are discussed below). This aspect is obvious [3], but its effective implementation is fraught with considerable difficulties. As an aside, we note that initial values of field functions can be interpreted as boundary conditions for slice in time $t = 0^+$, i.e. "right" zero, after applying action on boundary surface S of estimated flow area $\overline{V} = V \cup S$, $S = S_{\pm} \cup S_f$ (for $\overline{V}$ case in Fig. 1); hereinafter, the "+" superscript is omitted.

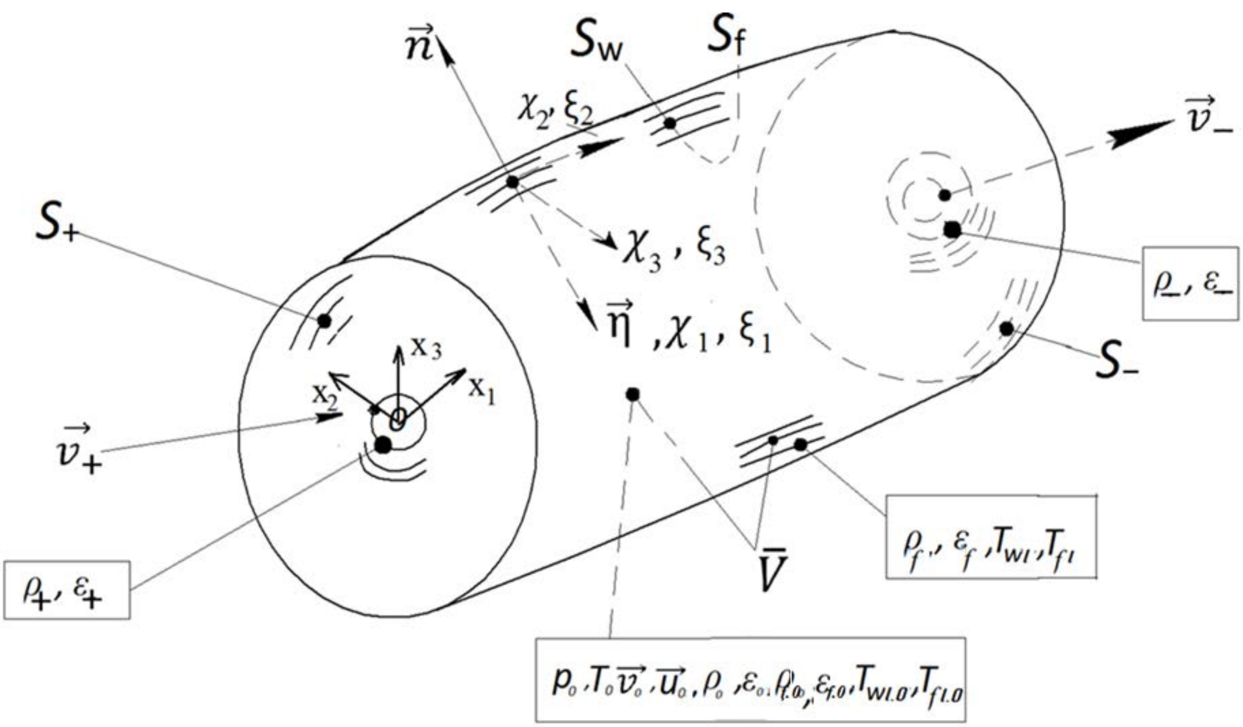

Fig. 1: Example of estimated flow area:

$\vec{v}$ – velocity / momentum per unit mass,

ρ – density, ε – internal energy increment

There are well known correct classical stipulations as well as formulations and rules of setting boundary conditions for quasi-linear differential equations of elliptic, parabolic and hyperbolic types providing (possibly in presence of some additional but not too strict limitations) existence and uniqueness of their solutions. Unfortunately, the considered in the theory being developed mathematical model is strongly nonlinear and, particularly, media $3D_t$ dynamics equations *associate* in themselves, both individually and in aggregate, the specific properties of solutions intrinsic to noted "reference" types of differential equations in partial derivatives of mathematical physics.

- In the most frequently observed intermittent and developed turbulent flows quasi-chaotic pulsations $\vec{v}, \rho, \varepsilon$ of monad/essential substances are distributed by the system of appearing therewith wave disturbances (the media are compressible) with local sound speed throughout the $\vec{x} \in \overline{V}$ space causing thereby aberration of initially fixed boundary conditions [4].

Hence, stipulations of respective boundary value problems turn out to be *objectively incorrect*, since it is obvious that, in general case, the requirement of obtaining *a unique* solution cannot be strictly satisfied. In the situation outlined, in any way, two alternatives are admissible assuming it quite acceptable to understand as *a generalized solution*:

- $\vec{v}, \rho, \varepsilon$ substances values (with rationally normalized dispersion) obtained according to *algorithm* described in *work* [4], with possible involvement of procedures of their *self-setting* in outflow section S_- (see Fig. 1) at completing computation time slots;
- Averaged, over *ensemble* of realizations of the respective boundary value problem in the range of low-level macro-scales wave and frequency numbers, values of noted variables at the forecast that these average values exist and admit their acceptably stable determination.

II. Main Part

We proceed with exposition of *the first topic* of the work (see the title), noting that notations not specified in the text are explained in publication [1].

The problem of identifying and explaining the laws of near-wall interaction of solid boundary with fluid phase actually determining respective boundary conditions and properties of flow at distances of strong, medium and weak action of surface molecular-atomic layer of the wall has been and remains the subject of scientific discussions. Intensity of these discussions in different historical periods had intermittent nature, but, as we observe, it has been significantly increasing in recent years largely due to development of nanotechnologies.

One of the main points in discussions there was a dilemma of existence or absence in the dynamics of the effect of sticking (slipping) fluid phase to (on) solid wall, or some combination of these two possibilities. Since a fairly complete overview in time aspect of essence of the mentioned studies based on theoretical prerequisites and experimental data is contained in compilatory part of monograph [2] chapter 7, we only confine to fixation of main results of these studies and statement of status of the specified problem in current years. The expressed below summary will, of course, take into account limitations in *Kn* numbers indicated in the introduction.

It is important to note that this problem has attracted attention of prominent physicists and, in particular, fluid mechanicians since 18th century up to the present day. It is understood that instrumental/technological equipment of those distant years allowed carrying out experiments only in the framework of macro-resolution, for example, experiments with water and mercury in glass tubes with minimum diameters of 1 mm [5 – 7].

Omitting details of judgments, we present general and quite reasonably formulated in monograph [2] results of analytical and experimental studies on the topic under discussion.

- By the middle of 20th century there established *"an opinion that slipping is possible, but it cannot be measured reliably by any available experimental techniques. Hence, for all practical applications the slipping is of no importance …"*, and in the literature almost exclusively *"for viscous liquid only the condition of sticking was used"*. The noted, of course, is referred also to sufficiently dense gases.
- For the current moment, *"despite numerous studies (experimental precision, up to molecular-atomic layers, as well as analytical at deterministic and statistical levels of molecular dynamic simulations – our addition) the final mechanism of slipping remains unclarified"* due to the following basic (in our opinion) reasons (see [2], 410, 430, 431):

∗ *"Slipping acts on molecular level"*

∗ *"Apparently, the thinnest layer of molecules of liquid yet still firmly "sticks" to solid body, but velocity gradient is so great that molecules above this layer move. The thickness of such "stuck" layer can be equal to only one layer of molecules ... or some higher"*;

∗ *According to modern understandings … flows of liquid have an inner layer of air (or other gas), and that leads to greater effective slip lengths"* as in effect of *"lotus leaf"*.

Note: in this paragraph, the text marked with quotes and additionally highlighted in italics is the citation from publication [2].

In terms of discussions and on phenomenological level of understandings we suggest and try, if possible, to justify, at least qualitatively, the author's view on the nature of near-wall interaction between surface layers of solid and fluid phases, which, in assumed absence of solid phase surface nano-structurization and gas interlayer between contacting pair of wall/dropping liquid, in principle, consistent with the last three statements marked with "asterisks".

Anticipating the stated below, we note that in Fig. 1 being the sample of estimated flow area for internal problem of fluid/gas dynamics, in addition to the previously mentioned, the following notations are specified: $S_w \wedge S_f$ – contacting solid and fluid surfaces; $\vec{\eta} \wedge \vec{n}$, x_κ and $((\chi = \chi_1,\chi_2,\chi_3) \vee \chi_k) \wedge ((\xi = \xi_1,\xi_2,\xi_3) \vee \xi_k), k = 1,2,3$ internal and external normals to *S*, global (for entire estimated flow area $\overline{V}$), as well as local Cartesian coordinate systems for micro-, meso-, nano- and molecular *linear* scales for substance-field (to the left of ∧ sign; hereinafter, to shorten the records, simply, *micro-scales*), and macro-scales of physical points (to the right of ∧ sign), respectively. Next: $p \wedge T$ is compression pressure and absolute temperature; subscripts +, -, *w*, *f*, *wl*, *f l*, 0 is assignment of field functions to S_+, S_-, S_w, S_f surfaces and initial values of these functions. It is also understandable satisfaction of collinearity conditions $(i_k \chi_k \wedge i_k \xi_k) \| (\vec{\eta} \wedge \vec{n})$, where i_k is unit vector of respective coordinate axis. Finally, equalities $\chi_1 = \chi \wedge \xi_1 = \xi$ for coordinate axis, orthogonal axis $S_w \wedge S_f$, are introduced for further simplification of notations in graphic representations related to this coordinate direction.

We now turn directly to the problem of binary interaction of $S_w \cup S_f$ boundaries, but first note the following. An understanding seeming, at first sight, elementary, but as a whole, obviously fair, of qualitative type of force interaction between two individually allocated *molecules* of the substance has been widely established. Namely, the emergence and rapid growth of *repulsive*/repulsion force during *approaching* of these molecules/corpuscles at distances less than the distance corresponding to quasi-equilibrium thermal power state, and vice versa: *attractive* forces during these molecules motion in the directions of their *moving apart* from each other with achievement of optimum attractive binary action (see χ^* point below in Fig. 2) and further asymptotic approaching of this force to zero with this divergence increasing. Here, as in the following, the *quasi* prefix in the "equilibrium thermal power state" term has quite a distinct sense consisting in understanding that, in this position, the said micro-scale substance-field oscillates in conditions of kinetic/dynamic impacts from the micro world containing it.

It is appeared consistent to take as a working hypothesis the assumption of a certain similarity of events specified in preceding paragraph with attractive/repulsive influence of surface molecular-atomic structure of the wall on fluid phase in accordance with illustrative scheme in Fig. 2. The accepted hypothesis assumes existence of some similarity with noted case of single-phase structure of aggregate power action of electron shells and atomic nuclei in molecules of the binary phases being considered. In Fig. 2, by shaded background in 3D image the estimated change of $\vec{F}_a$ force of discussed here surface interaction of molecular-atomic layers $S_w \cup S_f$ in $\chi = \chi_1$ direction of χ_κ coordinate system is shown with highlighting by blackened reference points ● quasi-equilibrium position on surface S_f of molecules with $(\chi_1 = \chi^0, \chi_2, \chi_3) \in S_f$ coordinates; therewith macro-motion velocity $\vec{v} = 0$ for $\xi >> \chi^0$, i.e. with static macro-state of continuous fluid phase at considerable distances from S_w.

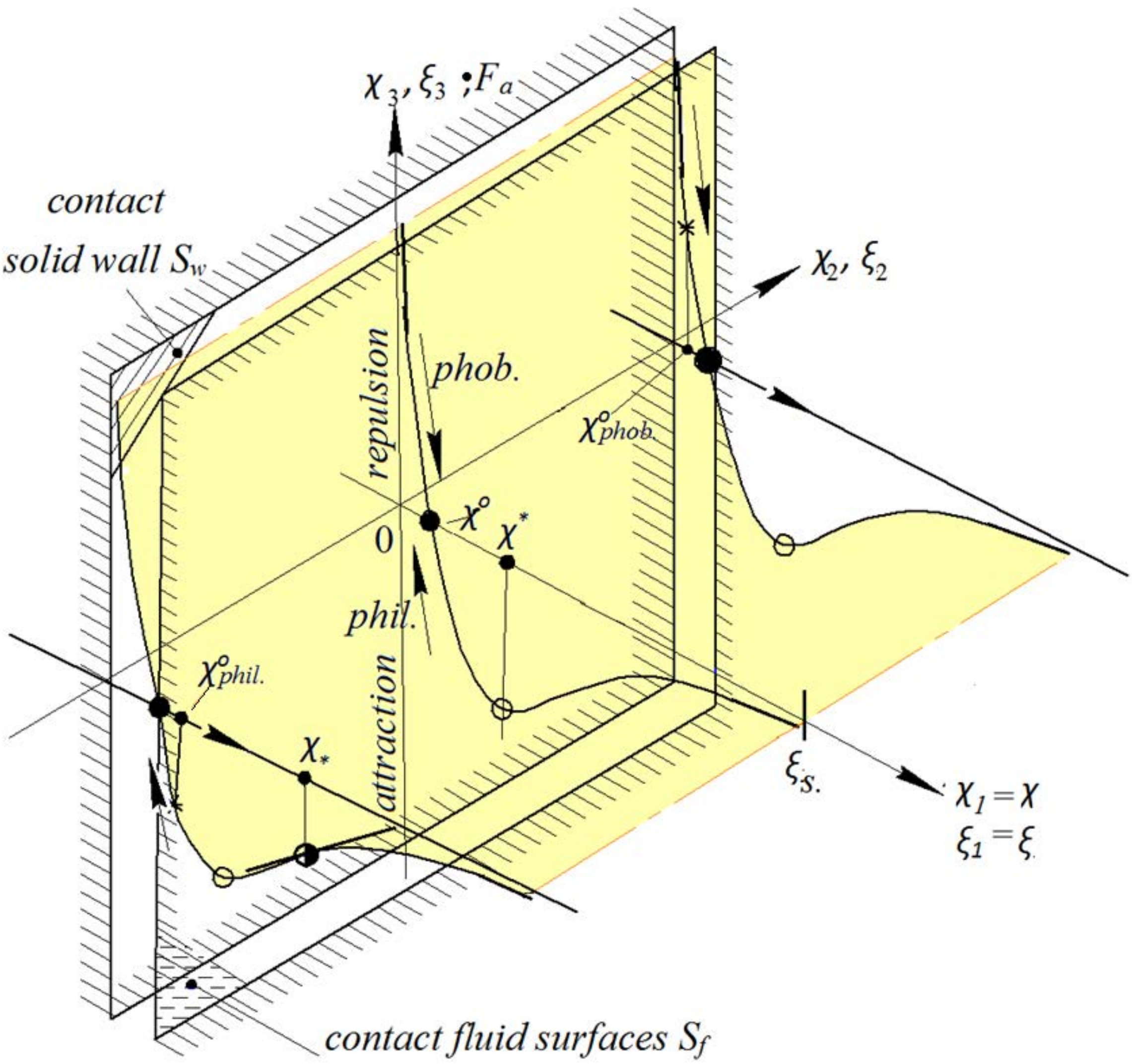

Fig. 2: Conditional scheme of force interaction of contact surfaces of smooth solid S_w and fluid S_f phases in micro-scale representation at static macro-state $\vec{v}\big|_{\xi>\xi_s,} = 0$

Self-setting of the noted state, from initial position of fluid contact layers $\chi^0_{phil} \vee \chi^0_{phob}$ to χ^0 is characterized eventually by absence of deformation velocities $\vec{v}_d$ and physical points $\ni (\vec{v} = \vec{v}_c + \vec{v}_d = 0)$ centers of mass $\vec{v}_c$ motion. Author's understanding of decomposition of motion of medium elementary particles is presented in paper [9]. This movement is effected, as noted, by motion of *corpuscles* of these extremely small macro-formations from their (corpuscles') initial in χ coordinate χ^0_{phil} positions for fluid-philic and χ^0_{phob} for fluid-phobic surfaces $S_w \cup S_f$ to position of force quasi-equilibrium χ^0. The specified transitions are shown in Fig. 2 conditionally by multi-directional pseudo-vertical arrows. Hereinafter, under the term $\vec{v}_d$ deformation velocity we mean cumulative velocity of both distortion of volume and shape of physical point and rotation about its center of mass.

More detailed, therewith still purely qualitative, schemes of processes of micro-scale self-setting are shown in Fig. 3; however, not only for conditions for achieving *static* quasi-equilibrium power macro-state of contact layers of solid and fluid media (Fig. 3a,b), but also for general case of *dynamic* near-wall motion (Fig. 3c). In Fig. 3a and 3b the vertical arrows indicate cumulative binary action of $\vec{F}_a$ force electromagnetic fields transferring molecules with conditional mark * of contact layer S_f from initial (at the moment of fluid touching the wall S_w) non-equilibrium state to position with mark ● of achieving power quasi-equilibrium for the cases of occurrence of adhesion (philic) and anti-adhesion (phobic) effects, respectively., The overall directivity of solid phase surface external electromagnetic field impact on fluid phase corpuscles is emphasized here symbolically by sharp corners of blackened triangles.

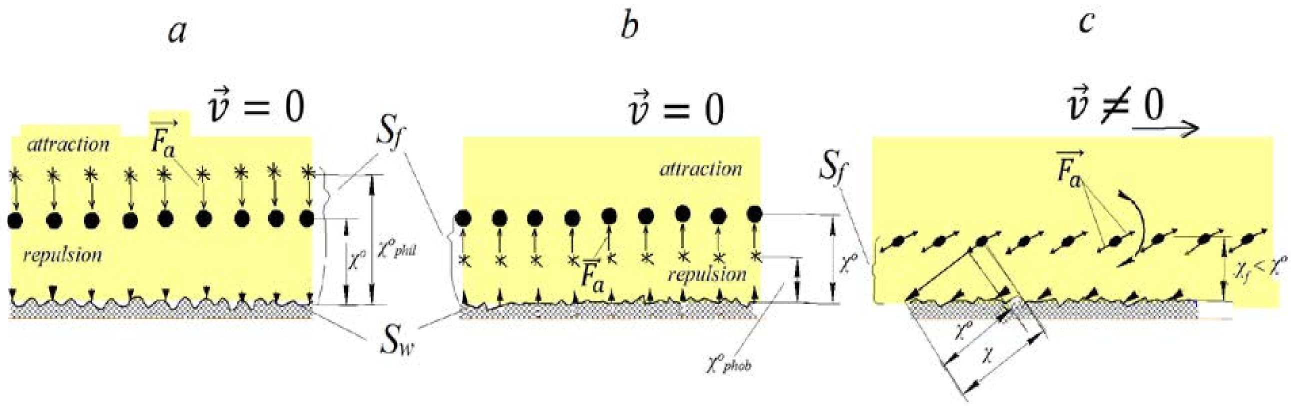

Fig. 3: Schemes of deformation of electromagnetic fields and corpuscular layer, contact surface S_f with respect to solid smooth-wall surface S_w in micro-scale representation in static $\vec{v}\big|_{\xi>\xi_s} = 0$ (a, b) and dynamic $\vec{v}\big|_{\xi>\xi_s} \neq 0$ (c) macro-states

Fig. 3c shows purely figuratively time slice of dynamic near-wall interaction accompanied, in our opinion, by distortion positively correlating with orientation and level of external flow velocity $\vec{v}$, *directivity* of initially orthogonal to S_w (in smooth wall case) force electromagnetic fields. These fields are created jointly by surface molecular-atomic structures $S_w \cup S_f$ and lead, as a consequence, to deformation shifts of associated in understandings of "substance-field" corpuscular groups of fluid phase. The indicated force field deformation is marked symbolically in Fig. 3c with an arc oriented clockwise for the case of fluid phase motion above contact layer from left to right. The described situation contains a prerequisite of a possibility of some accommodation aberration in the properties of surface molecular-atomic structures *cohesion* in level and direction of its (cohesion) action as S_w wall and, especially, S_f surface, accompanied by self-setting of dynamically balanced near-wall flow, but with fixed centers of mass $(\vec{v}_c = 0)$ of macro-particles belonging directly to S_f surface. It is understood that the prerequisite expressed demands its subsequent verification.

So, if we assume that the suggested phenomenological concept of near-wall interaction as portion of a pluralistic set of alternate approaches possess a predominant validity, it is possible, as main conclusions from the first topic of this article important for further discussion, to state the following.

a) At complete pouring of fluid-philic fluid phase onto the wall its contact layers, figuratively saying, somewhat *flatten*/shift to S_w without changing the volume (at fixed pressure) reducing to some extent depending on specific properties of medium the distance of corpuscles from solid phase surface $\chi^0 < \chi^0_{phil}$. We fix the noted as *event of approaching* (see Fig. 3a).
b) In a similar action with fluid-phobic phase we have $\chi^0 > \chi^0_{phob}$ and observe the *event of* substances *moving apart* from S_w, and molecular movement opposite to the previous type is realized (see Fig. 3b).
c) In dynamics (see Fig. 3c), the contact layer S_f, regardless of philia or phobia category in relation to S_w layer, is adjacent to this surface and in such a way that velocity component of the physical points

with $\xi \in S_f$ coordinate center of mass $\vec{v}_c$ is equal to zero. Hence,

$$\bar{v} = \vec{v}_d(0, \xi_2, \xi_3; t), \qquad (1)$$

where $\vec{v}_d$ is deformation velocity of marked physical points different from zero *only* for non-stationary modes of fluid medium motions.

We now turn to the *second topic* of the study mentioned in the title of this work. Therewith, due to the obvious complexity of the discussed phenomena and to reduce the article scope we confine ourselves henceforth to consideration of the boundary conditions only for the class of *internal* problems of fluid/gas dynamics and only in portions of fluid boundary *S* of estimated area $\overline{V}$ adjacent to its solid fragments $(S_f \cup S_w) = S \setminus (S_+ \cup S_-)$. Omitted and some other questions (see [8], §§4.10, 4.11) are scheduled to be discussed in subsequent publications.

We refer primarily to the problem of setting *kinematic boundary conditions* on S_f surface with natural use of results of the previous analysis. We introduce indexes used subsequently: $\chi_{Kn} = \xi_{s.}, \xi_{Kn}$ and ζ are *parameters*, for which we will take the next, essentially qualitative and at the *current* time established, unfortunately, by orders, estimates:

$$\chi_{kn} = Kn_{\chi}^{-1}\chi_f, \quad \xi_{kn} = Kn_{\xi}^{-1}\xi_{s.}, \qquad \chi_* = \zeta\chi_{kn}. \quad 0 < \zeta < 1 \qquad (2)$$

Here χ_{kn} is *parameter* of *linear boundary scale* between the largest micro- ($\chi_{\sup}$) and the smallest macro ($\xi_{\inf}$) thicknesses of near-wall interaction fluid layers, which explains the *dualism* of its further notation. We emphasize the general principal stipulation: all newly introduced *linear* dimensional indexes refer to *volumetric* ones, i.e. to 3D macro-scales of physical point *"flattened"* towards ξ_1 axis to levels specified in (2), but without changing its volume, i.e. with preserving the number of corpuscles in this "point". In mechanistic interpretation the $\xi_{s.}$ parameter is at extremely small volume scales of continuity hypothesis validity some average (currently, virtual) *distance* of fluid phase molecular-atomic layers from S_w including $[0, \xi_{s.}]$ range of *close*- and *meso*-action on them of force field $\vec{F}_a$ (see ξ_1 axis in Fig. 2). In relations (2):

χ_f is the *distance* (again, in the just indicated sense) of contact layer S_f corpuscles from S_w (see Fig. 3c), for gases is equal in average to the mean free path of molecules in boundary layer;

$Kn_{\chi} \wedge Kn_{\xi}$ are majorant and minorant values of macro-scale Knudsen numbers as a result of their consensual choice according to estimates given earlier;

ξ_{kn} *parameter* is the distance from S_w, including, in addition to range of *close*- and *meso*-action $[0, \chi^*] \wedge [\chi^*, \xi_{s.}]$ of field $\vec{F}_a$ also $[\xi_{s,}, \xi_{kn}]$ range of *distant*-action of the said force, i.e. a kind of majorant of internal "inertial"/conservative portion of viscous sublayer relatively passively reacting to disturbing impacts from external, in relation to it, flow. We recall that χ^* is the point in vicinity of maximum occurrence of attractive forces (see ξ_1 axis in Fig. 2). Next, χ_* is the point in vicinity of extreme decrease of attractive action of $\vec{F}_a$ with determination of its position on ξ_1 axis by introduction of ζ *parameter* which is now presented as "parameter of uncertainty" requiring its verification in further investigations.

Complexity of the introduced parameters setting is understandable stemming, in particular, from physically conditioned smallness of numerical values $\chi_{kn} \wedge \xi_{kn}$ and their unconditional dependence on various and substantially determining factors: physical and chemical structure of binary pairs being considered, technique and quality of S_w surface treatment, external conditions of near-wall interaction $S_w \cup S_f$.

Setting valid numerical values or at least possibly narrow ranges of the said parameters changing will obviously require application of precision instrumentation, experimental and theoretical methods of molecular physics researches of current and future time. By analogy with nano-physical understandings of near-wall phenomena (see [2], § 7.2) we call $\chi_{kn} = [0, \xi_{s.}]$ interval the *Knudsen (boundary) layer*, but in 3D macro-scales.

Next, we will observe objectively established practically obvious and therefore undoubtful fact of the most strong interaction of the considered phases in close proximity to the wall, namely, in macro-scales of *viscous sublayer* which, in view of the preceding, predeterminedly includes $\chi_{kn} \wedge \xi_{kn}$ scales in its *interior* portion. Therewith, almost in all scientific studies of the last decades on *continuous* fluids dynamics as a boundary condition on S_w wall the condition of fluid phase sticking to it with setting velocity $\vec{v}(\xi \in S_f) = 0$, including for the most common $3D_t$ stipulations (see compendium of the work *first topic*) is taken. The said condition a priori implies/postulates complete absence in the *dynamics* of any deformation of "stuck" to S_w contact layer S_f. It is clear that this aspect is in contradiction with the concept being developed and, most likely, with the physics of this phenomenon.

The next point: the derived for a *given* pressure gradient strictly linear profile of velocity for steady laminar Couette flow and also believed usually linear or close to that the form of this diagram for turbulent flows in entire viscous sublayer also including, naturally, Knudsen layer, lead to *complete* or *almost complete* absence of stress tensor divergence in momentum balance differential equation, i.e. $\vec{\nabla}\cdot\mathbf{P}\big|_{\xi\in[0,\xi_{kn}]}=0\vee\approx 0$. At the same time, it is the said component that shall reflect the most severe occurrence of viscosity effects.

Based on the above for *internal* portion of viscous sublayer, i.e. for $(\xi=\xi_1)\in[0,\xi_{kn}]$, we suggest the following *kinematic boundary conditions* with a type of smooth wall (substantial simplification) surface S_w (see also formulas (5.6) in work [9])

$$\left\langle v_{c.k}=\partial v_{c.k}/\partial\xi=0\right\rangle\Big|_{\xi=0+},\ k=\overline{1,3}; \tag{3}$$

$$\left\langle v_{d,k}=du_k/dt,\ u_k=u_{k.0}+\int_0^t\Big(\int_0^{\overleftarrow{t}}a_{d\,l.k}d\tau\Big)d\tau,\ \ v_{d.k}(t>t_+=0\right\rangle\Big|_{\xi=0+}, \tag{4}$$

where $\xi=0+\in S_f$ is right zero (for a given coordinate on S_w the $\xi=0-$notation, left zero, is used); t_+ is the time of reaching steady-state flow mode. We note that a type of boundary conditions (3) is acceptable with orthogonal to wall and non-zero gradient of particles center of mass velocity $v_{c.k}$, for example, taking into account S_w roughness. This aspect is expected to be considered in subsequent studies.

The next boundary equation of near-wall laws formalism is *dynamic condition* of change of momentum on S_f (see also formulas (2), (4) in work [1])

$$\left\langle \rho\vec{a}_d=\rho\vec{F}-\vec{\nabla}_{\vec{x}}p+2\vec{\nabla}_{\vec{x}}\cdot(\overset{\iota}{G}\overset{\iota}{\mathbf{S}}_d)\right\rangle\Big|_{\xi=0+},\ \iota=\varnothing,\bullet,\bullet\bullet;\ \ \vec{a}_d=\vec{a}_{d.l}+(\vec{v}_d\cdot\vec{\nabla}_{\vec{x}})\vec{v}_d \tag{5a}$$

with regard only to deformations of volume and shape of the medium particles.

Here: $\vec{a}_d\wedge\vec{a}_{d.l}$ are full and local accelerations of deformation and rotation of physical point on S_f relative to fixed center of mass of this elementary substrate; pressure p includes proper initial condition p_0 and, as a dependence on functional arguments $\rho\wedge\varepsilon$ [10], the boundary conditions expressed via $\varepsilon_{f.0},\rho_{f.0}$ (see Fig. 1 and the following text); $\overset{\iota}{\mathbf{S}}_d$ and $\vec{\nabla}_{\vec{x}}$ are deviators of respective tensors according to the specified values of circumflex accent ι and Hamiltonian operator recorded for changes in physical point volume form in *E-system* coordinates [9], finally $\vec{\nabla}_{\vec{x}}$ is Hamilton operator in *L reference system*.

We emphasize an important provision: based on results of researches presented in [9], we have $\dot{S}_d\{v_k\}=\dot{S}_d\{v_{d.k}\}$, i.e., in the matrix of this tensor there are components of velocity $\vec{v}_c$, and on S_f with $S_d\{0\}\big|_{\xi=0+,t>t_+}=0$ the divergence of this tensor is different from zero $\vec{\nabla}\cdot\dot{S}_d\big|_{\xi=0+,t>t_+}\neq 0$.

Keeping on the right of the equation (5a) only the most important, according to our interpretation of near-wall phenomena, components $\iota=\varnothing$ we can write

$$\left\langle \rho\frac{d\vec{v}_d}{dt}=-\vec{\nabla}_{\vec{x}}p+2\vec{\nabla}_{\vec{x}}\cdot(G\mathbf{S}_d)\right\rangle\Big|_{\xi=0+}, \tag{5b}$$

where $\mathbf{S}_d$ is deformation tensor deviator.
In steady-state mode, we get the equality

$$\left\langle \vec{\nabla}_{\vec{x}}p=2\vec{\nabla}_{\vec{x}}\cdot(G\mathbf{S}_d)\right\rangle\Big|_{\xi=0+,t>t_+}. \tag{5c}$$

We pay also attention to the fact that the existence of $\vec{v}_d$ velocity on S_f in non-stationary processes can be observed in precision physical experiments with resolution close to molecular level and accepted as a fact of S_f surface "slipping" relative to S_w.

For density occurring in boundary relations (5), we have boundary conditions in form (see (6) and the equation (1a) in work [1])

$$\left\langle \ln\rho/\rho_0=-\vec{\nabla}_{\vec{x}}\cdot(\vec{u}_0+\delta\vec{u})\right\rangle\Big|_{\xi=0+}, \tag{6}$$

where $\rho_0\wedge\vec{u}_0$ are initial values.

Based on the set forth above mechanistic part of the concept and its mathematical formalization with expressions (1) – (6) for internal part of viscous sublayer it is justifiable to expect the change in deformation shift modulus G in equations (5) and critical stress $\overline{P}_{w.cr}=P_{w.cr}/P_{cr}$ of turbulent mono-furcation occurrence on pre- and supercritical fluid media motion modes: $\mathrm{Re}\geq\mathrm{Re}_{cr}$ [1, 11], according to physically quite predictable but, in particular form, conjectural dependences shown in Fig. 4 a,b.

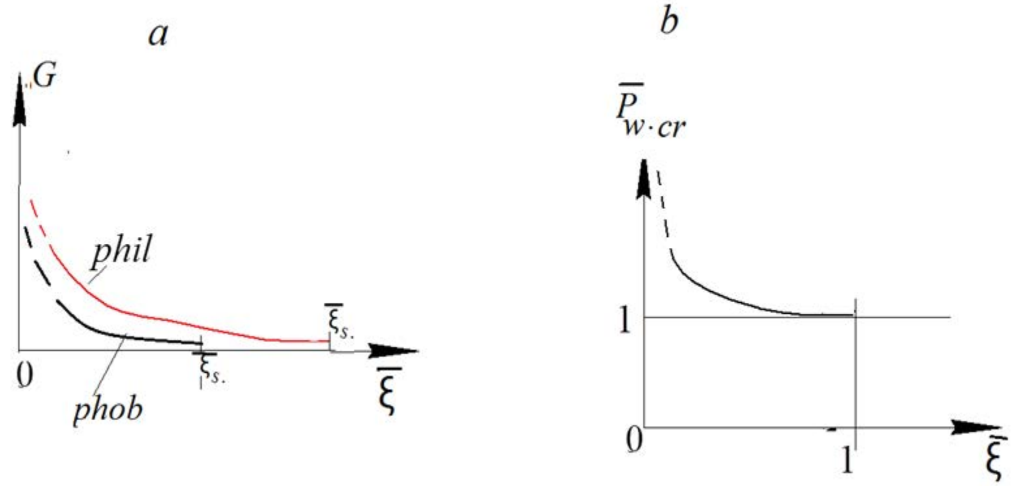

Fig. 4: Conjectured type of shear modulus change G (a) and critical stress $\overline{P}_{w\cdot cr}$ for turbulent mono-furcation (b) as functions of distance from wall for scales $\overline{\xi} = \xi / \xi_{kn}$

Here, dashed supplements to curves in their left side, i.e. with $\overline{\xi} \to 0+$, emphasize growing deficit and, in essence, absence of qualitative and, moreover, quantitative verification of these principally important parameters at $\overline{\xi} < 1$.

No less significant are the aspects of description of near-boundary processes of forward $S_w \to S_f$ and reverse $S_w \leftarrow S_f$ conductive and radiant energy exchange, in the case being considered, primarily, heat transfer. To this problem, presented in detail in the first topic of the article, a considerable number of studies (see e.g. monographs [2, 12] and bibliographies there) are devoted. We suggest a model of formalization of the agreed subject of analysis quite consistent in principal to common understandings of physical and mathematical foundations of dynamics of boundary heat flows emerging as a result of energy co-penetrations of contact frequency/wave electromagnetic, including the radiant ones, fields of solid and fluid phases.

In extended stipulation, modeling of these phenomena requires involvement of fundamental equation of internal energy balance increment ε (see e.g. [1], equations (3), (10)) in contact layers of *each* of $S_w \cup S_f$ phases. Then, the boundary conditions for ε on S_w and S_f surfaces take the form of the *two* equations

$$\left\langle \rho \frac{d\varepsilon}{dt} - \mathbf{P} \cdot \dot{\mathbf{S}} = \rho(q_{cd} + q_r) \right\rangle \Big|_{(\xi=0-)\vee(\xi=0+)}, (\xi = 0-) \in S_w, (\xi = 0+) \in S_f \tag{7}$$

If conductive q_{cd} and radiative q_r forms of specific (per unit of time and mass) energy come from solid phase to fluid phase, then (see also [1], equation (13); [12], §§ 1.5, 8.1, 12.1)

$$\rho q_{cd} = \mathrm{Im}_{f\,l}(T_{wl} - T_{f\,l}), T_{wl} > T_{f\,l} \tag{8a}$$

$$\left\langle \rho q_r = \vec{\nabla}_{\vec{x}} \cdot \left[\vartheta \int \int_{2\pi\nu_{\inf}}^{\upsilon_{\sup}} (1 - \omega_\nu) I_\nu(\xi, t; \vec{\Theta}, \nu)\, \vec{\Theta}\, d\nu\, d\Theta \right] \right\rangle \Big|_{\xi=0+} \tag{8b}$$

Omitting the intermediate manipulations for monochromatic intensity of radiation I_ν, in (8b) we have the following integral-differential equation of transfer on binary electromagnetic interaction interval $[0+, \xi] \subset [0+, \xi_{s.}]$

$$I_\nu = I_{\nu.0}(0+, \xi_2, \xi_3, t)\varepsilon + \varepsilon \int_{0+}^{\xi} (\beta_\nu S_\nu - (c^{-1}\partial I_\nu / \partial t))\varepsilon^{-1} d\xi, \quad \varepsilon = \exp\left(-\int_{0+}^{\xi} \beta_\nu d\xi \right) \tag{8c}$$

with boundary condition in form of first summand on the right which, in particular case of *"black"* solid phase (bb – black body) with satisfying Kirchhoff's law, is equal to

$$I_\nu\Big|_{\xi=0+} = I_{\nu.0} = I_{\nu.bb}(T_{bb}), \quad T_{bb}\Big|_{\xi=0-} = T_{bb}\Big|_{\xi=0+} = T_{wl}(0-,\xi_2,\xi_3,t) \qquad (8d)$$

and radiation from S_w falls on S_f without distortion.
In expressions (8):

T_{wl} and T_{fl} are absolute current temperatures S_w and S_f depending on functional arguments $\rho \wedge \varepsilon$ (see [10]); $\mathrm{Im}_{f\,l}$ is impedance/thermal boundary resistance of fluid phase $\left(\frac{\mathrm{W}}{\mathrm{м}^3\ {}^o\mathrm{K}}\right)$; for solid phase, this physical parameter is assigned Im_{wl} notation; $I_{\nu.bb}$ is spectral intensity of absolute blackbody radiation into fluidic/flowing medium as defined by Planck formula

$$I_{\nu.bb} = 2\hbar\nu^3 / \left\langle c_{f\,l}^2\left[\exp(\hbar\nu/kT_{bb}) - 1\right]\right\rangle, \quad c_{fl} = c_0/\left|\gamma_{f\,l}\right|, \qquad (9)$$

where c_0 is the speed of light in vacuum establishing a well-defined order of $d\xi$ and dt differentials ratio in (8c); $\gamma_{f\,l}$ is beam refractive index in a specific fluid medium (in general case, a complex value); $\hbar \wedge k$ are Planck's and Boltzmann's constants; β_ν is spectral attenuation coefficient [m^{-1}]; S_ν is spectral function of the radiation "source" equal to

$$S_\nu(\xi,t) = (1-\omega_\nu)I_{\nu.bb} + (2\pi)^{-1}\omega_\nu \int_{2\pi} In_{f\,l}(\vec{\mho} \to \vec{\Theta}) I_\nu d\Theta, \qquad (10)$$

$In_{f\,l}$ is Hopf's *scattering indicatrix* - normalized probability function of directions of incident radiation with unit vector $\vec{\mho}$ and its dispersion with unit vector $\vec{\Theta}$.

It is easy, by changing or interchanging *wl* and *fl* subscripts, to rewrite the relations (8) – (10) for other options of energy exchange, for example, when q_{cd} and q_r powers are coming in direction from S_f to S_w. For example: $\rho q_{cd} = \mathrm{Im}_{wl}(T_{wl} - T_{f\,l}), T_{wl} < T_{f\,l}$.

To summarize: initial boundary conditions on the wall are written in form of expressions

• (3) – (5) for functions $\vec{v}_c, \vec{u}, \vec{v}_d$;

•• (6) for density ρ;

••• (7) – (10) for internal energy ε.

These conditions can only be established in the process of iterative solution of $3D_t$ problem and, of course, for verified physical modules, parameters and coefficients included in the specified relations. If the put forward phenomenological constructs basically correspond to reality, then such factors to be determined include $\xi_s, \xi_{kn}, \zeta, G, P_{w.cr}, \vartheta, \mathrm{Im}_{wl}, \mathrm{Im}_{f1}, In_{fl}$ and some other indexes noted in work [1].

III. Conclusion

A number of other also substantive stipulation issues of fluid media $3D_t$ dynamics go out beyond the scope of this article, including influence of wall roughness, effects of over- and subsystem disturbing impacts in fluid portions of boundaries, etc., which are scheduled to be considered in subsequent publications.

The incontestable fact that in the future there will be required an in-depth analysis of necessary and sufficient completeness of exposed boundary conditions to obtain solutions in the senses indicated in the introduction.

References Références Referencias

1. Morgunov G.M. A Neoformalism approach to the dynamics of continuous media / World intellectual property organization. Publ. date 05.02.2015, 44p. [in Russian] https:// patentscope.wipo.int/search/en/ detail.jsf?docId=WO2015016736.
2. Dmitriev A.S. 2014, "Introduction to nano-heat-physics", Binom, Laboratory of knowledges, Moscow, 790 p. [in Russian].
3. Fletcher C.A.J., 1988, "Computational Techniques for Fluid Dynamics 1". Springer•Verlaq, Berlin•Heidelberg (Russ.ed.: Fletcher C. "Computing methods in fluids dynamics", v.1, Moscow, Mir Publ. 1991, pp. 35-67, 504 p.
4. Morgunov G.M. Discrete spectrum decomposition of field functions for strongly indignany dynamics of continuous mediums // Materials of the V international scientific and practical conference "Fundamental and applied sciences today V", vol. 1, 30-31 march. 2015 - North Charleston, SC, USA: CreateSpace, 2015, pp. 144-148. – ISBN:978-15181565684.

5. Warburg E. Poggendorff's Annalen, 140, 1870, pp.367-379.
6. Villari E., Memorie dell' Accademia delle Scienze dell' Instituto di Bologna, 6, 1875, pp.487-520.
7. Whetham W. // Philosophical Transactions of the Royal Society of London. Ser.A. 181, 1890, 559p.
8. Volkov K.N., Emelianov V.N., 2008, Simulation of the large vortexes in the turbulent flows calculations, Moscow, PhysMathLit Publ., 368 p. [in Russian].
9. Morgunov G.M. Deduction of action factors in Neoformalism of dynamics of continuous media // Materials of the VIII international scientific and practical conference "Academic science – problems and achievements VIII", vol…, 15-16 Feb. 2016 – North Charleston, SC, USA: CreateSpace, 2016, pp…. . – ISBN: …
10. Morgunov G.M. Rational phenomenological models of external fields effect in conditions of non-equilibrium thermomechanics of continuous media // Materials of the VII international scientific and practical conference "Fundamental science and technology – promising development VII", 1-2 Dec. 2015 – North Charleston, SC, USA: Create Space, 2015, pp.154-166. – ISBN: 978-1519735447.
11. Morgunov G.M. Phenomenons of plastic transition in deformable solid and turbulent transition in fluids // Materials of the V international scientific and practical conference "Fundamental science and technology-promising developments V", vol. 1, 24-25 Feb. 2015 - North Charleston, USA: Create Space, 2015, pp. 147-156. – ISBN:978-1508657552.
12. Ozisik M.N. 1973, "Radiative Transfer and Interactions with Conduction and Convection", Wiley, New York (Russ.ed.: Ozisik M.N. "Compound heat exchange", Moscow, Mir Publ., 1976, pp. 9-15, 25-28, 269-275, 295-301. 696p.

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How does Universal Gravitation Arise

By Huawang Li

Abstract- Great principles are simple, and looking for the essence of physics requires us to trace the roots. Binary can be arranged to combine our information world, then would the three elementary particles [1] to form the periodic table of elements? Without giving them additional attributes (such as electricity, magnetism, gravity, etc.), would they further arranged this world? This paper proved the existence of a new particle through three physical experiments. The mass of this new particle is only 10-20 of the electron, and it is named Yizi. Through the discovery of Yizi, we will reveal the cause of gravitation and expound the essence of force.

Experiment 1: The gravitational force between two objects is not only related to their masses but also their ambient temperature. The force between two objects is mutually exclusive when their temperature is lower than ambient.

Experiment 2: Change the temperature of the big metal ball on the gravitation torsion scale, keeping the temperature of the small metal ball unchanged, and observe the force of the big ball on the small ball.

Experiment 3: Under constant temperature and vacuum conditions, the temperature of an object is related to its mass. The greater its mass the higher its temperature.

Keywords: the essence of force, universal gravitation, elementary particles.

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I. Introduction

Physics is the cornerstone of human civilization. In recent years, the development of physics is in a state of stagnation. Facing many new physical experimental phenomena, physicists are hard to justify themselves. Where did it go wrong? To find out the answer, we must start with the most elementary particles that make up matter. Determine the correct properties of them so that we can find the roots of matter.

There are a lot of colorful interstellar clouds [2] suspended in the vast universe, which seem to be set off by a kind of gas, just like the clouds set off by the air. Will there be such a kind of gas? In an electron cyclotron [3], would a speeding electron be slowed down by the resistance of gas in the vacuum? Will the propagation of light be transmitted through gas like air-borne sound? Will gravitation be from the buoyancy of gas, just like the buoyancy of air to an object? The atmospheric pressure generated by the air can squeeze two objects together, but people don't feel the presence of atmospheric pressure. Then will the nucleus be squeezed together by high pressure gas? Is the Brownian motion of the electron around the nucleus [4] caused by this gas pressure? Is the cosmic background radiation 2.735K [5] the microwave generated by this gas? Under normal temperature and pressure, the average mass of air molecules is 29g/mol, and the average kinetic energy of an air molecule is 6.02×10^{-21}J, then will the Planck constant $h=6.626\times10^{-34}$ [6] be the average kinetic energy of this gas particle in a vacuum? At normal temperature and pressure, the average velocity of air molecules is 500m/s, the speed of sound is 340m/s, and the speed of light is 2.99792458×10^{8} m/s [7]. Will the average rate of this gas particle in a vacuum be $v=\sqrt{2}c=4.24\times10^{8}$ m/s or not?

There are indications that our space is full of gas like air, and the particles that make up this gas we name it Yizi. The difference between Yizi and Ether is that Yizi has mass and kinetic energy, and its average kinetic energy is Planck's constant. The movement of Yizi obeys the law of conservation of energy and momentum. Three physical experiments will be introduced here to prove the existence of Yizi.

II. The Essence of Force

Force is a macroscopic concept. The amount of change in the momentum of a group of particles per unit time is the amount of force generated by this group of particles. Let's look at an experiment. Making small balls as particle models, hold the cup with balls 5cm above the scale, pour one ball onto the scale pan, the pointer will swing once. And then at the same height pour 100 or more continuously and quickly, as shown in Fig.1, the pointer will swing around a position. This phenomenon shows that a large number of balls hitting the pan produces a constant and uniform pressure on the scale. The more balls collide during a certain period, the greater the pressure on the pan. If pour the balls from a higher position above the pan, we can observe the pointer indicates a greater pressure. This result shows that the greater the momentum of the balls, the greater the pressure on the scale pan. This is the description of the concept of force in Chinese junior high school physics textbook. However, when physicists face the universal gravitation, electromagnetic force, weak interaction force, and strong interaction force, they completely forget the essential concept of force. These forces are all caused by the change of momentum due to particle collision. This is also the essence of force (the grand unified theory) [8].

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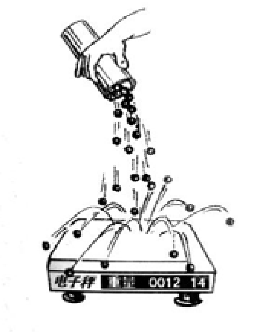

Fig. 1: The small balls slip onto the electronic scale

III. The Cause of Gravitation

The universe is full of Yizi gas, and all the planets suspend in it. The volatile Yizi gas rippled in space, forming the cosmic background temperature of 2.736K. However, the center temperature of each planet is very high, far higher than the background temperature of the universe, which makes the energy of Yizi gas near it, especially high. The farther away from the planet, the lower the energy of Yizi gas. Where the energy of Yizi gas is high, the density of it is low, that is to say, the number of Yizi per unit volume is few, as showing in Fig.2.

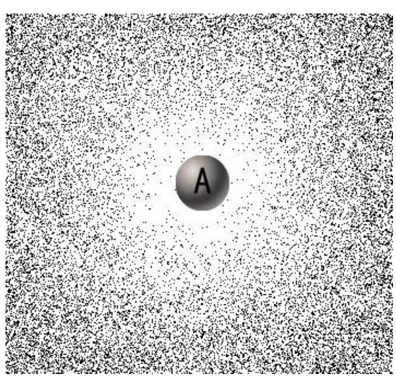

Fig. 2: Distribution of Yizi gas around planet A

Where the energy of Yizi gas is low, its density is high, and the number of Yizi gas per unit volume is large. The density of Yizi gas increases with the elevation, and it creates a top-down buoyancy. The amount of buoyancy an object receives depends only on the volume of the elementary particles that make up the object to displace the Yizi gas. If the quality of basic particle density is same, then the buoyancy produced by Yizi gas is related to the mass of the elementary particles that make up the object. This is why both a feather and a iron ball fall at the same time in a free-fall experiment.

On earth, the gravitational force of one object on another is not always positive, sometimes negative, meaning that one object repels another. When the temperature of object B is lower than the ambient temperature, the distribution of Yizi around it showing in Fig.3: the kinetic energy of Yizi around object B is small, and the density is high, and then object B has a repulsive effect on the object at ambient temperature.

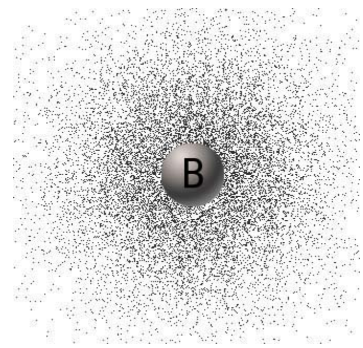

Fig. 3: The distribution of Yizi gas around object B when the temperature of object B is lower than the ambient temperature

You may ask, does the earth's gravity decreases in freezing winter? The earth's center temperature is very high, and its radius is 6400 kilometers. The sun can only change the earth's surface temperature about 10 meters deep. Temperature below 10 meters are generated by the earth itself, and it is relatively constant, so freezing is not enough to change the gravity of the earth.

Gravity can only exert a force within a certain distance. When an object is too far away from a planet, space where it is located will have the same density of Yizi gas as the cosmic background temperature, and the force on the object will become zero.

Someone asked, if the temperature had such an effect on gravity, the rocket would have been so hot that it would have been impossible to control it. Right? When two objects attract each other, each changes the density of the Yizi gas around it, and creates a gravitational field, the corresponding constant acceleration of gravity, such as the surface of the earth's gravitational acceleration g=9.8m/second^2, and the gravitational acceleration constant produced by the rocket probably be only 10^{-9}-10^{-8}m/second^2, negligible, that is to say, the contribution of earth and rocket to the magnitude of gravitation is not the same. The earth generates an active gravitational field.

Although the density of Yizi gas around the stars increases with the altitude, however in unit time, in any given radial direction of the planet, Yizi passes through a unit area. The number of Yizi diffuses from the inside of the unit area to the outside is equal to the number from the outside to the inside, both are n. Let Yizi's outer-to-inner diffusion velocity be V_1, V_2, V_3, ... V_n, the inner-to-outer diffusion velocity be V_1', V_2', V_3', ... V_n', the average velocity of Yizi outer-to-inner diffusion be $\overline{V}$, and the average velocity of Yizi inner-to-outer diffusion be $\overline{V}'$. Then

$$\overline{V}=\frac{V_1+V_2+V_3+......+V_n}{n} \quad (1)$$

$$\overline{V'}=\frac{V'_1+V'_2+V'_3+......+V'_n}{n} \quad (2)$$

Let ΔV be the velocity variance of Yizi outer-to-inner diffusion, and ΔV' be the velocity variance of Yizi inner-to-outer diffusion.

$$\Delta V=\frac{(V_1-\overline{V})^2+(V_2-\overline{V})^2+(V_3-\overline{V})^2+......+(V_n-\overline{V})^2}{n} \quad (3)$$

$$\Delta V'=\frac{(V'_1-\overline{V'})^2+(V'_2-\overline{V'})^2+(V'_3-\overline{V'})^2+......+(V'_n-\overline{V'})^2}{n} \quad (4)$$

The irregularity of a star decreases as the radius increases. The closer to the star, the greater the unevenness of the motion rate of Yizi is. So the unevenness of the motion rate that diffuses from the inside to outside is greater than that from the outside to inside, ie

$$\Delta V' > \Delta V \quad (5)$$

Expand Equation 3 and Equation 4:

$$\Delta V=\frac{V_1^2+V_2^2+V_3^2+......+V_n^2}{n}-\frac{2\overline{V}(V_1+V_2+V_3+.....+V_n)}{n}+\overline{V}^2 \quad (6)$$

$$\Delta V'=\frac{V_1'^2+V_2'^2+V_3'^2+......+V_n'^2}{n}-\frac{2\overline{V'}(V'_1+V'_2+V'_3+....+V'_n)}{n}+\overline{V'}^2 \quad (7)$$

Substituting Equation 1 and 2 into Equation 6 and 7, respectively:

$$\Delta V=\frac{1}{n}(V_1^2+V_2^2+V_3^2+......+V_n^2)-\overline{V}^2 \quad (8)$$

$$\Delta V'=\frac{1}{n}(V_1'^2+V_2'^2+V_3'^2+......+V_n'^2)-\overline{V}'^2 \quad (9)$$

Substituting Equation 8 and 9 into Equation 5 respectively

$$\frac{1}{n}(V_1^2+V_2^2+V_3^2+......+V_n^2)-\overline{V}^2<\frac{1}{n}(V_1'^2+V_2'^2+V_3'^2+......+V_n'^2)-\overline{V}'^2 \quad (10)$$

According to the law of conservation of energy,

$$\frac{1}{2}M_YV_1^2+\frac{1}{2}M_YV_2^2+\frac{1}{2}M_YV_3^2+......+\frac{1}{2}M_YV_n^2=\frac{1}{2}M_YV_1'^2+\frac{1}{2}M_YV_2'^2+\frac{1}{2}M_YV_3'^2+......+\frac{1}{2}M_YV_n'^2$$

$$\text{i.e.} \quad V_1^2+V_2^2+V_3^2+......+V_n^2=V_1'^2+V_2'^2+V_3'^2+......+V_n'^2 \quad (11)$$

Substituting Equation 11 into 10 gives: $\overline{V} > \overline{V}'$ i.e.

$$\frac{V_1+V_2+V_3+......+V_n}{n}>\frac{V'_1+V'_2+V'_3+......+V'_n}{n} \quad (12)$$

multiplying both sides of Equation 12 with $M_Y n$, we obtain

$$V_1M_Y+V_2M_Y+V_3M_Y+...+V_nM_Y>V'_1M_Y+V'_2M_Y+V'_3M_Y+...+V'_nM_Y \quad (13)$$

Since force is a change in momentum per unit time, the force exerted by Yizi on this unit area:

$$F=V_1M_Y+V_2M_Y+V_3M_Y+......+V_nM_Y-(V'_1M_Y+V'_2M_Y+V'_3M_Y+......+V'_nM_Y) \quad (14)$$

IV. The Light and Heat of the Sun is not Generated by Fusion

a) Our universe is a mixture of protons, electrons, and Yizi. Most protons and electrons suspend in Yizi gas in different material forms, as shown in Fig.4.When a single proton suspends in Yizi gas since the volume of the proton is much larger than Yizi, a proton collides with a large number of Yizi around it at the same time. The cooperative force of Yizi on the proton tends to be balanced, the kinetic energy of the proton is very small, and the temperature tends to zero (cosmic background temperature). At the same moment, the number of collisions of protons, in a certain line, in opposite two directions is n_1 and n_2 respectively, and set up $n=|n_1-n_2|$, then the momentum of a proton tends to be equal to that of n Yizi:

$$M_{proton} \times v_{proton} \approx n \times m_{Yizi} \times V_{Yizi} \qquad (1)$$

Because n_1 and n_2 tend to be the same, so the value of n is small,

And because $M_{proton} \gg n \times m_{Yizi}$

So: $$v_{proton} \ll V_{Yizi} \qquad (2)$$

From (1)×(2), we get:

$$M_{proton} \times v_{proton} \times v_{proton} \ll n \times m_{Yizi} \times V_{Yizi} \times V_{Yizi}$$

That is, $$\frac{1}{2} \times M_{proton} \times v_{proton}^2 \ll \frac{1}{2} \times n \times m_{Yizi} \times V_{Yizi}^2 \qquad (3)$$

At this time, the energy of n Yizi is much larger than the energy of a proton. That is to say, when a single proton suspends in Yizi gas, the momentum of the proton tends to be equal to that of n Yizi, while the kinetic energy of the proton is much less than that of n Yizi, and the temperature of the proton tends to absolute zero, although the energies of Yizi around the proton are very high.

b) And when the multiple protons are separated from the Yizi gas, since there is Yizi gas on one side of the proton and no Yizi gas on the other, that is to say, n1=0, n2=n. The proton's one side collides with n2 Yizi at the same time, and the kinetic energy of n2 Yizi is much greater than that of the individual proton suspends in the gas. As shown in Eq. 3, so the proton will continuously absorb energy from the Yizi gas, so that the kinetic energy of a proton tends to be equal to the kinetic energy of n2 Yizi, and the pressure tends to be equal, as shown in Fig. 5:

Now, $$\frac{1}{2} \times M_{proton} \times v_{proton}^2 \approx \frac{1}{2} \times n \times m_{Yizi} V_{Yizi}^2 \qquad (4)$$

Because of $$v_{proton} \ll V_{Yizi} \qquad (5)$$

So (4)÷(5) get: $$M_{proton} \times v_{proton} \gg n m_{Yizi} \times V_{Yizi} \qquad (6)$$

That is to say, when multiple protons and Yizi gas are completely separate, the kinetic energy of a single proton tends to be equal to that of n Yizi, while the momentum of a single proton is far greater than that of n Yizi.

The greater the mass of the object, the less the Yizi gas that penetrates the interior of the object, and the greater the difference in the Yizi density of the inner and outer parts of the object. More Yizi transfer kinetic energy to the proton, and the temperature of the object is higher. The object absorbs energy in the form of a direct collision and then releases the energy in the form of thermal radiation to form a dynamic equilibrium.

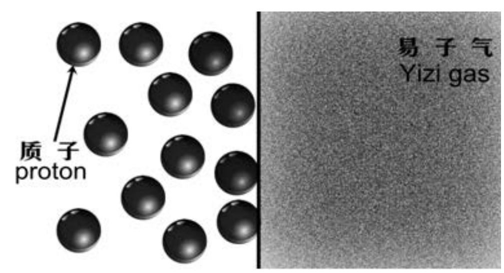

Fig. 5: Proton gas and Yizi gas are distributed separately

V. Three Physical Experiments Prove the Existence of Yizi

a) *Experiment 1: The gravitational interaction between two objects is not only related to the masses of the two objects but also to the ambient temperature at which the two objects are located. The force between the two objects is mutually exclusive when their temperature is lower than the ambient temperature.*

i. Experimental equipment and environment: The vacuum tank, as shown in Fig.6. The inner diameter is 1.8m, and the inner height is 1.8m. It is placed in a constant temperature cave. The gravitational torsion scale (Cavendish torsion scale) is placed on a small table in the vacuum tank, as shown in Fig.7. The light is injected from the outside of the vacuum tank onto the small mirror on the torsion scale and reflected the opposite side on the whiteboard.

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Fig.6: Vacuum tank with a torsion scale placed in

Fig.7: A homemade Cavendish torsion scale placed in the vacuum tank

ii. Basic parameters and principles of the experiment:
As shown in Fig.8 and Fig.9:

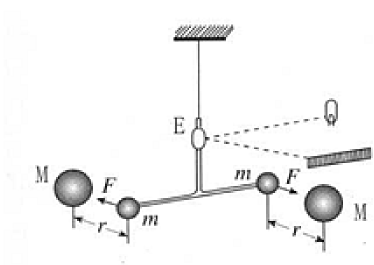

Fig. 8: Working principle diagram of Cavendish torsion balance

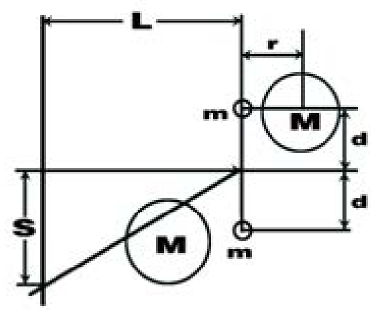

Fig. 9: Vertical dimension of the torsion balance

a. The size of gravity $F = \frac{\pi^2 mds}{T^2 L}$,
b. The distance of the reflective plane mirror from the whiteboard L=10.3m
c. The small copper ball mass m=0.575kg, the large lead ball mass M=1.5kg
d. Torsion balance arm length d = 0.15m
e. The free vibration period of the torsion balance is T=214s
f. S is the amount of movement of the scale light spot
g. The distance between the center of mass of the big ball and the small ball is r.

iii. Matters need attention:
a. When the gravitation torsion scale is placed in a vacuum tank with constant temperature, it does not change the ambient temperature or the temperature of the metal ball, the big metal ball and the small metal ball attract each other, because the temperature of the metal ball is slightly higher than the temperature of the surrounding Yizi gas. The larger the mass of an object in a constant vacuum, the higher its central temperature will be. This will be proved in the following experiment.
b. The vacuum degree of the vacuum tank should be less than 1000Pa. If there is too much residual air, when the ambient temperature changes, the air around the large metal ball and the small metal ball will turn over, affecting the experimental results.
c. There should be no objects around the metal sphere other than the one used to measure gravity. Otherwise the experiment will be complicated and even lead to the opposite result.
d. Not all metals are suitable for gravitational experiments. For example, metal aluminum has a repulsive effect on the metal lead itself, so neutral metals are more suitable for gravitation experiments.
e. Slowly inject ice water or hot water to avoid the obvious Thomson effect and the additional gravity, which will have a great impact on the experiment.

iv. Experiment steps:
a. Remove the two large lead balls from the torsion scale, leaving only two small copper balls on the T-frame of the torsion scale.
b. Vacuum the vacuum tank with a vacuum degree below 1000Pa.
c. It will take 72 hours for the torsion scale to stop swinging in the vacuum. When the torsion scale

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stops swinging, mark the position of the light spot on the white board, and draw a vertical line in red to represent the balance position.

d. Send hot air to the insulating room to do a basic test on the whole experimental system. There is no obvious change in the point of light, so the influence of the system on it can be ignored.
e. Turn off the air conditioner, open the vacuum tank, and put the big ball on the torsion scale. Keep the center distance between the big ball and the small ball about 10cm, then close the tank and vacuum it.
f. After standing in the natural environment without heating or cooling for 72 hours, it was found that the light spot shifted to the direction of attraction by about 0.4-0.5cm, S≈0.0045m.
Gravitation force in the natural state

$$F = \frac{\pi^2 mds}{T^2 L} = \frac{3.14^2 \times 0.575 \times 0.15 \times 0.0045}{214^2 \times 10.3} = 8.11 \times 10^{-9} \text{ Newton.}$$

g. At this time, sent hot air to the insulating room. The temperature inside the room rises by 3 to 4 degrees in 3 minutes, and the temperature inside the vacuum tank rises less than 0.1 degrees. At this time, the temperatures of the big ball and the small ball are lower than the environment in which they are located. The light spot move 3.5cm in the direction in which the big ball and the small ball repel each other. As the temperature in the room increases, the maximum moving distance of the light spot to the repulsive direction is about 15cm, as shown in Fig.10.

Fig. 10: When the external temperature of the vacuum tank rose, the light spot moves in a repulsive direction

The repulsive force F which generated by the light spot moving 15cm:

$$F = \frac{\pi^2 mds}{T^2 L} = \frac{3.14^2 \times 0.575 \times 0.15 \times 0.15}{214^2 \times 10.3} = 2.7 \times 10^{-7} \text{ Newton}$$

This repulsive force is 33 times the gravitational force measured at the natural ambient temperature.

h. Turn off the air conditioner and leave the heat-insulating room alone. After two days, send cold air into it. As the temperature of the room decreases, the gravity between the big ball and the small ball increases, and the light spot moves in the direction of mutual attraction, and the maximum moving distance reaches 17cm. This attractive force is 37 times the gravity measured in the natural environment temperature.

b) *Experiment 2: Change the temperature of the big metal ball on the gravitation torsion scale, while the small ball's temperature remains unchanged. Observe the force exerted by the big ball on the small ball (when the temperature of the big ball increases, it will attract the small one; when the temperature of the big ball decreases, it will repel the small one).*

i. Laboratory equipment and environment: A constant temperature room built in a cave. A vacuum tank, placed inside the room, with a gravitational torsion scale placed inside it. A hanging wire hangs a T-frame on the torsion scale, and at the two ends of the T-frame, there is a small copper ball respectively, as shown in Fig.11. One of the small copper balls has a large hollow copper ball by its side. The large ball has an inlet and an outlet pipe, which are used to change its temperature by injecting hot water or ice water into it through a miniature water pump, as shown in Fig. 12.

Fig. 11: Top view of gravity balance in the vacuum tank

ii. Matters need attention

a. The vacuum degree of the vacuum tank should be less than 1000Pa. If there is too much residual air, when the ambient temperature changes, the air around the large metal ball and the small metal ball will turn over, affecting the experimental results.

b. There should be no objects around the metal sphere other than the one used to measure gravity, which would complicate or even reverse the experiment.

Fig.12: A small pump and a bucket used to fill in the large hollow copper ball with hot or icy water

c. The large hollow copper ball must be connected with the ground wire to avoid electron transfer and electrostatic attraction inside the hollow copper ball caused by the injection of ice water or hot water.

iii. Experiment steps:

a. Put the big hollow copper ball on the torsion balance, and suspend two small copper balls at each end of the T-frme. Keep these balls centers on the same level, as shown in Fig.13.

Fig. 13: The center of the large hollow copper ball is on the same level as the center of the small copper ball.

Fig.14: The small copper ball below the suspension stops swinging, and the light spot stays on the midline

b. After being placed for a long time, the small copper ball under the suspension wire has stopped swinging, and the light spot stays on the middle line of the white board, as shown in Fig.14.

c. When we inject hot water into the large hollow copper ball, it attracts the small copper ball, and the light spot moves in the direction of attraction.

d. When we inject ice water into the large hollow copper ball, it repels the small copper ball, and the light spot moves in the direction of repelling.

c) *Experiment 3: Under the condition of constant temperature and vacuum, the temperature of an object is related to its mass. The larger the mass of an object, the higher its temperature will be.*

i. Laboratory equipment and environment: a homothermal room built in the cave, a vacuum tank placed in the homothermal room; a vacuum pump, a temperature collector and computer are placed outside the room; a 1000kg copper ball and a 1.2kg copper ball, both are placed in the vacuum tank as shown in Fig.15.

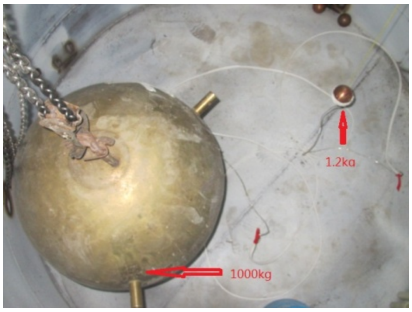

Fig. 15: A 1000kg copper ball and a 1.2kg copper ball suspendin a vacuum tank

ii. Matters need attention:

a. Thermistor [9] is very sensitive, and its temperature measuring error is 0.002 degree, so all- electric lines must be welded, the main circuit must use electrostatic shielding wire, and the joints shall be insulated.

b. Copper balls are used in this experiment mainly because of the high thermal conductivity of copper. The temperature reaches the equilibrium state quickly and its price is moderate. There are three main ways of heat transfer: heat conduction, convection, and heat radiation. Here, to maintain a constant temperature, we place the large and the small copper ball in a vacuum tank, suspend them, and let them balance the temperature mainly in the form of heat radiation. The center of the large and the small copper balls should be on the same horizontal plane, which mainly takes into account the inconsistency of the ambient temperature at different horizontal planes.

c. The current flowing through the thermistor should be as small as possible, otherwise, the current will generate the same amount of heat. The small copper ball will be warmer than the large copper ball because it can't dissipate as much as the large ball. Here the thermistor carries a current of 0.0104 mA.

d. The 24-hour temperature change of the vacuum tank in the homothermal room shall not exceed 0.2 degrees.

iii. Experiment steps:

a. Place the large copper ball and the small copper ball in the vacuum tank and keep their centers at the same level. The thermistor R1 attaches to surface of the large copper ball, and the thermistor R2 attaches to surface of the small copper ball.

b. Close the vacuum tank and evacuate it to a vacuum of -0.1 MPa.

c. Because the copper balls have been placed in the cave for a long time, the heat balance will not take too much time, and 24 hours is enough. After 24 hours, the temperature curve shown in Fig.16 is recorded by the thermistor collector and computer. The red line indicates the temperature change curve of the large copper ball with time. The blue line is the temperature change curve of the small copper ball with time. The average temperature of the large copper ball is about T1=10.13, and the average temperature of the small copper ball is about t1=10.04.

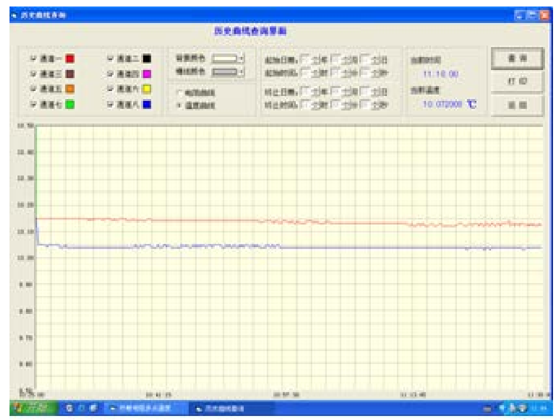

Fig. 16: The temperature curve of the big copper ball and the small copper ball over time. The red line represents the temperature of the big copper ball, and the blue line represents the small copper ball

d. Open the vacuum tank, reverse the two resistances. Attach the resistor R1 to the surface of the small copper ball, and measure its temperature. Attach the resistor R2 to the surface of the large copper ball, and measure its temperature. Close the vacuum tank, vacuum, and check the temperature record after 24 hours.

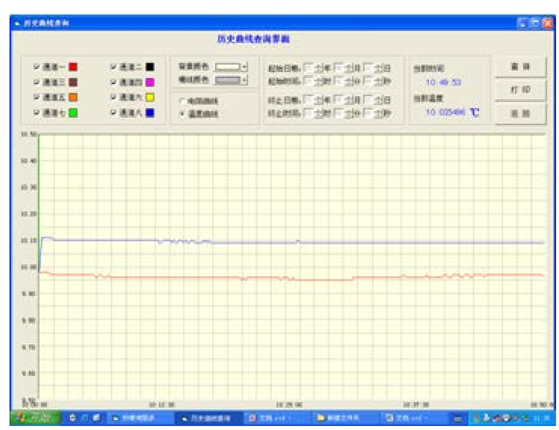

Fig. 17: The temperature curve of the big copper ball and the small copper ball over time. The blue line

represents the temperature of the big copper ball and the red line represents the small copper ball

e. After 24 hours, query the computer, as shown in Fig.17; the blue curve shows the temperature curve of the large copper ball change with time. The average temperature of the large copper ball is about T2=10.07. The red line is the temperature curve of the small copper ball change with time, and its average temperature is about t2 = 9.97. The average temperature difference between the two balls measured twice.

$$t=\frac{(10.13-10.04)+(10.07-9.97)}{2}=0.095$$

The temperature of the large copper ball of 1000 kg is 0.095 degrees higher than the small copper ball of 1.2 kg.

The two thermistors are swapped for the purpose of eliminating system errors because the temperatures measured by the two thermistors are erroneous at the same temperature.

The above experiments proved that under constant temperature and vacuum conditions, the greater the mass of the object, the higher the temperature of the object, and the greater the gravitational force formed. Gravity can only exert force within a certain distance. When an object is too far away from the planet, the force on the object will become zero when the microwave in the space where the object is located is the same as the microwave intensity generated by the Yizi gas at the cosmic background temperature.

VI. The Physical Properties of Yizi

a) The trajectory of Yizi movement

Assume that the Yizi is a rough surface sphere, as shown in Fig.18. In addition to translation, Yizi also has an eccentric rotation motion around the x-axis, the y-axis, and the z-axis. The eccentric rotation makes the movement trajectory of Yizi in each plane to be a circle. The circles in three planes combined into a closed ellipse, so the trajectory of Yizi is a closed ellipse, instead of a straight line. The Yizi has not only high translational speed but also a higher edge velocity when rotating.

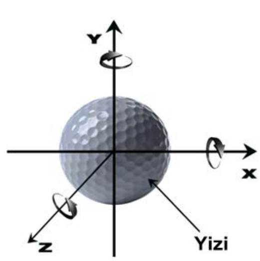

Fig. 18: Yizi model

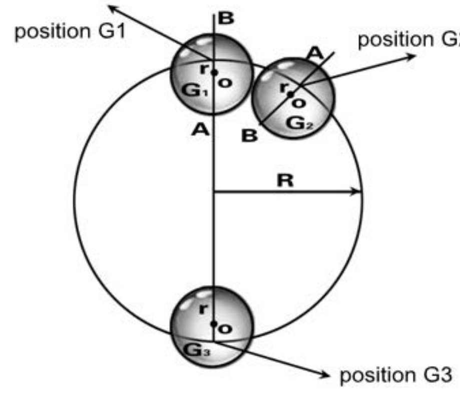

Fig. 19: Plane movement trajectory of Yizi

When Yizi collides with each other, they transfer not only translational momentum, but also angular momentum. The edge collision of Yizi makes it have a very high rotational speed. As shown in Fig.19, suppose that Yizi moves in a circle. When Yizi is in position G1, the angular momentum of A is greater than that of B.The commutator rotates in half a circle and the angular momentum is transferred once, the angular momentum at A is transferred to B, and B transfers angular momentum to A.When Yizi moves to the position G2, it rotates n+1/2 times. At this time, the angular momentum of the A end is converted to B, and the angular momentum of the B end is converted to A. During this conversion between the A end and the B end, the angular momentum of Yizi in the inner side of the large circle R is always greater than the angular momentum outside the large circle. This inner and outer angular momentum difference only changes the direction of motion, but it doesn't affect on the magnitude of the inner and outer angular momentum. The eccentricity r and the radius R of the Yizir's circular motion satisfy the following formula,

$$\frac{V^2}{R}=\frac{(2\pi rn)^2}{r}=4\pi^2n^2r$$

where V is the plane motion rate of the Yizi, R is the radius of the circular motion of the Yizi eccentricity point, r is the eccentricity of the Yizi rotation, and n is the number of rotation times of the Yizi revolution.

The same is true for electrons and protons. If the surface is rough and the trajectory is a closed ellipse, it is not surprising that large angles of scattering occur in collisions. There is no straight linear motion in the micro-world. Then why does the macro world have a linear motion? Since the macroscopic objects are composed of many particles, as shown in Fig.20 when the macroscopic object rotates, the particles in the object collide with each other, and the angular momentum in the object is quickly distributed uniformly, so that the object rotates around the centroid.

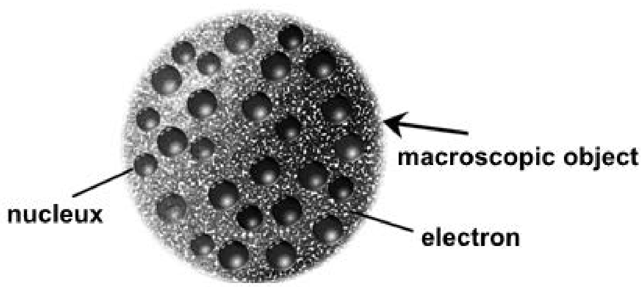

Fig. 20: A macroscopic object composed of proton-electron commutons

b) *Average Speed of Yizi*

Light is transmitted by Yizi gas, just as sound is transmitted by air. The average speed of Yizi's irregular movement in Yizi gas determines the speed of light propagation in Yizi gas. The light will be like a sound, gradually weakening in the spread, and eventually dissipate in Yizi gas. The speed of sound propagation in the air is related to the rate of thermal motion of air molecules. As the temperature increases, the rate of thermal motion of air molecules increases and the speed of sound increases. Light is transmitted by Yizi gas, and a large number of Yizi do irregular movements colliding with each other. Unlike air molecules, air molecules do elastic collisions, while Yizi does hard collisions, and there is no time of relaxation. The opportunity for Yizi to move in all directions is equal. If the direction of movement of Yizi is divided into two directions, the average direction of movement of the Yizi with a tendency to move forward should be 45°angle in the forward direction, as shown in Fig.21, where Vy is the average velocity of Yizi, C is the speed of light, and the average propelled forward velocity $C=\frac{\sqrt{2}}{2}Vy$, is the speed of light. The average speed of Yizi is $Vy=\sqrt{2}c= 4.24 \times 10^8$m/sec.

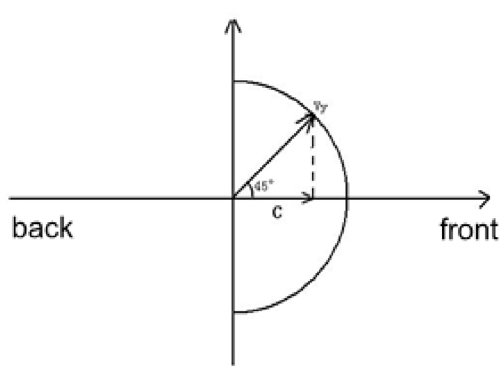

Fig. 21: Schematic diagram of the relationship between the average velocity of commutons and the speed of light

c) *The mass of Yizi*

We know the energy carried by electromagnetic waves $\varepsilon=h\gamma$ [10], where h is the Planck constant and γ is the frequency of the electromagnetic wave. h is the minimum average energy that electromagnetic waves can carry, that is, the average kinetic energy carried by per Yizi, so $h=\frac{1}{2}m_y v_y^2$, where m_y is the mass of the Yizi.

$$m_y=\frac{2h}{v_y^2}=\frac{2\times 6.626\times 10^{-34}}{(4.24\times 10^{8})^2}\approx 7.37\times 10^{-51}\text{kg}$$

References Références Referencias

1. Fundamental particles : Edited by Cen yisheng and Lizengzhi University Physics Edited the second volume of Tianjin university press 1999.2
2. The interstellar cloud: Edited by lee chongwei and Xiao xinghua Astrophysics, Beijing higher education press 2000
3. Electron cyclotron: Edited by Cen yisheng and Lizengzhi University Physics Edited the second volume of Tianjin university press 1999.2
4. Brownian motion: Edited by Cen yisheng and Lizengzhi University Physics Edited the second volume of Tianjin university press 1999.2
5. Cosmic background radiation of 2.735k: Edited by lee chongwei and Xiao xinghua Astrophysics, Beijing higher education press 2000
6. Planck's constant: Edited by Cen yisheng and Lizengzhi University Physics Edited the second volume of Tianjin university press 1999.2
7. The speed at which light travels: Edited by Cen yisheng and Lizengzhi University Physics Edited the second volume of Tianjin university press 1999.2
8. Grand unified theory: Edited by Zhangli Progress in modern physics, Beijing Tsinghua university press 1997
9. Thermistors: Edited by Wang cu、Li chun and Zhou lezhu. Electromagnetics. Peking university press 2000.2
10. $\varepsilon=h\gamma$: Edited by Jin zhonghui、Liang deyu,University basic physics. Beijing science press, 2000.5

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Semi-Analytical Established Factors in Modern Theory of Fluid Mediums Thermomechanics

By G. M. Morgunov
National Research University "MPEI"

Annotation- Subjects of the present development are: analysis and reasonably complete consideration by semi-analytic methods of investigation of the specific peculiarities of flows into inner part of layer which are placed in immediate, nearness to wall, as well as action perturbation on determinately cognizable stream from stochastic fluctuation of measured functions of field in extremely right/high-level zone of its frequency-wave numbers outside of solvable ability of the accepted 4D computation net.

Keywords: viscous under-layer, conservative part, knudsens scales, frequency-wave spectrums, numbers, defect, continuous hypothesis, turbulent mini-moles, roughness,, random fields, distribution laws, monte carlo method, united control element, asperity characteristics.

GJSFR-A Classification: *FOR Code: 020304*

SEMIANALYTICALESTABLISHEDFACTORSINMODERNTHEORYOFFLUIDMEDIUMSTHERMOMECHANICS

Semi-Analytical Established Factors in Modern Theory of Fluid Mediums Thermomechanics

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For virtual limits of the Knudsen's scales of nearness to wall the interaction of fluid and *smooth* solid phases is selected quasi-pellicle/conservative part of the viscous under-layer. For this part qualitatively formalism of dependence of the fundamental matter-field substances: density, increment of internal energy and component of specific momentum,-is realized as functions from time and distances relatively wall into under-net indicated intervals with entering universal functions of it approximation.

On conceptual level and within the framework of the continuous medium hypothesis is offered procedure of semi-analytical shorting of frequency-wave spectrums of unknown basis substances of medium change: density, increment of internal energy and momentum. This process is realized by means in view of action on indicated variables of intra-net random disturbances from *measured* functions of field, including effects appearance of roughness of the real solid fragments of flow boundaries, on base of Monte Carlo method of mathematical statistics and theory of probabilities. It was distinguished qualitatively bands of spectrum fluctuations action for physically measured random quantities: pressure, temperature, components of a velocity.

Chooses three groups fields of the dissipated perturbations for under-grouse very/extreme right intervals of frequency-wave numbers.

It's concretizes diapasons of activation of the under-grid clusters perturbation of the distinguished and measured thermomechanical functions with their description as following random fields:

- Of defect of the continuous medium hypothesis with estimate interval of spectrums between the lowest and the greatest frequency-wave numbers of physical point;
- Of defect of the accounting completeness of turbulent mini-moles with estimate interval of spectrums between the greatest frequency-wave numbers of turbulent mini-moles which are considered by four-measuring 4D of a rated grouse and it lowest values for physical point;
- Of imitative 4D fluid layer with action, which is much like of the real roughness appearance on solid fragment of the laundries in rated flow field.

The present actions are interpreting by random variables as one-dimensional, founded and continual, including derivatives from its up to second order inclusively.

For good reason of essential deficiency of the experimental values object of the study are regarded mainly at set up plan.

Keywords: viscous under-layer, conservative part, knudsens scales, frequency-wave spectrums, numbers, defect, continuous hypothesis, turbulent mini-moles, roughness,, random fields, distribution laws, monte carlo method, united control element, asperity characteristics.

I. Introduction

Present sufficiently expanded presentation possibly to consider on conceptual level of opinions in the capacity of completion of the series of presentations [1-9]. Its papers forms on total foundations of the modern theory of continuous mediums thermomechanics and which we are assumed as known. Developing further highly non-ordinary paradigm satisfies in the large of these sence, aims and arrangements which are presented in primordial work by this global subject [1] however with their following partial correction and extension, on which author leaves behind yourself the right as was marked in published – forerunner [1].

Subjects of current investigation are half-analytical means of description in functions of action[7] especially specific factors which requires under-net approximation and by the need of additional determination. The term «semi-analytical» in title of this paper instead of the term «semi-empirical», which we exploits, for example, in theory of turbulence, is accepted at consequence of this that deductive further relations which requires, of course, of its own verification and attendant of it experimental redefinition its has nevertheless sufficiently common character and only indirectly are bounded with concrete kind of under consideration domain of a flow.

Under the circumstances of evidently existing deficit of empirical data considered material presents chiefly in contextual statement.

Of special note is that non-formal perception of the present development contents demands of the preliminary and attentive first-hand acquaintance with works [4,8] including accepted in its notations.

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Contents of the represented material is the following.

- These parathion and quality mathematical description of the basic substances of a medium ρ, ε, $\vec{\upsilon}$[2] into interior/conservative part of the viscous under-layer, i.e. in limits of the Knudsen's scales of a fluid and *smooth* solid phases of nearness to wall interaction at accompanying by it circumstance condition $\xi \epsilon$ [0^+, ξ_{kn}] for distance from wall [8]. This is particularly important item in aspect of a numerical realizations of proper initial and boundary problems.

Stated in the following result of the formalization will permit in many to avoid purpose of necessary but appearing extremely thick four-dimensional rated net («damnation» of dimensional) for micro- and middle-scale of a computer solution procedures of near-wall interaction with expected sufficiently reliable result of its reproduction.

Recall that indicated part of the viscous under-layer in its own surface of contact S_f directly adjoins on wall S_w (here accepted smooth) and combined attractable electromagnetic field strongly interacts with it from virtual boundary of demarcation S_{wf}/S_{fw}. There foreover system disturbance, i.e. fluctuations from outward flow, appear to be as its hows experimental data, well low with very small, as a rule, amplitude of matter-field function fluctuations.

So far as describe later procedure of a modelling to a considerable extent unification it application demonstrates on the most complex example of vector substance approximation, namely, specific refer to unit mass momentum $\vec{\upsilon}$.

- Recording in the generalized form additional dissipated disturbances of pressure *p*', temperature *T*', components of a velocity $\upsilon'_i (i=\overline{1,3})$, which we are assigned to one-dimensional, bounded and continuous, including derivatives from its at to (x_i, *t*) until of second order inclusively, random fields and admitted at experimental precision measuring at properly modal filtration of proper spectral expansion of the *full* function, p, T, υ_i. These disturbances onto own spectral parts of determination enters into terms of action functions of the termomechanics fundamental laws with physical modules /coefficients/parameters depending from *current* and also *total* meaning of the basic substancesρ, ε [2].

We mention in passing that condition of the one-dimensional of random variables appears definitely restrictive. In particular, stochastic out comes of the components velocity $\vec{\upsilon}$ pulsations are regarded as independent from each other. It is expedient too call to that used further marks «Λ», «V», «∀» means «and», «or», «any».

Indicated stochastic perturbations occurs on its far right/high-level/under-net meaning of frequency-wave numbers (*FWN*) $\omega_{s.} \wedge æ_{s.j}, j=\overline{1,3}$ (see lower) and are characterized of very small amplitude of oscillations but with inherent of this background *intensification* values of derivatives by arguments (x_i, *t*) in *E-system* of counting. These in many sporadic winkling(at some extent as relic noise) in turn and according to algorithm described in work [4] acts upon distributions of basic substancesρ, ε, $\vec{\upsilon}$ in *L-system* of counting.

Given in article [4] mechanism of a back bat continuously *smoothing* transfer of random fluctuations to the left along frequency-wave spectrums (*FWS*) in the direction all more scales is *filter effect* inherent to fluid mediums.

Later on are given off three type in principle differing of random fields.

- *Group* of thermomechanics actions subjects to simulation as stochastic functions on scales of a physical point (PP)*,* i.e. in diapason *FWS*

$$[\omega_{s.} \wedge æ_{s.j}]^{PP}_{inf} < (\omega_{s.} \wedge æ_{s.j}) < [\omega_{s.} \wedge æ_{s.j}]^{PP}_{sup} \qquad (1)$$

with appropriate *«laws» of distribution* $\Re_{dhc}$ of continuous random quantities $p' \vee T' \vee \upsilon'_i$ from spectral *FWC* in accordance to (1). Inequalities (1) we can be treated as consequence from hypothesis about *local thermodynamics quasi-equilibrium*(*LTDQE*) with just now marked spectral intervals of discrepancy. We will call of this group under-net perturbations by fields for a compensation of *hypothesis continuous defect* (subscript *dhc*).

Note, that distributions $\Re_{dhc}$, if registration of given aspect in principle is expedient, must to be appeared with certain intensity at every, among them static condition of continuous mediums. Here can to detect mental analogy with appearance of a «relic radiation».

- *Group* representations and too by continuous random distributions of turbulence pulsations also in under-net parts of *FWS* but for intervals

$$[\omega_{s.} \wedge æ_{s.j}]^{trb}_{sup} < (\omega_{s.} \wedge æ_{s.j}) < [\omega_{s.} \wedge æ_{s.j}]^{PP}_{inf} \qquad (2)$$

with *«laws»* $\Re_{dmt}$ of distribution of the quantities $p' \vee T' \vee \upsilon'_i$ from indicated range in the capacity of approximate way to fulfill of loss-of its action in cutted off turbulence minimum moles in moles overlarge-scale[4]. Here under term *turbulent mole* should be realized the limit small material formation, until scale most fine $3D_t$computation net, which is bearer of noted pulsations. First term at (2) defines the right boundary *FWN* of the direct modeling of turbulence. Superscript *trb* is reduction from *Lat. turbulences*.

Present group under-net disturbances it is possible to distinguish as the fields *of compensation defect at description of turbulent moles action*(hence is followed subscript *dmt*).

Next observe, that putting in algorithm of computing programs intervals (1), (2)practically totally, but approximately locks spectrum distribution of the functions of matter and field by strongly disturbed dynamics continuous mediums outside of zones of among phases interaction.

- Group stochastic mimicking of perturbations actions on stream from surface of real solid fragment of boundaries, i.e. with roughness, being investigated various domains motion of a fluid mediums with *«laws»* of $\mathfrak{R}_{asp}$(index from L at. *asperitas* – roughness).

In studies effects of asperity we leave aside problem questions at motion present mediums on hyper- or super- scales of being, in particular, tasks of hydro- and meteorology. Then in overwhelming majority cases, at least, at practical applications solid boundaries have industrial making and its contact surfaces are characterized of technical roughness with varied local drift of form, height of lugs, depth of hollows, its substantively non-predicted of configurations together with concentrations of scattering in date factors on each unit of solid boundary area. Thereby detailed description topology of non-polished roughness appear is extremely complicated and escorts by appearance of known effect of the *fractal uncertainty* at all greater growing small of observation scales (see, for example, [10], p.63-65). According to noted representation about degree regularity of solid boundaries S_w– *real* and its exhaustive description in strict mathematical meaning in point of fact loses its definiteness. In such a situation is lose rational possibility to operate with similar boundary as with analytical 2Dsurface of Liapunov's S_w– *ideal* at simple established normal $\vec{n}$ in every point $\forall\vec{\mathbf{x}}\in S_w$– *ideal* independently from direction of approach at to it.

Presented ascertaining evidences about that in common case possibility *direct* modeling of element asperity exponents and its immediate action on near wall motion of a fluid phase is representation highly problematical, unless to tell unreal. Thus we suppose be in order at least in the immediate prospect to mimic present kind of locations of strongly sharp heterogeneities also by *random* disturbances. These effects are concentrated in its layer as *source* of active show of the roughness factor.

Mentioned perturbations we will consider in the capacity of *addition* to outcome of *smooth-wall* binary interaction of the contact surfaces of solid and fluid phases. Clearly, that spatial mutually adjusted interconnection S_w – *real* ∧ S_w – *ideal,* as well as geometric characteristic properties of a asperity layer requires special determination (see below). It is clear also, that *properly* asperity factors of perturbations can, as rule, to be taken stationaries. However practically always (apparently except for creeping flows) introduces in motion near to wall four-dimensional bifurcations.

Returning now to common characteristic properties of the three indicated groups of random fields we shall underline, that the set of *«laws» distribution* $\mathfrak{R}_{dhc}$, $\mathfrak{R}_{dmt}$, $\mathfrak{R}_{asp}$ by meaning of its introduction are relative to *causative* functions of action [7]. Further, its represents themselves in an explicit from simple, rate fixing and *definitely positive* from established above continual random quantities but with concrete view of these consistencies. Present correspondences *parametrically* depends from current meaning of the basic substances $\rho, \varepsilon, \vec{v}$, as well as from certain specific exponents mainly for group $\mathfrak{R}_{asp}$ (see later).

In further out reason of the presentations compact and if not special indications in common part of description procedures of random outcome identity in *«laws»*$\mathfrak{R}$ lower indexes are omitted and stochastic fields p', T', v_i' are marked as Φ' or in rate fixing recording over φ'.

II. Main Part

We shall become now directly to consideration of each from *two*, outlined into introduction at common context (see identations selected at the left by symbols .,..), of subjects for investigation. One again we will underline that non-formal perception of the contents of the present investigation possible at preliminary and attentive acquaintance with works [4, 8] including accepted in its designations.

- On Fig.1 for *interior* part of a viscous under-layer and at fixed moment of a time is shown one from possible variants epure of a velocity in local orthogonal coordinate system (*LSC)*$\xi_k, k = \overline{1,3}$ with bench-mark $\vec{j}_k$ and ort of a interior normal $\vec{j}_1 \ni (\vec{\xi}_1 = \vec{\xi} = \vec{j}_1\xi)$ to *smooth-wall* fragment S_w of a boundary S of rated flow in some domain $\overline{V} = V \cup S$. This normal $\vec{j}_1$ restores by two main radiuses of a curvature in some point $\forall\vec{\mathbf{x}}\in S_w$ of a global Cartesians coordinate system. In addition on boundary of phases demarcation we have (see Fig.1)

$$(\xi = 0^-) \in S_w \wedge (\xi = 0) \in S_{fw} \wedge (\xi = 0^+) \in S_f.$$

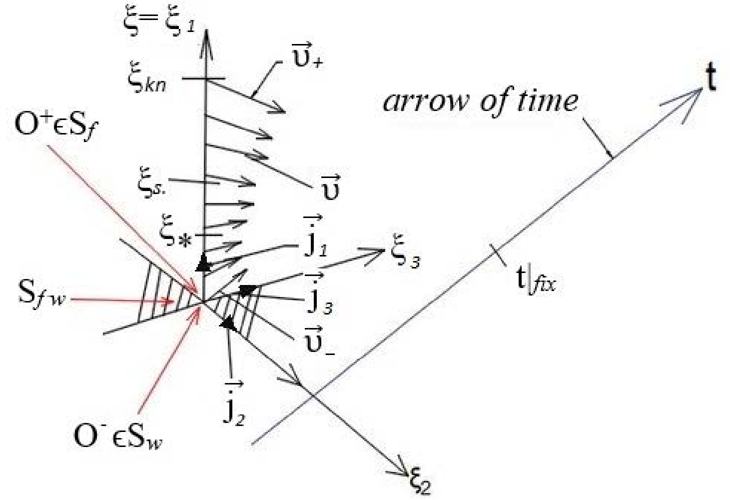

Fig. 1: Possible qualitative form of a velocity $\vec{\upsilon}$ epure in conservative part of a viscous under-layer and in fixed time moment $\boldsymbol{t} = \boldsymbol{t}\Big|_{fix}$

We remained meaning appearing on the Fig.1 and next in text designations (see too [8]): -, + - are velocities on the contact surface $S_{fw} = S_f \cup S_w$ and on upper boundary $_{kn}$ conservative part of viscous under-layer; ξ_{kn}, $\xi_{s.}$,$\xi_*=\zeta\xi_{s.}$, $0 < \zeta < 1$ – are respectively distance from S_{fw} of a long-, middle- and near-action of attractive force field $\vec{F}_a$ from two phases interdependence in immediate proximity to wall. Indicated geometric exponents, among other things, depends from $|\vec{\upsilon}_+|$ and requires its experimental establishment. Evidently, that exponent ξ_{kn} can be accepted as virtual *thickness* of a conservative part of a viscous under-layer. Velocity v- defines from procedure of establishment of the boundary conditions on the wall [8], and velocity v+ sets to iterative scheme of a computation in accordance algorithm stated in work [4].

At present we will approximate dependence of velocity v from time t and coordinate $\xi \in [0^+, \xi_{kn}]$ with beginning of count in some point $x \in S_f$ by following monotonically changing on both quantity and direction to relation

$$\vec{\upsilon}(\bar{\xi}, t) = \vec{\iota}(\bar{\xi}, t)\left[\upsilon_+(1, t) f_+(\bar{\xi}) + \upsilon_-(0^+, t) f_-(\bar{\xi})\right], \bar{\xi} = \xi/\xi_{kn} \in [0^+, 1], \tag{3}$$

where

$$\vec{\iota} = \vec{j}_k i_k, i_k = m(\bar{\xi}, t)\left[i_{k+}(1, t) W_{i_+}(\bar{\xi}) + i_{k-}(0^+, t) W_{i-}(\bar{\xi})\right], \tag{3a}$$

$$m = \left[\sum_{k=1}^{3}(i_{k+}W_{i+} + i_{k-}W_{i-})^2\right]^{-\frac{1}{2}}, \vec{\iota}_\pm = \vec{\upsilon}_\pm/\upsilon_\pm, W_{i+} + W_{i-} = 1 \ni |\vec{\iota}| = 1, \tag{3b}$$

$$f_+ = \bar{\xi} W_{f+}(\bar{\xi}), f_- = (1 - \bar{\xi}) W_{f-}(\bar{\xi}), W_{f+} + W_{f-} = 1. \tag{3c}$$

Here:
$\vec{\iota}, \vec{\iota}_\pm \wedge i_k, i_{k\pm}$ are orts to direction of vectors $\vec{\upsilon}, \vec{\upsilon}_\pm$ and its projections on axes *LSC* with orts $\vec{j}_k$; *m*- multiplier of the norm; $f_\pm$are universal functions only from one argument $\bar{\xi}$; $W_{i+\vee f+}$ are weight coefficients equal 0, 1/2, 1 at $\bar{\xi} = 0, \bar{\xi}_*, 1$ respectively and having non-negative of first derivative and also the point of bend at $\bar{\xi} = \bar{\xi}_*$ [8]. Concrete form presented in relations (3) – (3c) functions from $\bar{\xi}$ among indicated marks as well should be stipulated on base of special experimental investigations with super-resolving thinness of measurements. Cases $(\upsilon_+ \vee \upsilon_-) = 0$ requires attraction of procedure indeterminacy for elimination for instance by Liouville method.

On Fig.2 we represents one from possible modifications of functions $W_{i+\vee f+}, f_\pm$ change. In this connection position of the point $\bar{\xi}_{s.}$ On absciss axis is shown conditionally.

At approximation of scalar functions ρ, ε we are used expressions (3), (3в) with replacing by $\upsilon_\pm$ *on* $\rho_\pm, \varepsilon_\pm$and of first cofactor$\vec{\iota}$in (3) on unit.

At present objectively it is not known how for described model of approximation of the base substances ρ(ξ), ε(ξ), $\vec{\upsilon}(\xi)$, at$\xi \in [0^+, \xi_{kn}]$ is in good agreement with the reality and in what extent essentially influence of reliable distributions of indicated functions in bounds conservative interval of viscous under-layer on evolution exterior macro-motion.

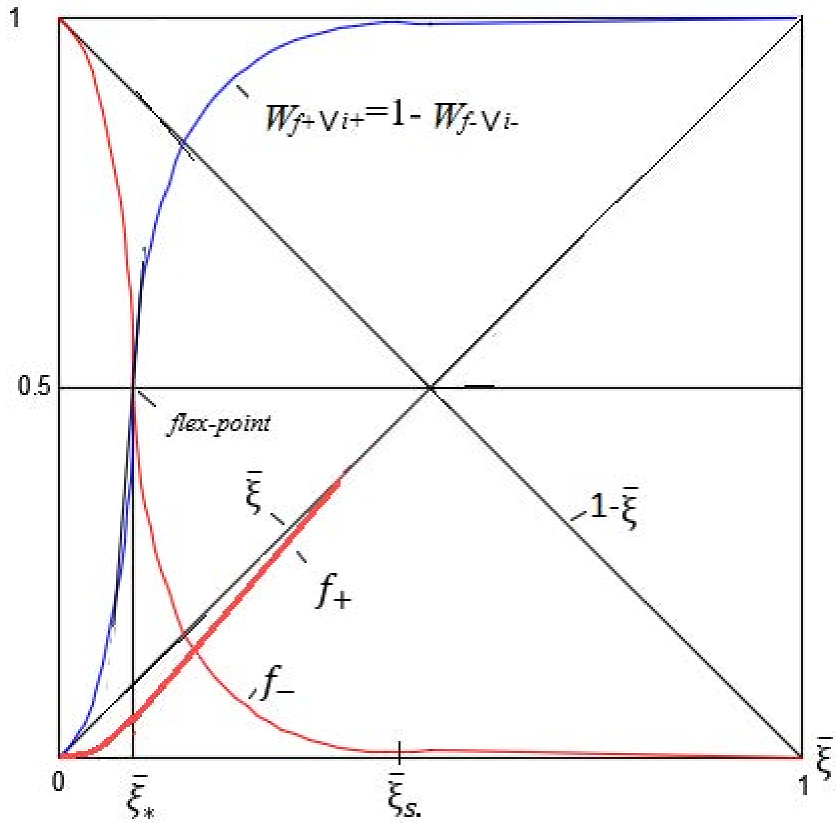

Fig. 2: To be expected typical change of weight $W_\pm$ and universal functions $f_\pm$ in conservative part of a viscous under-layer

•• Passing now to matter of a modeling of stochastic processes for chosen earlier of two first group of continuous, random quantities Φ' (marked previously common designation) we will be to suppose that densities/ «laws» of its distribution $\Re$ (also common designation) are integral *non-negative* functions from $\Phi' \in [\Phi'_{inf}, \Phi'_{sup}]$, monotonically decreasing (as a rule) at to boundaries of the stated physically bounded from the left and on the right range.

At present we will convent attention on next circumstance. It is customary at issue in guidebook by theory of probabilities and mathematical statistic methods of determination and analysis of outcome for different sort of continuous random processes, at given density of distribution for the proper stochastic quantities, operated mainly with moments of its quantities, characteristic and productive functions from moments, semi-invariants, i.e. with definite *integrated* indicators of prognosis of a possible fall of one event or another. However in accordance to aims of the present investigation it is required attraction of the formalism which permits with physical plausible reliability *to reproduce properly* the random perturbation.

As is known such, to a considerable extent effective, acceptance of approximate realization action of phenomena by stochastic character is totality of Monte Carlo methods. We uses one from its modification in which the key link makes perfect computer program of random quantity *generation* distributed *evenly* and *continuously* on closed interval of the own meanings G ∈ [0,1].

We will notice that interval [0,1]by of the simple linear operator can be transformed in the diapason $[-1,1]$.

Further we accepts not principal condition

$$(sgn\Phi'_{inf} = -sgn\Phi'_{sup}) \wedge \quad |\Phi''_{inf}| = \Phi'_{sup},$$

which is fulfilled in much applications. Now we makes use to non-dimensional recording of a random quantity

$$\varphi' = \Phi'/\Phi'_{sup}, \ \varphi' \in [-1,1],$$

where parameter Φ'_{sup} establishes from physical concepts with attraction of directs or indirect (at forced cases) experimental data for each concrete object of study.

Then for *current integral* function of distribution $\Psi(\varphi')$ with norm || Ψ||=1 we obtain

$$\Psi(\varphi') = \int_{-1}^{\varphi'} \Re(\varphi') d\varphi', \Re(\varphi') = r(\varphi') / \int_{-1}^{1} r(\varphi') \, d\varphi',$$

where (φ') is a prescribed under-integral and in common case non-norm density of a random value depending from φ' distribution with indicated earlier properties. Function (φ') generates a distribution «law» $\Re(\varphi')$

In each moment of time number G supposes equal of a instantaneous value of the function Ψ so that

$$\int_{-1}^{\varphi'} \Re(\varphi')\, d\varphi' = \text{G}. \qquad (4)$$

If in accordance to (4) to take in the capacity of a *direct* transformation quantity φ', *monotonically* varying on opened to the right interval $[-1, \varphi'[$, in current value of the function Ψ action of the operator

$$\mathcal{L}[\upsilon] = \int_{-1}^{\upsilon} \Re(\upsilon)\, d\upsilon \ \ni \mathcal{L}[\varphi'] = \Psi, \qquad (5)$$

than inverse transformation is possible symbolically to write in the form

$$\varphi' = \mathcal{L}^{-1}[\Psi] \ni \varphi'|_t \longleftrightarrow \Psi|_t = \text{G}\,. \qquad (6)$$

On Fig.3 obviously demonstrates of stated transformations. One-to-one correspondence of the presented operations is supported, as marked, by *definitely increasing* relationship $\Psi(\varphi')$ at any φ' from range $-1 \leq \varphi' \leq 1$.

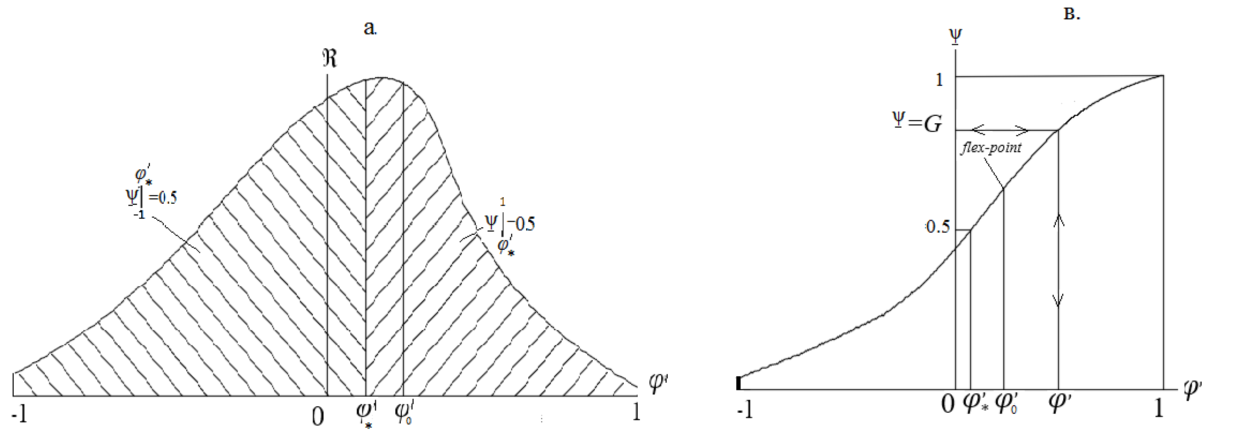

Fig. 3: Illustration of one-to-one correspondence for integral function of distribution Ψ from random quantity φ`. Here: a – variant of "law" $\Re(\varphi`)$; в– proper graph of a relation $\psi(\varphi`)$

In cases of appropriateness use some kind of classical distribution "law" $\Re_c$ from its general totality with possible one or two infinite limits of integration, so that $\varphi'_c \in [0, \infty[\ \vee \ ] - \infty, \infty]$, transition from φ'_c at to φ' is realized expression

$$\varphi' = (\varphi'_c - 1)(1 + \varphi'^2)^{-1/2} \ \vee \ \varphi'_c(1 + \varphi'^2_c)^{-1/2}$$

respectively.

We should remind about agreement of concluding indentation of the introductory division by present investigation according which under φ' and $\Re$ it should be read next variants their concrete purpose

$$\varphi' = \rho' \vee \varepsilon' \vee \upsilon'_i (i = \overline{1,3}), \qquad \Re = \Re_{dhc} \vee \Re_{dmt}\,.$$

Establishment define or even if suggested kinds of distribution density be represented labour-intensive theoretical and experimental task with far non-simple complex scientific, among them empirical, findings in difficult of access ranges of *FWS* (1), (2). It is required large-scale and multiparametric statement and reliable physical fixation $3D_t$ change under consideration here functions for limits high value *FWN* in its spectrums moreover separately marked is important for supercritical regimes motion of a fluid mediums. Correct processing required and, most likely, colossal volume of a further (besides existing) experimental information by modern effective methods of mathematical statistics will be enable bring in, within certain limits, clarity in problems of distribution "law"$\Re_{dhc}, \Re_{dmt}$ of forming at accompanying the most problem estimate of the $\Phi'_{sup} \wedge \Phi'_{inf}$ meaning.

In addition to that with respect to its two groups of the random fields can be a priori expressed the following qualitative judgements conditionally illustrated on Fig.4.

Possible appearance fields of the hypothesis of continuous defect (*dhc*) discovers in accordance inequalities (1) only at extreme high values FWN and with the most probable very small random deviation from zero meanings. Consequently at tuning out from pulsation with FWN large of proper number for left boundary $[\omega_{s.} \wedge æ_{s.j}]^{pp}_{inf}$ of a physical point PP permissibly to expect of tendency of "law"$\Re_{dhc}$ transformation by form of Dirac's δ -function (see dotted lines along of ordinate axis on Fig.4).

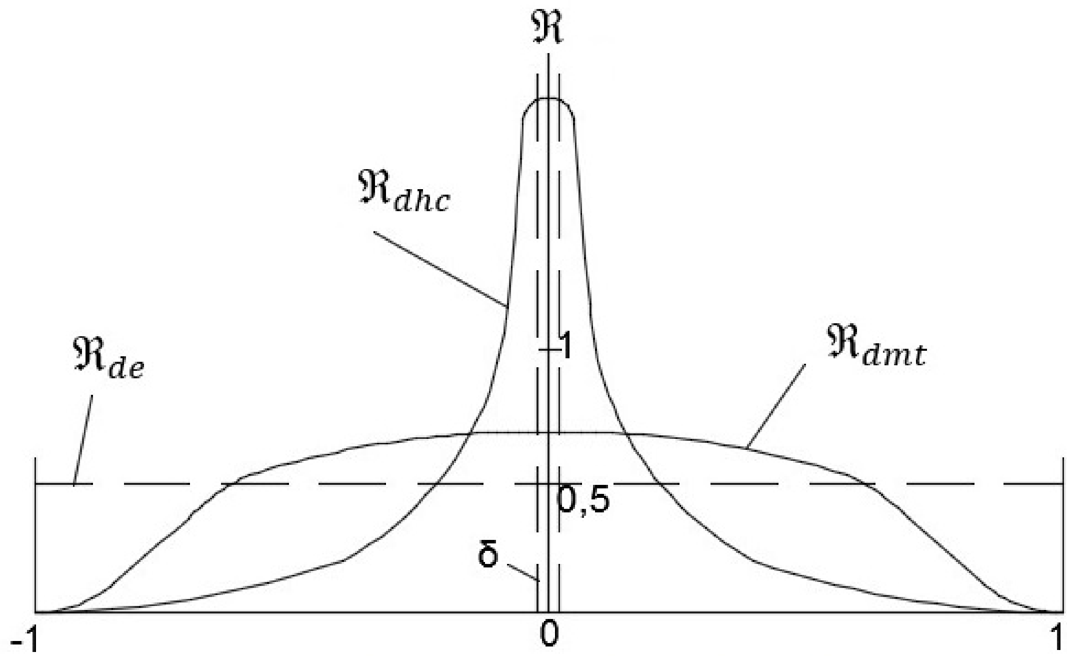

Fig. 4: Supposed partial kinds of even distribution “laws” for first and second groups of a random fields

Other of declivity degree and direction of change of outlines will have prognostic “law”$\mathfrak{R}_{dmt}$ for values *FWN* selected by inequalities (2). From qualitative consideration of experimental oscillogram for turbulence pulsations of components velocity presents in literature, usually selectively and most often in the capacity of examples their level and species (see, for example, [11]), is acceptable nevertheless to compose of opinion about expectation of more filled and gentle relation $\mathfrak{R}_{dmt}$ from φ'. In so doing it’s appearing not inconsistent to expect approach of given function, as far as of the sequential evolution all more small-scale turbulence and property of *quasi-isotropy*, to “law” of a *uniform* distribution (see on Fig.4 horizontal dotted line). By this point we are concluded treatment of *two first* groups of random processes.

We will refer now to analysis of *third* group of stochastic actions. No smaller but most likely larger difficulty, as underlined into introduction, represents task of quite acceptable modeling influence on stream of a *roughness* at the real solid fragments of boundary S_w – *real* for domains various kind flows. In following for reasons, stipulated previously, is regarded set up in which present actions are reproduced approximately by continuous and one dimensional random perturbations *each*, in establishing aspect are *measured experimentally*, function of field $p \vee T \vee v_i$. This perturbations concentrated in 3D layers of asperity V_a of some, strictly speaking, *virtually* (from Lat. *virtualis* – possible) thickness $h_{a.s}$ (see lower).

We will be and other parameters/exponents/functions involving directly to effects of roughness to separate (at necessity) by lower index a, replaced, in particular, for simplicity designation $\mathfrak{R}_{asp}$ onto$\mathfrak{R}_a$.

Besides we will leave out of the way deep questions of analytical geometry connected with present subject of discussion and requiring in perspective, namely at development of computing algorithms, of the attentive to its accesses.

Thus, reasoning from hypothetic and deductive considerations we will set that for definite categories configuration of the solid parts of boundaries in some domains of flow with asperity from category of it typical kinds there exist possibility to establish comparatively small two-dimensional, but *united 2D control element* (*UCE*) $\delta\mathbf{s}$. This in its own way conditional *controller* play a key role of the indicator of roughness local geometrical properties. Element $\delta\mathbf{s}$ we will represent as an of a perfectly smooth surface element with norm No=$\|\delta\mathbf{s}\|$ and with regular contour admitted of it breaking up on finite get of identical and true, but provided with indices polygons $d\mathbf{s}_m$, $m=\overline{1,m_s}$ ∋ $\sum_{m=1}^{m_s} d\mathbf{s}_m = \delta\mathbf{s}$.

Characteristics of a roughness surface liable to concrete definition emerges on the cuts $h_{a,j}$ by controller *UCE* of each local *j*-th volume layer $\delta\mathbf{v}_{a.j}$ with thickness $h_{a.s,j} = \delta\mathbf{v}_{a.j}/\|\delta\mathbf{s}\|$. These cuts on indicated local section is *near-parallel* of conditional, but analytical lower S_{wf} and upper S_{fw} boundaries of a *full* layer of roughness by volume V_a (see then) .

According to combinations and views of solid and fluid *spots* on obtained by marked way of totality of “*portraits*” from some number of cuts $h_{a,j}$ $[0,h_{a.s,j}]$ composes judgement about specific levels of roughness properties for each section of a solid boundary. To wards mentioned showing besides of the thickness $h_{a.s,j}$ we will refer *contour* ledges and hollows with norm, for example, by there relative radiuses of curvature $r_a/\|\delta\mathbf{s}\|$, as well *concentration* $æ_m$ of solid disseminations/tracks for each mini-element $d\mathbf{s} \in \delta\mathbf{s}$, where $æ_m$ means number of these spots.

Stated two *showings* we will represent in generalized form by coefficients a_r and $aæ$, depending from groups of proper numbers of its estimate. That estimate demands of methodical systematization and identification on base of preliminary deductive analysis as averaged along $\delta\mathbf{s}$ and $h_{a.s.j}$ of face-values of unevenness forms and distributions in its *j*-th local volume $\delta\mathbf{v}_{a.j}=h_{a.s.j}\delta\mathbf{s}$ (later on, if not of the special indication index *j* for local volume layer $\delta\mathbf{v}_{a.j}$ omits without loss for clarity of the presentation).

Now with a view of more thorough perception furthest opinions we cite following illustrative material.

On Fig.5 represented selection from transverse cutting of some part of solid (here plane) flooded by liquid boundary with real rough contact flooring S_w-*real*.

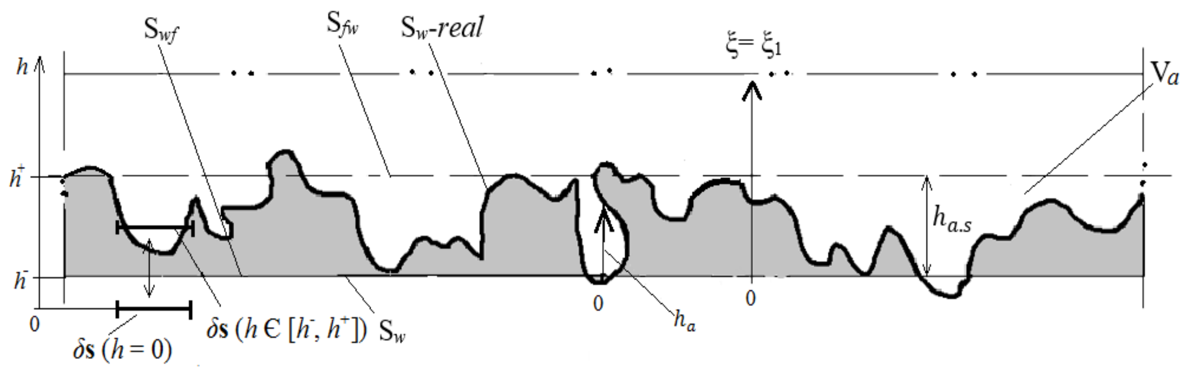

Fig. 5: Fragment of filling of a regular selection for solid technically roughness boundary S_w – real

Here introduced designations meaning of which are clarifications: $S_{wf}\wedge S_{fw}$ are conditional lower and upper boundaries of a roughness in the form analitic jointed on these boundaries and in pairs "*near-parallel*" each other of totalities *USE*, i.e. by ratio towards every pair elements $\delta\mathbf{s} \in S_{wf} \wedge \delta\mathbf{s} \in S_{fw}$ from similar points on $S_{wf}\wedge S_{fw}$. In addition distances $h_{a.s}$ between $S_{wf}\wedge S_{fw}$ are taken for thickness of the layer of roughness on each binary element from its marked of joining up on chosen part of the solid boundary. Stated index/showing for each *j*-th element of a layer can be determined by relations

$$h_{a.s}=h^{+}-h^{-}, h=h^{+}\vee h^{-}\, si \sum_{k=1}^{k_s} \overline{\partial\mathbf{s}}_{w.k} \le \varepsilon_w \vee \sum_{l=1}^{l_s} \overline{\partial\mathbf{s}}_{f.l} \le \varepsilon_f; \quad (7)$$

$$\overline{\partial\mathbf{s}} = {}^{\partial\mathbf{s}}/_{\delta\mathbf{s}},\ \delta\mathbf{s}_{w\vee f} = \sum_{k\vee l} \partial\mathbf{s}_{w.k\vee f.l},\ \delta\mathbf{s}_w + \delta\mathbf{s}_f = \delta\mathbf{s}, \quad (7a)$$

Here and too on Fig.5 is marked: h is current distance from *UCE*, established on certain fixed level of *comparison* (h =0) "near-parallel" with respect to $S_{wf}\wedge S_{fw}$; si – from Lat if; $\partial\mathbf{s}_{w\vee f}$– solid (index *w*) or fluid (index *f*) square of spits on cuts of roughness in sections h=const;$\varepsilon_{w\vee f}$– given small positive numbers; $\delta\mathbf{s}_{w\vee f}$– joint squares by proper spots in each section. Relations (7a) with consideration (7) are evidently. Axis $\xi = \xi_1$ is orthogonal to $\mathbf{S}_{wf}$ direction which is defined in common (of not plane) case by two main of radiuses of a curvature *UCE* $\delta\mathbf{s}$ for it weighted condition into fragment of a roughness layer $\delta\mathbf{v}_a$.

Later on surface $\mathbf{S}_{wf}$ is treated in the capacity of solid *smooth* wall $\mathbf{S}_w$ of a common boundary of designed flow domain.

Controller *UCE* s in each elementary volume $\delta\mathbf{v}_a$ must own in addition by next physical and geometrical properties: of

- *flexibility* but without of *tension;*
- *one-valued* establishment of curvature main radiuses and consequently of bench –mark$\vec{j_k}$, $k = \overline{1,3}$ of the local Cartesian's coordinates system *LSC* with radius-vector $\vec{\xi} \in \delta\mathbf{s} \in \delta\mathbf{v}_a$*;*
- *connexion continuity* of own contour with contours of its boundaries identities up to derivatives of second order from $\mathbf{X}_l$ *by* ξ_k, $l \wedge k = \overline{1,3}$ ($\vec{\mathbf{x}}$-global Cartesian's coordinates system).

On Fig.6 demonstrates imitation of a developed turbulent flow along wall at limits of conditional viscous under-layer (*VUL*) for selection by Fig.5. Presented here only qualitatively are epure time-averaged (by Reynolds) velocity $\vec{\upsilon}_{vl}$ and instantaneous sporadic distribution of pulsations $\vec{\upsilon}'_a$ as own from turbulization of a flow so and from action asperity approximately be modeled by means of developing here conception (see also lower). In immediate closeness to S_w by dark background is selected superthin layer $h_c = \xi_{kn}$ of a conservative part of a viscous under-layer h_{vl} with velocities $\upsilon_{-}(\xi = 0^{+})$ and $\upsilon_{+}(\xi = \xi_{kn})$ (see also Fig.1).

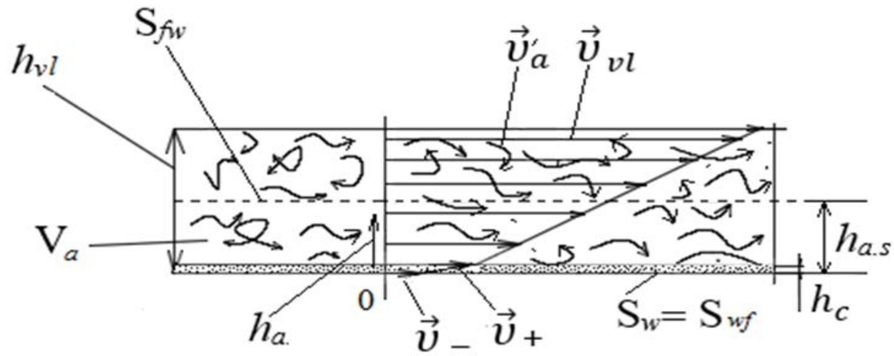

Fig. 6: Scheme of dynamics imitation of asperity actions by stochastic field of velocity $\vec{\upsilon}'_a$ for a developed turbulent flow of main stream

Analysis represented above permits to propose in principal plan of the following procedure of perturbation account from roughness actions. At mentioned previously common conditions (see in introduction article chosen from the left by two thickened points ••) to direct and back transformations (5), (6) are set up *one-to-one* correspondence between certain current random φ' and proper bu it prescribed "law" of distribution $\Re(\varphi')$ also current but integral function distribution Ψ (see too Fig.3). Then, *for imitation of random acperity disturbance sources in each j-th elementary volume* $\delta\mathbf{v}_a$ *of full layer of roughness* V_a *but for concrete cut* $\bar{h}_a = h_a/h_{a.s}\, hasin\delta\mathbf{v}_a$ *with virtual focus* $\vec{\mathbf{x}}_f$ *placed in it cut UCE* $\delta\mathbf{s}$, can be composed, *on condition of achieved at to present time but far not full knowledge about subject of study and therefore in many symbolically and along form recording structurally,* functional

$$\Phi'_a = \Phi'_{a.\sup}\{\bar{h}_a, \boldsymbol{a}_r, \boldsymbol{a}_{æ}; Rg^*\} \cdot \mathcal{L}^{-1}\{\Psi_a[\Re_a(\varphi'_a|_{[-1,1]}; \bar{h}_a, \boldsymbol{a}_r, \boldsymbol{a}_{æ}; Rg^{**})]\}; \tag{8}$$

$$\Phi'_a = p'(\vec{\mathbf{x}}_f, \boldsymbol{t}) \vee T'(\vec{\mathbf{x}}_f, \boldsymbol{t}) \vee \upsilon'_i(\vec{\mathbf{x}}_f, \boldsymbol{t});\ \vec{\mathbf{x}}_f \in \delta\mathbf{s} \in \delta\mathbf{v}_a \in \mathbf{V}_a;\ \Psi_a = \text{G}. \tag{8a}$$

Functional Φ'_a at not principal restrictions $\Phi'_{a.\sup} > 0$, $|\Phi'_{a.\inf}| = \Phi'_{a.\sup}$, in particular for law"$\Re_a$ as even function from φ'_a, reproduces changes indicated in (8a) random qualities and represented in view product of the two factors. First factor in expression (8) is, as indicated previously, estimate of above of a random pulsation for one from quantities Φ'_a (see (8a)) in points $\vec{\mathbf{x}}_f$. Second factor represents result of transformation by operator $\mathcal{L}^{-1}$of integral functions of distribution Ψ_a in represented by norm random qualitied φ'_a. Both factors parametrically depends from characteristics of roughness $\bar{h}_a, \boldsymbol{a}_r, \boldsymbol{a}_{æ}$ and also by some generalized way from functions of flow regime Rg^*, Rg^{**} on upper boundary $\mathbf{S}_{fw}$ of layer V_a (see Fig.6). Its functions are defined by current estimates of fundamental substances $[\rho(\vec{\mathbf{x}}_f, \boldsymbol{t}), \varepsilon(\vec{\mathbf{x}}_f, \boldsymbol{t}), \vec{\upsilon}(\vec{\mathbf{x}}_f, \boldsymbol{t})]|_{\bar{h}_a=1}$.

Regarding measure of determination dependences of functional Φ'_a and "laws" $\Re_a$ from indexes $\bar{h}_a$ in present time permissibly reasoning only from physical premises to assume that

$$\Phi'_{a.s}|_{\bar{h}_a=0} < \Phi'_{a.s}|_{\bar{h}_a>0},\ \Phi'_{a.s}|_{\bar{h}_a=1} > \Phi'_{a.s}|_{\bar{h}_a<1},\ \Re_a(\varphi'_a \in [-1,1])|_{\bar{h}_a=0} = \tfrac{1}{2},$$

Where index $s = sup$.

It is clear that concrete definition representations (8), (8a) possible only by results of a statistical analysis of experimental information about specifically and will posed measurements of pulsatile quantities in immediate closeness at to ledges of a roughness. In range $0<\bar{h}_a<1$ the most simple approximation of functions in presented relations evidently is its linear dependence from $\bar{h}_a$.

At development of computer algorithms obtained on base of the stated concept fields of random quantities in one way or another of inter – or extrapolation are translated on fixed 3Drated net of the *E-system* of count.

Considered stochastic quantities naturally enters into kinematic, force, moment and heat functions of action, i.e. into terms of the left part of thermomechanics fundamental equations marked at work [9] by numbers (I) - (IV) in right column of table contained into it publication. It is important to keep in mind, that present quantities are appearing directly just on greatly high interval *FWS* in accordance of estimates (1), (2) and also in a layer of roughness $\mathbf{V}_a$ with "laws" of distribution $\Re_{dhc}, \Re_{dmt}$, и $\Re_{asp} = \Re_a$ accordingly.

To this end, we will state the next of no small importance remark. In our work [8] in sufficiently expanded appearance considered problem of the binary interaction smooth-wall solid and fluid phases. However, concrete mean of the description for electromagnetic by force and volume action of field $\vec{F}_w$ on the conservative part of the fluid viscous under-layer was omitted.

Necessity into immediate account of the indicated effect is emerged at development in present time of algorithm for computer realization of developing by author's theory.

Experience shows that both for interior and for exterior tasks of fluid stream dynamics at until and over critical conditions of streams, including turbulence, by steady and instability flows exists however zones with *extremely high* wall layer gradients of fields functions at current without breaking-off: parts of discharge into canal, vicinity of the braking points, transitional processes and other.

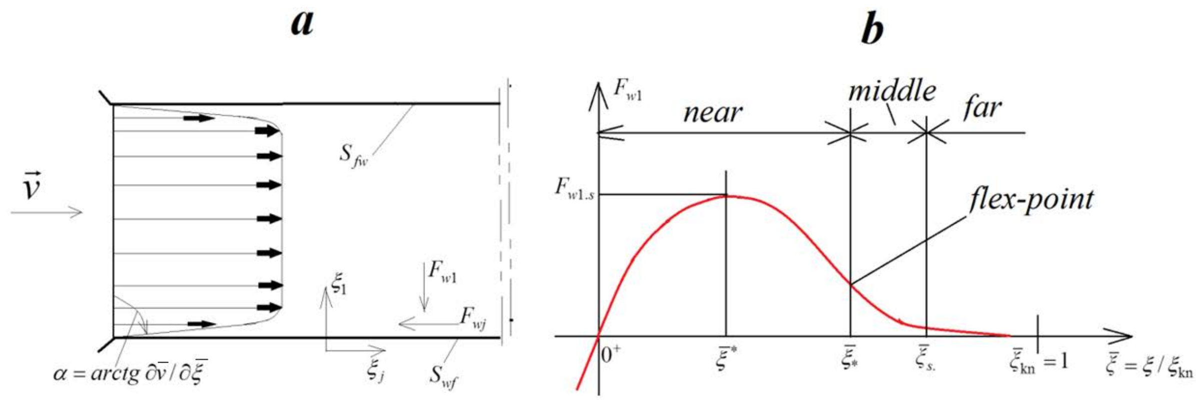

Fig. 7: To account of two-phase interaction of the smooth wall solid surface with fluid layer ($\bar{\xi}_1 = \bar{\xi}$)

On Fig. 7a is shown epure of a velocity at *smooth* but *intensive* discharge flow into canal with primary stage of boundary layer formation and consequently at an angle **α** ≈ *π*/2 for non dimension gradient of velocity on $\bar{\xi}$.

Noted fact provide a explained by attractable operation of the interphase force field $\vec{F}_w$. It field substantially counteract, i.e. are opposite in sign, super high repulsion shear stress in noted layers of fluid mediums (see [8], subscript *a* replaced by *w*). On Fig. 7b is given quality representation of component F_{w1} of function $\vec{F}_w$ by normal surface S_{wf}. Corresponding terms, occurring only in the layer $\bar{\xi} \in [0^+,1]$, for equation of a momentum balance (see table and equation II in work [9]) at quasi-linear statement and at restriction by consideration only properly of elementary particles deformation from adjoined on wall liquid layer S_{fw} in local Cartesian's coordinates system we can to down takes the next forms

$$\vec{F}_w = i_k F_{wk},\ k=\overline{1,3};\ F_{w1} = \kappa_{w1} G_n(\bar{\xi})\bar{u}_{d1};\ F_{wj} = \kappa_{wj} G_s(\bar{\xi})(1-\bar{\xi})\bar{u}_{dj},\ j=2,3; \tag{9}$$

$$\bar{u}_{d1} = u_{d1}/\xi_{kn} = \xi_{d1}/\xi_{kn},\ \ \bar{u}_{dj} = u_{dj}/u_d^*,$$

where κ_{wk} - collapse-functions (see [9]), u_d^* - critical meaning of a shear deformations on wall, $\vec{F}_w = 0$ at $\bar{\xi} > 1$.

Clearly that concrete aspect and meaning marked on Fig. 7b parameters of near - $[0^+, \bar{\xi}_*]$, middle - $[\bar{\xi}_*, \bar{\xi}_{s,}]$ and far - $[\bar{\xi}_s, 1]$ action of the component F_{w1} , and also coefficients $G_n = \rho g_n$, $G_s = \rho g_s$ (*Dim* $g_{n\vee s} = \text{м/c}^2$.), parameters ξ_{kn}, u_d^* are requiring of own experimental establishment.

III. Conclusion

From contents of text it follows extraordinary complexity of random effects consideration even on level of qualitative estimates and semi-analytical acceptances of its under-net sources of perturbation.

Approach at to desired can be achieved only on the basis of system statement and careful realization of complex and precision physical experiments with particularly high resolving ability. In this connection no doubt attraction of modern and powerful computer software, in particular, for probabilistically statistical machining treatment obtained empirical of material and it of consequent methodical study.

References Références Referencias

1. Morgunov G.M. (2015) Neoformalism approach to the dynamics of continuous media // World intellectual property organization. Publ. date 05.02.2015: 44 p. [In Russian]. http://patent-scope.wipo.int/search/en/detail.jst?docId=WO2015 016736.
2. Morgunov G.M. (2015) Rational phenomenological models of external fields effect in conditions of non-equilibrium thermomechanics of continuous media // Materials of the VII international scientific and practical conference «Fundamental science and technology – promising developments VII», vol. 1, 1-2 Dec. 2015 – North Charleston, SC, USA, pp. 154 - 166. – ISBN:978-1-51973-544-7.
3. Morgunov G.M. (2015) Deduction of action factors in Neoformalism of dynamics of continuous media // Materials of the VIII ISPC «Academ. Science-problems and achievements», v.1, 15-16 Feb. 2015 – North Charleston, USA, pp. 142-146, ISBN: 978-1530131884.
4. Morgunov G.M. (2015) Discrete spectrum decomposition of field functions for strongly indignant dynamics of continuous mediums // Materials of the V ISPC «Fundamental and applied sciences today», v.1, 30-31 March, – North Charleston, USA, pp. 144-148, ISBN: 978-1511565684.
5. Morgunov G.M. (2015) Phenomens of plastic in solid and turbulent transition in fluids // Materials of the V ISPC «Fundamental science and technology – promising developments V», v.1, 24-25 Feb. 2015, – North Charleston, USA, pp. 147-156, ISBN: 978-1508657552.
6. Morgunov G.M. (2016) Paradigm of the amplification in kinetics of continuous mediums and generated by it's consequences // Materials of the IX ISPC «21 century: fundamental science and technology IX». v.1, 30-31 May 2016. – North Charleston, USA, pp.151-157. – ISBN: 978-1533648594.
7. Morgunov G.M. (2016) Truth episteme in continuous mediums dynamics // Materials of the VI ISPC «Topical areas of fundamental and applied research VI». v.1, 20-23 June 2016, – North Charleston, USA, pp.144-148. – ISBN: 978-1514717370.
8. Morgunov G.M. (2016) Compendium near-wall interaction problem and boundary conditions on smooth solid boundaries in dynamics problems of continuous fluid media // Materials of the VIII ISPC «Science in the modern information society VIII», v.1, 28-29 March 2016, – North Charleston, USA, pp. 117-131, – ISBN: 978-1530830374.
9. Morgunov G.M. (2016)Restrictions of the traditional model of continuous/fluid medium dynamics and alternative conception // Materials of the INPC «Academic science-problems and achievement X», v.1, 24-25 oct. 2016, North Charleston, USA, pp.83-98. – ISBN: 978-1539815716.
10. Morgunov G. M. (2005) Socio sinergetic and Education: M., Pabl. MPEI, - pp.75-77, 152p. [in Russia].
11. Comte-Bellot G. (1968) Ecoulementturbulententred euxparous parallels: Paris, 1965 [Rus. Ed. G. Cont-Bello. Turbulent flow in canal with parallel of walls: M., Pabl. «MIR», -pp.153-156, 176p.]

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Structural, Optical and Raman Characterization of Nano-Crystalline Cu Doped ZnO Thin Films Deposited by Pulse Laser Deposition Technique

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University of Puerto Rico

Abstract- In the present work, Cu doped ZnO thin films were deposited on Indium Tin Oxide (ITO) substrates using Pulse Laser Deposition(PLD) at different substrate temperatures. The effect of substrate temperature on the structure of thin films, surface morphology, optical, and electrical properties of the deposited thin films was investigated. The structure of Cu doped ZnO confirmed by using a X-ray diffraction pattern. X-ray diffraction patterns show that all thin films have a wurtzite structure with (002) orientation. Atomic force microscopy are used for surface analyses. The transmittance of the thin films was measured in the wavelength range of 300 nm - 800 nm. The band gap of the thin films was estimated (3.14 eV to 3.28 eV) using the UV-Visible absorption spectra. Raman spectroscopy was used to find the atomic bond behavior at room temperature and lower than room temperature. These films have a possible application in thin films based on solar cells and sensors.

Keywords: *ZnO, PLD, XRD, AFM, and raman characterization.*

GJSFR-A Classification: *FOR Code: 020599*

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Abstract- In the present work, Cu doped ZnO thin films were deposited on Indium Tin Oxide (ITO) substrates using Pulse Laser Deposition(PLD) at different substrate temperatures. The effect of substrate temperature on the structure of thin films, surface morphology, optical, and electrical properties of the deposited thin films was investigated. The structure of Cu doped ZnO confirmed by using a X-ray diffraction pattern. X-ray diffraction patterns show that all thin films have a wurtzite structure with (002) orientation. Atomic force microscopy are used for surface analyses. The transmittance of the thin films was measured in the wavelength range of 300 nm - 800 nm. The band gap of the thin films was estimated (3.14 eV to 3.28 eV) using the UV-Visible absorption spectra. Raman spectroscopy was used to find the atomic bond behavior at room temperature and lower than room temperature. These films have a possible application in thin films based on solar cells and sensors.

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I. Introduction

Zinc Oxide is one of the most employed nanomaterials by its environmental safety and ease to fabricate by chemical methods. ZnO is commercially available with advantages viz. comparatively low cost, environment-friendly non-toxic material, wet chemical processes [1, 2]. ZnO is a large band gap (3.37 eV) semiconductor with excitonic energy (60 meV) [3]. Usually, ZnO shows intrinsically n-type conductivity due to native defects [4]. ZnO has been investigated extensively for applications in UV photodetectors [5], light-emitting diodes [6], photodiode [7], chemical industry [8, 9] and transparent conductive layer [10]. Optically transparent ferromagnetic DMSs, obtained by doping paramagnetic transition metal ions into semiconductors, has received particular attention for integrated Opto-spintronic applications [11, 12]. ZnO, which has large bandgap and exciton binding energies, excellent mechanical characteristics, and is inexpensive and environmentally safe, has been identified as a promising host material. Stable ferromagnetic configurations arising from carrier-mediated exchange interactions have been predicted for several transition metal-doped ZnO DMSs [13, 14].Among all TMs, Cu doping in ZnO has received a lot of attention owing to less contradictory results about the ferromagnetic property. Herng et al found ferromagnetism in their Cu-doped ZnO thin films, which were prepared at a pressure of 5×10^{-6}Torr [15] and found to have oxygen vacancies. They have shown that the presence ofa coupling between oxygen vacancies and Cu^{1+} isolated impurities is essential for their films to exhibit ferromagnetism. TM doping induced ferromagnetism and Mg/Li doping induced ferroelectricity in ZnO film, efforts have been made to study the effect of co-doping of Mg and Li studies on structural, optical and magnetic properties of Mg- and Li-doped Cu: ZnO films in TM-doped ZnO films [16].

As per the literature available, the ferromagnetic property in doped ZnO still remains controversial. Even though the consensus about absence of ferromagnetic coupling in intrinsic TM-doped ZnO film is grow in rapidly, new reports are claiming ferromagnetic coupling in TM-doped ZnO film. In the present work, Cu doped ZnO thin films were grown on ITO coated glass substrates by PLD method. The substrate temperatures were fixed at 150^{0}C, 250^{0}C, 350^{0}C, 450^0 Crespectively during the growth of samples. The effect of substrate temperature on structural, morphological, optical and magnetic properties of Cu/ZnO have been investigated.

II. Experimental Method

In this Paper ZnO:Cu thin films samples of thickness around 200nm were prepared using pulsed laser deposition technique. The substrate temperatures were fixed at 150^{0}C, 250^{0}C, 350^{0}C, 450^0 Crespectively during the growth of samples. The substrates were clean up sequentially using isopropyl alcohol, detergent solution, methanol followed by deionized water in the ultrasonic bath cleaner. And subsequently ZnO: Cu thin films were deposited by PLD on the highly cleaned Indium Tin Oxide (ITO) coated glass substrates. To obtain free- risking pinhole thin film each parameter of the PLD was optimized (25 m torr, 250 m J) at high vacuum condition using a KrF Laser (248nm, 10 number

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of shots per sec, 30Hz) to ablate a sintered ZnO:Cu target in nitrogen atmosphere. Laser ablation was carried out by scanning the sample inside the vacuum chamber which is kept at 10^{-6}torr, by using a molecular pump together with a mechanical pump. The target was sintered at 900^{0}C in Ar gas atmosphere in vacuum condition for 5 hours. The laser beam was focused onto the target material surface using a leans of focal length 5cm. The target was maintained in continuous horizontal and vertical displacement in order to refresh the ablated zone. The incident laser pulse energy and repetition rate for film deposition on ITO substrates was obtained as 90mJ, and 10 Hz, respectively. The target and the glass substrate holder were rotating at 5rpm and -5rpm, respectively. The distance between the substrate holder and the target inside the vacuum chamber was ~5cm. A resistive type heater was used to heat the substrate temperature to reach the set value. Before deposition, pre-ablation procedure was followed by irradiating the ZnO: Cu target.

III. Results and Discussion

a) Structural properties

The structural properties of the ZnO thin films were studied from the X-ray diffraction (XRD) patterns in the 2θ scan range of 10˚ to 80˚. Fig. 1 shows the XRD patterns of Cu doped ZnO thin films deposited on the ITO coated glass substrate at substrate temperature 250^{0}C. The observed XRD peaks verify the polycrystalline nature with the hexagonal wurtzite structure of ZnO. XRD spectra indicated the presence of substrate peak and denoted (*) in the XRD pattern. The obtained XRD spectra were well matched with JCPDS (Card No. 36-1451) of the wurtzite ZnO structure [17, 18]. All the diffraction peaks are indicated to ZnO (except for the diffraction peaks of ITO substrate indicated by star) and no other peaks were detected for any impurities on the XRD pattern. The diffraction peaks correspond to (100) and (002) planes, which indicate that the film have preferential c-axis orientations.

The crystal size for the films was calculated by using Debye Scherer's formula [19].

$$D = \frac{0.94\lambda}{\beta\cos\theta} \quad (1)$$

where, θ is the Bragg's diffraction angle, β is the full width at half maximum of (002) peak of XRD pattern and λ is the X-ray wavelength (1.54 Å). The crystallite size observed forZnO:Cu thin film on ITO substrate is 38 nm.

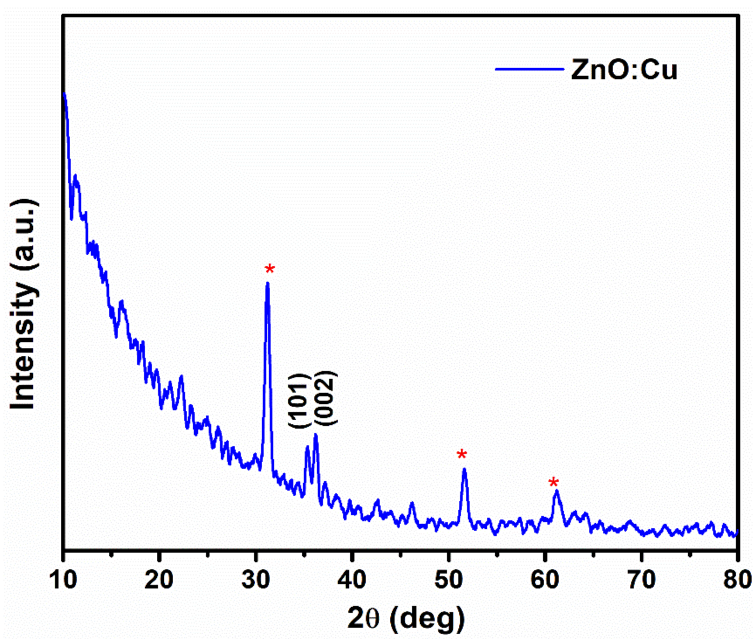

Fig. 1: XRD patterns of Cu doped ZnO thin films deposited on the ITO coated glass substrate at substrate temperature 250^{0}C

b) Surface Morphology

AFM measurements were performed to study the differences on the surface microstructure and roughness of the ZnO:Cu thin films. The AFM images (Fig. 2) were taken in a 5×5 μm^{2}areaand show that all the films consisted of nanoparticles while the particle size continuously decreased with increasing substrate temperature. The surface root-mean-square roughness values of different films were found to be 32, 28, 25 and 22 nm for substrate temperature 150^{0}C, 250^{0}C, 350^{0}C, 450^0 Crespectively. It has been observed that the samples had agglomerated particles. The average grain sizes were found to be almost in the same range of 100nm for all of the samples. Similar results were obtained by Trilok et al. [1] in CdZnO thin films on glass substrates by sol-gel method with different Cd concentration. It was observed that the surface characteristics of all samples were the same, only the grain size and roughness changed with relative oxide proportion.

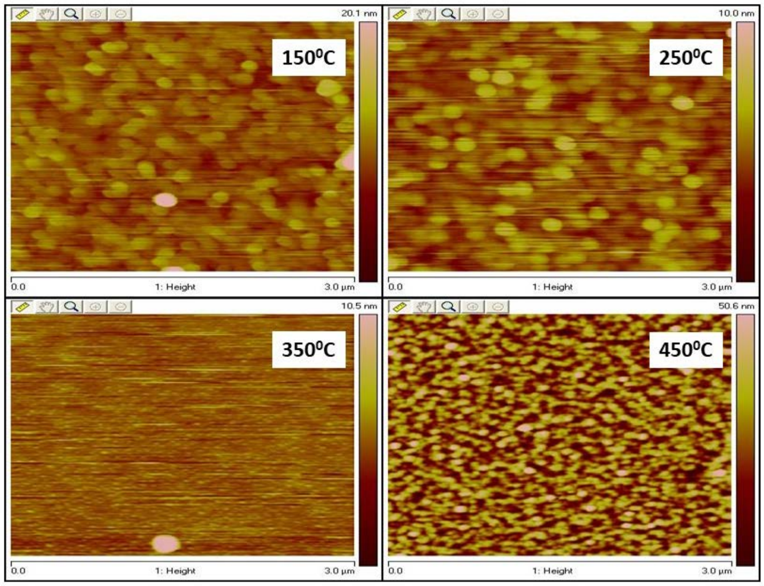

Fig. 2: AFM images of Cu doped ZnO thin films deposited on the ITO coated glass substrate at substrate temperature 150^{0}C, 250^{0}C, 350^{0}C and 450^{0}C

c) *Optical analysis*

The optical properties of Cu doped ZnO thin films deposited on ITO coated glass substrate at different substrate temperature were studied. Fig.3 shows the optical transmittance spectra in the wavelength range 300-800 nm. The thin films show average 25 % optical transmittance in the visible region 400 - 800 nm and a sharp absorption edge in the ultraviolet region was observed. The transparency of thin films minimum for Cu:ZnOthin film deposited at 450^{0}C substrate temperature.

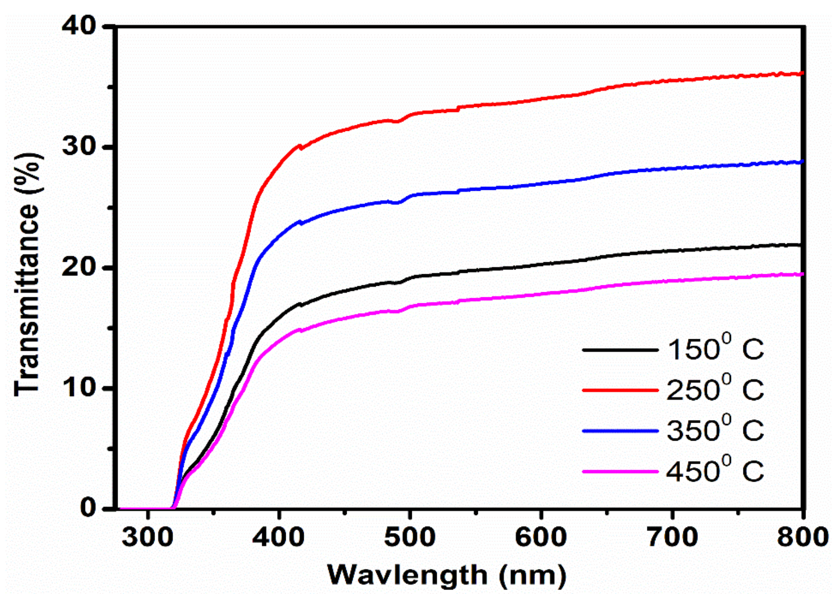

Fig. 3: Transmittance spectra of Cu doped ZnO thin films deposited on the ITO coated glass substrate at substrate temperature 150^{0}C, 250^{0}C, 350^{0}C and 450^{0}C

The optical band gap of Cu doped ZnO thin film of different substrate temperature was calculated from Tauc's plot method as shown in Fig. 4.

$$(\alpha h\upsilon)^2 = A(h\upsilon - E_g) \quad (2)$$

Where, α is the absorption coefficient, $h\upsilon$ is the photon energy, A is an energy independent constant and E_g is the optical band gap. The optical bandgap E_g values were obtained by extrapolating the linear portion of the plots of $(\alpha h\nu)^2$vs hν [20]. The resulting optical band gap of 250⁰C film was highest 3.28eV due to highest transmittance in violet region and it continuously decreases as substrate temperature increases and the smallest band gap 3.14 eV was obtained for highest substrate temperature film 450⁰C. The increase in the crystalline size and the reduction of defects might be the reason for the decrease in band gap energy with increase in deposition substrate temperature [21].

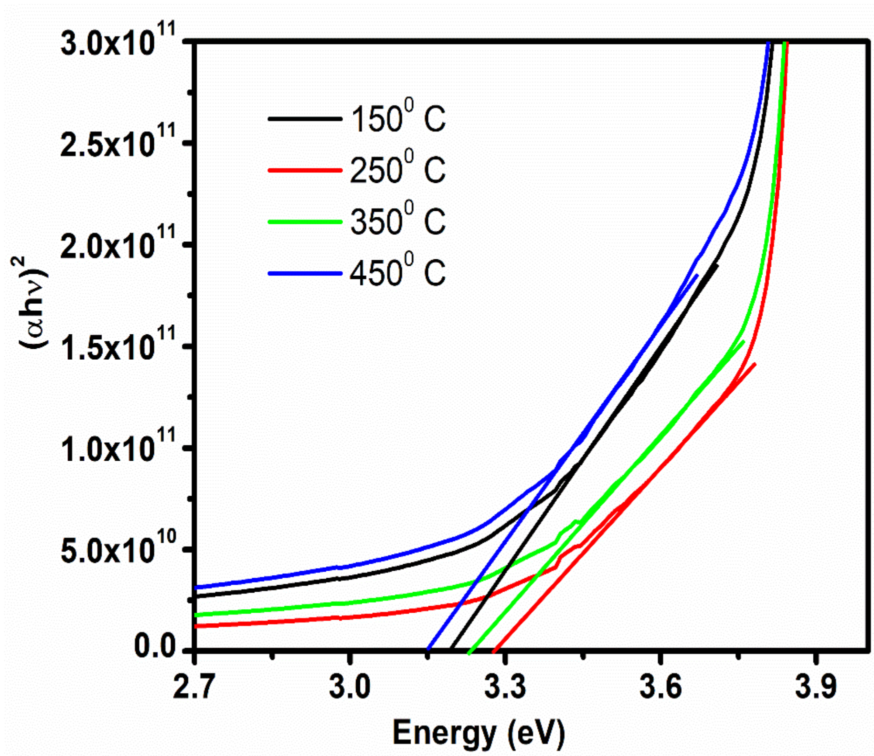

Fig. 4: Bandgap spectra of Cu doped ZnO thin films deposited on the ITO coated glass substrate at substrate temperature 150⁰C, 250⁰C, 350⁰C and 450⁰C

IV. Raman Analysis

Fig.5 shows low temperature Raman spectra for Cu-doped ZnO films deposited on ITO coated glass substrate, substrate temperature 250⁰C, keeping the incident light near normal to the surface. The temperature varied from -153⁰C to room temperature 27⁰C to observed Raman spectroscopy. Only two modes should be observed for Cu doped ZnO film, i.e. E2and A1(LO), if the incident light is near normal to the surface, because other modes are forbidden according to the Raman selection rules in this situation [22]. In Cu:ZnO films, a broad band ranging from 500 to 620cm^{-1} is observed. No E2(high) mode is observed in these films, possibly due to the breaking of translational symmetry caused by the intrinsic defects or by the dopant. It has been reported that the breakdown of the translational symmetry due to structural disorder results in an enhancement and broadening of the A1(LO) mode (at 564 cm^{-1}). No Raman peaks from CuO are present in the Raman spectra for any of the films, which further supports structural results from the XRD patterns that there is no CuO phase present in the ZnO: Cu thin films.

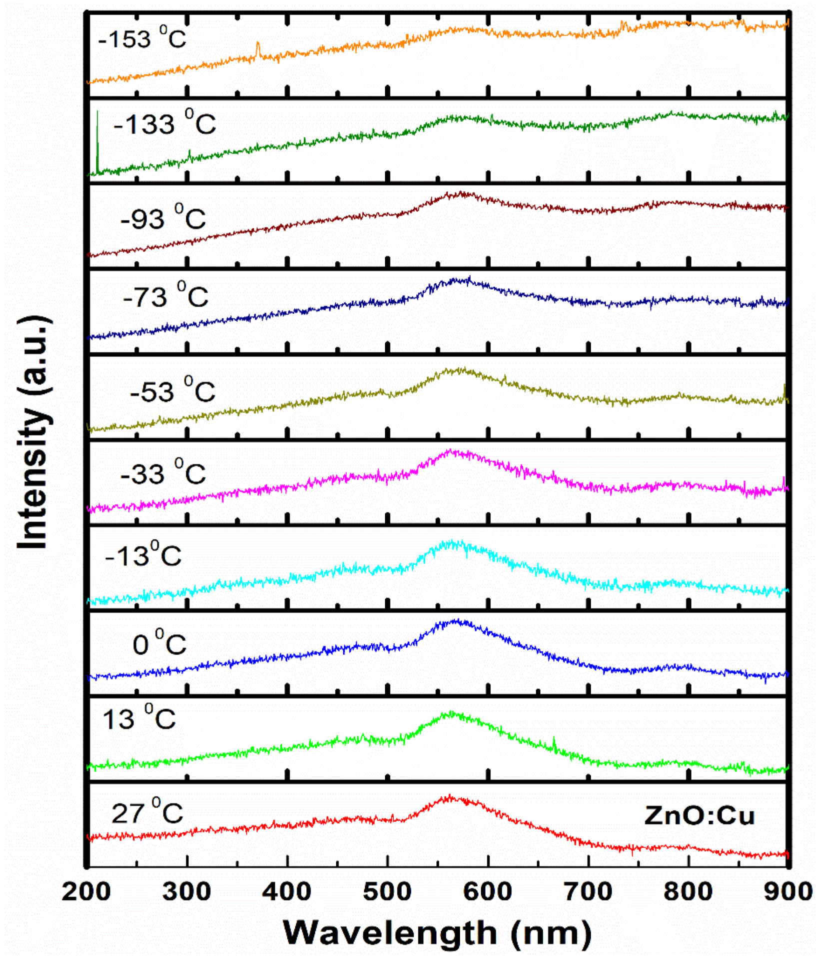

Fig. 5: Low temperature Raman analysis of Cu doped ZnO thin films deposited on the ITO coated glass substrate at substrate temperature 250^{0}C

V. Magnetic Properties

The magnetic measurements for ZnO: Cu thin film is carried out using the VSM at 300 K. The results for ZnO: Cu thin film (deposited at 250^{0}C) is shown in Fig. 6. The film with the substrate shows diamagnetic behavior. No evidence of ferromagnetic behaviour is observed for the film. Herng et al [15] have studied Cu-doped ZnO films and found that oxygen vacancies play an important role in favouring ferromagnetism in films deposited by PLD. The films in the present study are prepared under a base pressure of 10^{-5}Torr butthey are not found to be ferromagnetic, although we have also observed a broad peak at 564 cm^{-1} in the Ramanspectra, which confirms the presence of oxygen vacancies in the films. It was found that an oxygen vacancy in the first nearest shell can suppress ferromagnetism quite a lot, and if it is in the second nearest shell the suppression is less. So, in either case the oxygen vacancies should decrease any ferromagnetism as compared to film without oxygen vacancies, as per our theoretical calculations. Furthermore, the position of an oxygen vacancy is also important in determining its effect on magnetism, in addition to its concentration. So, the difference in magnetic propertyin our Cu:ZnO films and in films reported in [15] may be due to the different position of oxygen vacancies present in the wurtzite structure.

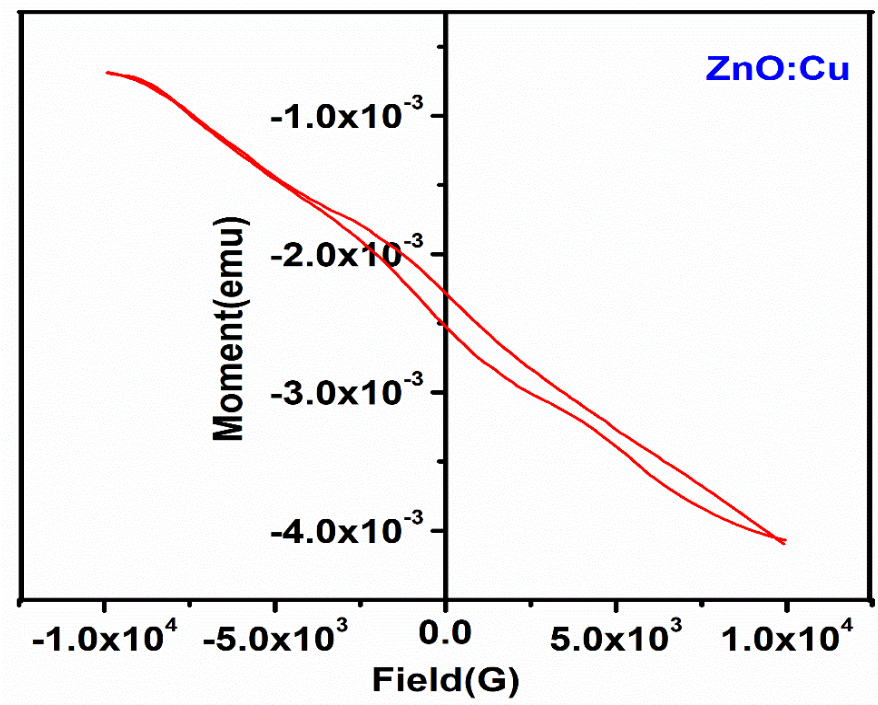

Fig. 6: Magnetic properties of Cu doped ZnO thin films deposited on the ITO coated glass substrate at substrate temperature 250°C

VI. Conclusion

Cu doped ZnO films, prepared by PLD, show a single phase as determined by X-ray diffraction pattern. X-ray diffraction pattern shows the wurtzite structure with a preferential c-axis (002) orientation. Atomic force microscopy is used to measure particle size of thin films. The average transmittance of the thin film was 25% and highest band gap observed 3.28 eV. A further structural analysis by Raman spectroscopy does not show any evidence of an impurity phase in the films. The VSM result shows the diamagnetic behaviour of Cu doped ZnO thin films. It is concluded that the concentration of oxygen vacancies is not the only important parameter for the occurrence of ferromagnetism in Cu: ZnO but that the position of oxygen vacancies also plays an important role.

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References Références Referencias

1. T.K. Pathak, J.K. Rajput, V. Kumar, L.P. Purohit, H.C. Swart, R.E. Kroon, Transparent conducting ZnO-CdO mixed oxide thin films grown by the sol-gel method, Journal of Colloid and Interface Science 487 (2017) 378-387.
2. U. Chaitra, D. Kekuda, K.M. Rao, Dependence of solution molarity on structural, optical and electrical properties of spin coated ZnO thin films, Journal Materials Science: Materials in Electronics 27 (2016) 7614–7621.
3. T.K. Pathak, V. Kumar J. Prakash L.P. Purohit, H.C. Swart and R.E. Kroon, Fabrication and Characterization of Nitrogen Doped p-ZnO on n-Si Heterojunctions, Sensors and Actuators A 247 (2016) 475-481.
4. V. Kumar, N. Singh, A. Kapoor, O.M. Ntwaeaborwa, H.C. Swart, Fabrication and characterization of n-type aluminum-boron co-doped ZnO on p-type silicon (n-AZB/p-Si) heterojunction diodes, Materials Research Bulletin 48 (2013) 4596–4600.
5. V.S. Rana, J.K. Rajput, T.K. Pathak, L.P. Purohit, Multilayer MgZnO/ZnO thin films for UV photodetectors, Journal of Alloys and Compounds 764 (2018) 724-729.
6. Y.S. Choi, J.W. Kang, D.K. Hwang, S.J. Park, Recent advances in ZnO-based light-emitting diodes, IEEE Transactions on Electron Devices 57 (2010) 26–41.
7. H.D. Um, S.A. Moiz, K.T. Park, J.Y. Jung, S.W. Jee, C.H. Ahn, D.C. Kim, H.K. Cho, D.W. Kim, J.H. Lee, Highly selective spectral response with enhanced responsivity of n-ZnO/p-Si radial heterojunction nanowire photodiodes, Applied Physics Letters 98 (2011) 033102.

8. R. Ahmad, N. Tripathy, Y.B. Hahn, Wide linear-range detecting highsensitivity cholesterol biosensors based on aspect-ratio controlled ZnOnanorods grown on silver electrodes, Sensors and Actuators B: Chemical 169 (2012)382–386.
9. M.R. Alenezi, S.J. Henley, N.G. Emerson, S.R.P. Silva, From 1D and 2D ZnO nanostructures to 3D hierarchical structures with enhanced gas sensing properties, Nanoscale 6 (2014) 235–247.
10. J.K. Rajput, T.K. Pathak, V. Kumar, H.C. Swart, L.P. Purohit, Tailoring and Optimization of Optical Properties of CdO Thin Films for gas sensing Applications, Physica B: Physics of Condensed Matter, 535 (2018) 314-318.
11. H Kimura, T Fukumura, M Kawasaki, K Inaba, T Hasegawa and H Koinuma., Rutile-type oxide-diluted magnetic semiconductor: Mn-doped SnO2. Appl. Phys. Lett, 80 (2002) 94-96.
12. M. Venkatesan, C. B. Fitzgerald, J.G. Lunney, and J. M. D. Coey., Anisotropic Ferromagnetism in Substituted Zinc Oxide. Phys. Rev. Lett, 93 (2004) 177206-177209.
13. Nguyen Hoa Hong and Joe Sakai., Ferromagnetic V-doped SnO2 thin films. Physica. B, 358(2005) 265-268.
14. Nguyen Hoa Hong, Antoine Ruyter, and W Prellier. Magnetism in Ni-doped SnO2 thin films. J. Phys: Condens. Matter, 17 (2005) 6533-6538.
15. T S Herng, Room temperature ferromagnetism of Cu-doped ZnO films probed by soft x-ray magnetic circular dichroism, Phys. Rev. Lett. 105 (2010) 207201.
16. P S Vachhani, Amit H Rawal, A K Bhatnagar, R J Choudhary, D M Phase, Parasmani Rajput, S N Jha and D Bhattacharyya, Studies on structural, optical and magnetic properties of Mg- and Li-doped Cu:ZnO films, Mater. Res. Express 4(2017)076109.
17. J.K. Rajput, T.K. Pathak, V. Kumar, H.C. Swart, L.P. Purohit, CdO:ZnO nanocomposite thin films for oxygen gas sensing at low temperature, Materials Science & Engineering B 228 (2018) 241–248.
18. H.D. Dhaygude, S.K. Shinde, N.B. Velha, G.M. Lohar, V.J. Fulari, Synthesis and characterization of ZnO thin film by low cost modified SILAR technique, AIMS Materials Science 3 (2016) 349-356.
19. T.K. Pathak, V. Kumar, H.C. Swart, L.P.Purohit, Electrical and optical properties of p-type codoped ZnO thin films prepared by spin coating technique, Physica E77 (2016) 1-6.
20. C.J. Raj, S.N. Karthick, K.V. Hemalatha, S.K. Kim, B.C. Kim, K.H. Yu, H.J. Kim, Synthesis of self-light scattering wrinkle structured ZnO photoanodebysol-gel method for dye-sensitized solar cells, Applied Physics A 116 (2014) 811-816.
21. S. Velanganni, S. Pravinraj, P. Immanuel, R. Thiruneelakandan, Nanostructure CdS/ZnO heterojunction configuration for photocatalytic degradation of Methylene blue, Physica B: Condensed Matter 534 (2018) 56–62.
22. Y M Hu, C Y Wang, S S Lee, T C Han, W Y Chou and G J Chen, Identification of Mn-related Raman modes in Mn-doped ZnO thin films J. Raman Spectrosc. 42 (2011) 434–7.

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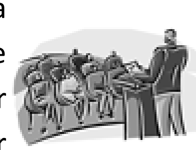

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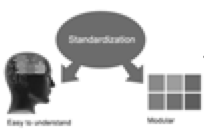

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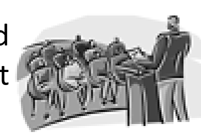

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

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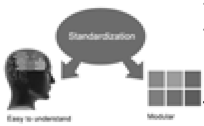

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8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

  - Single section and succinct.
  - An outline of the job done is always written in past tense.
  - Concentrate on shortening results—limit background information to a verdict or two.
  - Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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