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Stretching of the Super-Elastic Double-Helix Geon. Wheeler´s Thermal Geons as Quanta of Heat and Momentum. Bohm´s Diffusion and the Heating of the Solar Corona and Heating of the Earth - Geon Engineering. Milgrom-Verlinde Constant. Mareš - Šesták constant. (15.02.2020)

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Abstract

In our approach we have combined knowledge of Old Masters (working in this field before the year 1905), New Masters (working in this field after the year 1905) and Dissidents under the guidance of Louis de Broglie and David Bohm. Based on the great works of Julian Schwinger and John Archibald Wheeler we will study properties of geons formed by fusion of two soft x-ray particles (dyons) in the Schwarzschild gravitation core in our Sun at temperature 16 * 10^6 K. There are now several Teams that are able to achieve this fusion temperature in their special instruments (Tokamak, HL-2M Tokamak, Wendelstein 7-X, NIF, etc.) and to study properties of those formed geons. Thermal geons are with us all the time but they are very deeply hidden in our experiments. We have newly introduced Mareš - Šesták constant as the ratio of geon momentum to heat quantum of geon. The key information to enter into the World of geons was the empirical formula of David Bohm - the very well-known Bohm diffusion. From this formula we have extracted the amplitude, wavelength, frequency, quantum of the geon action, displacement law for geons, etc. It was found that geons are highly sensitive to the magnetic field strength. At a low magnetic field strength, the "inflation of geons" can occur. This effect could explain the Superheating of the Solar corona and the observed Heating of the Earth during two last centuries influenced by the changes in the Earth´s magnetic field. Geon engineering might modify the geon volume through the magnetic field strength. On the other hand, we were stimulated by the works of Mordehai Milgrom and Eric Verlinde and derived the Milgrom-Verlinde constant describing the gravitational field strength leading to the Newtonian gravitational constant on thermodynamic principles. The quantum of the geon momentum might open a new way how to understand gravitational phenomena. Can it be that Nature cleverly inserted geons into our experimental apparatuses and into our very-well known Old Formulae? We want to pass this concept into the hands of Readers of this Journal better educated in the Mathematics, Physics, and Thermodynamics.

Keywords: Super-Elastic Double-Helix Geon, Stretching Effect in the Magnetic Field, Temperature Effect - Mareš - Šesták Constant, "Geon Inflation", Geon Properties Hidden in Old Formulae, Bohm Diffusion, Advanced Tokamak and Nif Apparatus, Big G and Advanced NIF, Quantum of Heat, Quantum of Momentum, Milgrom-Verlinde Constant, Superheating of the Solar Corona, Heating of the Earth, Geon Engineering, "Nature Loves to Hide"

1. Introduction

The model of the double helix for the description of the photon wave appeared many times in the so-called dissident literature (outside of the mainstream literature). There are known many proposals for this double helix composition. Louis de Broglie proposed at the 1927 Solvay Conference his model of the full wave and the pilot guiding wave but could not give a deeper physical interpretation of his concept. Later Louis de Broglie (1939) proposed two component model of the photon. (Many modern Dissidents continue to develop this double-helix model of the photon where both helical paths are occupied by particles). In 1952 David Bohm rediscovered this pilot wave model and developed it as the de Broglie - Bohm theory. Since that time the concept of empty guiding waves remains still open and has been waiting for the physical interpretation. See J.S. Bell in 1992, L. Hardy in 1992, P.J.

Lewis in 2007, W. Seager in 2018, and many others.

Can we use this model of the super-elastic double-helix for geons formed from two soft x- ray photons as it was predicted by Julian Schwinger and John Archibald Wheeler? Can we describe properties of this double-helix geon formed in the Schwarzschild gravitational core at 16 * 10^6 K? Solar geons are with us all the time but perfectly hidden and masked in our very well-known Old Formulae.

In order to achieve our target, we have to combine knowledge of Old Masters (working in this field before the year 1905), New Masters (working in this field after the year 1905), and Dissidents working on the double helix model of the photon for many years. The key breakthrough was found in the empirical formulae of David Bohm - Bohm diffusion. This Formula might guide us into the hidden World of Geons.

(We were inspired by the famous quote of Richard Feynman: "I learned a lot of things in biology, and I gained a lot of experience". We could find in those Laboratories stimulating experimental data about entropic force, enthalpic force and overstretching of the DNA double-helix.)

2. Inspirations from Old Masters and New Masters - What is Heat? What is Temperature? What is Gravity?

We were inspired by many Great Researchers working in this field for generations. In Table 1 and 2 we summarized some of those steps in our understanding of those topics. Words written in big capitals were critical for the model presented in the contribution.

Table 1. What is Heat? What is Temperature?

What is Heat? What is Temperature?
Heraclitus, Lucretius: MATERIAL SUBSTANCE "HEAT", MATERIAL SUBSTANCE "COLD"
Comenius: CALORIC, FRIGERIC
Bacon, Descartes, Locke, Hooke, Huygens, Newton, Lomonosov: VIBRATION of some sort
Becher, Stahl: phlogiston
Black, Lavoisier, Laplace, Poisson, Fourier: CALORIC
Carnot: HEAT ENGINE EFFICIENCY
Count Rumford, Davy, Pictet: HEAT PRODUCTION BY FRICTION
Young, Herschel, Leslie, Melloni, Ampère, Maxwell: WAVE THEORY OF HEAT
Joule: MECHANICAL EQUIVALENT OF HEAT
Rankine, Clausius, Thomson, Helmholtz, Clapeyron: THERMODYNAMICS
Stefan, Boltzmann, Wien: thermodynamics with Maxwell´s ENERGY-MOMENTUM RELATIONS
Planck: QUANTUM OF THE LEAST ACTION
Einstein: SPECIFIC HEATS
Bohm: EMPIRICAL BOHM DIFFUSION
Many Great New Masters continue to work on these topics
Wheeler: THERMAL GEONS
J.J. Mareš: WHAT IS HEAT? WHAT IS TEMPERATURE?
J. Šesták: WHAT IS TEMPERATURE?

Table 2. What is Gravity?

What is Gravity?
Newton in 1687: "Hypotheses non fingo" GRAVITATIONAL FIELD STRENGTH
Newton in 1717: thinning of the aether density, PRESSURE DROP
Descartes, Huygens: vortex
Hooke: ALL BODIES EMTTING WAVES IN ALL DIRECTIONS
Le Sage: mechanical explanation
Euler: GRAVITATIONAL AETHER LOSES DENSITY in accordance with the inverse square
Lomonosov: AN ENORMOUS PENETRABILITY OF AETHER TROUGH BODIES
Herapath: THE AETHER IS HEATED BY BODIES and loses density, MOMENTUM of aether particles
Einstein: curved space-time
Many Great New Masters have been working on the QUANTUM GRAVITY
Milgrom: MOND, EMPIRICAL CONSTANT a_0
Verlinde: ENTROPIC FORCE

The key breakthroughs were found in the works of David Bohm - Bohm diffusion, Mordehai Milgrom - MOND and his empirical constant, and Eric Verlinde - his concept of the entropic force.

3. Formation of Thermal Geons in the Schwarzschild Gravitational Core of the Sun

Thermal geons formation in the Schwarzschild gravitational core of the Sun can be described as the Solar geon luminosity L_G in watts:

$$L_G = H_0 M_S c^2 = \sigma T_S^4 \ 4 \pi R_S^2 \approx 4.166 \ * 10^{29} W \quad (1)$$

where H_0 = 2.33138*10-18 kg kg^{-1} s^{-1} is the constant describing formation of geons in the Sun core (known in astrophysics as H_0 = 71.9388 km s^{-1} Mpc^{-1}, today´s experimental value is 72.5 ± 1 km s^{-1} Mpc^{-1}), M_S is the mass of the Sun, c is the light speed, σ is the Stefan-Boltzmann constant, T_S = 16.09*10^6 K is temperature inside of the Schwarzschild core, $R_S = 2GM_S/c^2$ - the Schwarzschild gravitational radius of the Sun core.

Photons (super-elastic double-helix dyons) created in the Sun have been emitting to the outside of the Sun and also to the Schwarzschild gravitational core as the material for the thermal geon formation (super-elastic double-helix geon):

$$2 \ soft \ X-ray \ Dyons \quad \rightarrow \quad Geon \quad (2)$$

We know that the Solar photon luminosity is L_S = 3.827 * 10^{26} W and the Total Solar Irradiance at the Earth´s orbit is TSI ~ 1366 W/m^2. Therefore, we should experimentally observe the geon irradiance very easily. But the geon super-elastic double-helix adjust its heat content to the surroundings as:

$$TSGI \ = \frac{L_G}{4\pi \ R_{S-E}^2} \frac{k_B}{2 \ m_g c^2} T_{orbit} \approx 36 \ W \ m^{-2} \quad (3)$$

where TSGI is the total solar geon irradiance at the Earth orbit and orbit temperature T_{orbit} = 393,15 K and m_g is the geon mass m_g = 1.2359*10^{-33} kg, R_{S-E} is the distance from Earth´s orbit to the Solar corona where geons were superheated once again to the corona temperature T_C:

$$T_C = T_{orbit} \sqrt{\frac{R_{S-E}}{R_S}} \approx 2.78 \ * 10^6 \ K \quad (4)$$

The same geon can reversibly adjust its heat content until the maximum temperature T_S = 16,09*10^6 K. The constant Z_G describes the reversible adjustment of the geon heat content towards its surroundings temperature:

$$Z_G = \frac{k_B}{2 \ m_g c^2} = 6.21482 \ * 10^{-8} \ \deg^{-1} \quad (5)$$

This is a very unique property of geons and might create the Geon Engineering Outshine Network (GEON) if we will be able to manipulate with these geons under the controlled conditions.

Geons formed in the Schwarzschild gravitational core create a super-elastic double-helix and the geon is running on the helical path with the Weber speed $c_W = \sqrt{2}$ c. Therefore, its energy content for the helical path is:

$$m_g \ 2 \ c^2 = k_B T_S \quad (6)$$

For the longitudinal path along the double-helix we should write:

$$E \ = m_g c^2 = \frac{k_B T_S}{2} \quad (7)$$

During its path outside of the Schwarzschild core the geon adjusts its heat content to the surroundings as:

$$E = m_g c\ V_{St} = \frac{k_B T}{2} \tag{8}$$

where V_{St} is the stretching speed of that geon - a characteristic transverse vibration speed for the given surroundings temperature T:

$$Y_G = \frac{V_{St}}{T} = \frac{k_B}{2\ m_g c} \approx 18.631561\ m\ s^{-1}\mathrm{deg}^{-1} \tag{9}$$

It could be very useful to discover more properties of these mysterious geons.

4. What is the Temperature? Mareš - Šesták Constant

Temperature, the central concept of thermal physics, is one of the most frequently employed physical quantities in common practice. There are many definitions of temperature as e.g.: "temperature is the manifestation of thermal energy, present in all matter (atoms, molecules, etc.), which is the source on the occurrence of heat, a flow of energy, when a body is in contact with another that is colder". All of these definitions are based on atomic or molecular kinetic energy of those particles. Jiří J. Mareš (2015) and Jaroslav Šesták (2019) have been trying to develop more rigorous treatment of temperature for many years. That is why we would like to introduce a new constant: Mareš - Šesták constant as ratio of the geon momentum to the heat quantum of geon as:

$$T = X_G\ V_{St} = \frac{momentum\ of\ geon}{heat\ quantum\ of\ geon} V_{St} = \frac{2\ m_g c}{k_B} V_{St} = 0.053672... \left[m^{-1}\ s\,\mathrm{deg}\right] V_{St}\left[m\ s^{-1}\right] \tag{10}$$

For the first time we have defined the temperature based on the geon properties - the ratio of geon momentum and the heat quantum of geon: Mareš - Šesták constant. The stretching speed V_{St} describes the transverse vibration of geons that modify the kinetic energy of atoms and molecules. The maximum stretching speed equals $V_{St} = c$ to the light speed. This the maximal temperature inside of the Schwarzschild gravitational core in the Sun.

5. Bohm Diffusion, Beta of Plasma and Geon Properties

David Bohm in 1949 conjectured the Bohm diffusion scaling for the diffusion of plasma across a magnetic field with the magnetic field strength B:

$$D_B = \frac{k_B\ T}{16Be} \tag{11}$$

The meaning of this empirical Bohm diffusion is actively discussed in the literature. The number 16 is only empirical constant and might be changed by a future modification.

We will extract from this equation amplitude A, wavelength λ and volume of geons V_G as:

$$A = \frac{\lambda}{2\pi} = \frac{1}{2\pi}\frac{k_B T}{2}\frac{1}{Bec} \tag{12}$$

$$\lambda = \frac{k_B T}{2}\frac{1}{Bec} \tag{13}$$

$$V_G = \lambda\frac{k_B^2 T^2}{16\pi B^2 e^2 c^2} = \frac{2\mu_0}{B^2}\frac{k_B T}{2} \tag{14}$$

Because the geon is in the equilibrium with the magnetic field strength B in the surroundings, we can express Beta of plasma as:

$$\beta = 1 = \frac{pressure\ of\ geon}{magnetic\ pressure} = \frac{\frac{energy\ of\ geon}{volume\ of\ geon}}{magnetic\ pressure} = \frac{\frac{k_B T}{2}\frac{1}{V_G}}{\frac{B^2}{2\mu_0}} \tag{15}$$

After some re-arrangement we will get an expression for the geon wavelength λ as:

$$\lambda = 8\pi\ \mu_0 e^2 c\ \frac{2c}{k_B T} = \frac{2\ h_G c}{k_B T} = \frac{0.0105550...\left[m\ K\right]}{T} \tag{16}$$

This is the displacement law for geons - an analogy with the Wien´s displacement law for photons. The quantum of geon action can be evaluated as:

$$h_G = 8\pi\ \mu_0 e^2 c\ = 2.43048... * 10^{-34} J\ s \tag{17}$$

We assume that geon brings heat energy to molecules as:

$$E = \frac{5}{2}\frac{k_B T}{2} = \frac{5}{2}\frac{h_G\ c}{\lambda} = \frac{5}{2} h_G\ \nu \tag{18}$$

(We were inspired by the expression for the specific heat at constant pressure Cp = 5/2*R for ideal gases, where R is the gas constant). For the laboratory temperature T = 300 K we will obtain effective geon wavelength λ around 14 μm. We know that objects at room temperature will emit radiation concentrated mostly in the 8 - 25 μm band. Is it just coincidence or geons are always present in our Rooms?

6. Ideal Geon Law and Quantum of Heat - A Look into the Microworld

We will try to formulate an analogy with the ideal gas law inspired by laws valid for macroworld - Boyle-Mariotte law, Charles law, Avogadro law, Gay-Lussac law, and the ideal gas law formulated by Clapeyron. For the values of the geon volume V_G, geon pressure P_G and temperature T_G we will get the quantum of heat Q_G represented by one geon:

$$V_G = \frac{2\ \mu_0}{B^2}\frac{k_B T_G}{2} \tag{19}$$

$$P_G = \frac{k_B T_G}{2\ V_G} \tag{20}$$

$$Q_G = \frac{P_G V_G}{T_G} = \frac{k_B}{2} = \frac{m_g c\ V_{St}}{T} = 6.90325 * 10^{-24}\ J\ \deg^{-1} \tag{21}$$

7. Superheating in the Solar Corona and Heating of the Earth

We can formulate Charles´ Law (derived for the ideal gas by Jacques Charles) for geons as:

$$\frac{V_G}{T_G} = \frac{2\ \mu_0}{B^2}\frac{k_B}{2} \tag{22}$$

The influence of the magnetic field strength B could be the explanation for the observed Superheating of the Solar Corona - the expansion of the geon volume in a very short time could dramatically increase temperature in that Solar Corona and create the observed Heliosheat ("inflation" of geon). E.g., the very important papers from L.F. Burlaga et al. (2009) and from T. Wiegelmann et al. (2014).

We expect a similar effect on the Earth´ heating on a smaller scale, too. The influence of magnetic field around and inside of the Earth might dramatically influence the heat properties of geons. We want to pass this model to specialists on the Earth´s magnetic field and to correlate the properties of the Earth´s magnetic field with the growing temperature in the last two Centuries. This could be an important effect on the heating of the Earth and might play many orders more significant role in compare with other "heat molecules".

8. Carnot´s Heat Engine Efficiency

We can re-formulate Sadi Carnot´s heat engine efficiency η as:

$$\eta = \frac{\frac{k_B T^{HOT}}{2\ m_g c} - \frac{k_B T^{COLD}}{2\ m_g c}}{\frac{k_B T^{HOT}}{2\ m_g c}} = \frac{V_{St}^{HOT} - V_{St}^{COLD}}{V_{St}^{HOT}} \tag{23}$$

In the Carnot heat engine geons change their transverse vibration speed expressed as the stretching speed V_{St} and the released heat energy can be transformed into the work.

9. Mechanical Equivalent of Heat (MEH)

The MEH states that motion and heat are mutually interchangeable and that in every case, a given amount of work would generate the same amount of heat, provided the work done is totally converted to heat energy.

Today a standardized value of MEH = 4.1860 J cal^{-1}.

This value is based on the experiments with water and its specific heat Cp at constant pressure:

Cp = 4185.5 Jkg^{-1} K^{-1} at 15°C, 101.325 kPa.

(It is known that specific heat Cp of water varies between 4.17 - 4.22 J/g/°C.)

We propose to express MEH as the ratio of a geometrical factor 4 π describing the space distribution of geons from its source and number 3 describing the number of degrees of freedom of geons:

$$MEH = \frac{4\pi}{3} = \frac{space\ distribution\ of\ geons}{3\ \mathrm{deg}rees\ of\ freedom} = 4.1887902...J\ cal^{-1} \tag{24}$$

10. Fine Structure of Dyons and Geons

There are known many interpretations of the dimensionless number α - the famous fine structure describing something in the microworld. There are more than ten different interpretations and many numerical attempts to derive the value of the fine structure constant.

We propose to interpret the fine structure as the ratio of two forces - F_C - the Coulomb force and F_N - the Newton force - both in the co-operation govern the motion of dyon (photon) on the super-elastic double-helix with one occupied helix and one empty helix (the concept introduced by David Bohm):

$$\alpha = \frac{F_C}{F_N} = \frac{\frac{1}{4\pi\ \varepsilon_0}\frac{e^2 4\ \pi^2}{\lambda^2}}{\frac{2\pi m\ c^2}{\lambda}} = \frac{1}{4\pi\ \varepsilon_0}\frac{2\pi\ e^2}{h\ c} \tag{25}$$

We can relate both quanta of actions for photons h and for geons h_G through the fine structure α as:

$$\alpha = \frac{\mu_0}{4\pi}\frac{2\pi\ e^2 c}{h} = \frac{h_G}{16\pi h} \tag{26}$$

It seems that this interpretation of the fine structure constant might bring to us some more information from the Microworld of dyons and geons.

11. Gravitation Field Strength - Milgrom- Verlinde Constant

Gravitation field strength describes the influence of a source mass M producing force on the test mass m. The gravitation field strength is measured in newtons per kilogram (N/kg).

For the source mass M = 1 kg, test mass m = 1 kg and the distance of their centers R = 1 m we can derive Milgrom-Verlinde constant C_P (N/kg) based on the thermodynamics rules and laws. We used the symbol C_P because in thermodynamics the specific heat for ideal gas at constant pressure is given as: $C_P = 5/2$ R where R is the gas constant. The factor "5/2" plays a very important role in thermodynamics describing number of degrees of freedom for monoatomic ideal gas at the constant pressure.

For one geon we can write the quantum of geon momentum c as:

$$c_P = m_G\, c\ \frac{3}{4\pi} = 8.84536\ {}^{*}10^{-26} kg\ m\ s^{-1} \approx 165.5\ eV\ /\ c \tag{27}$$

For N number of geons reflected from the source M =1 kg towards the test mass m = 1kg at the distance between their centers R = 1 m we can write:

$$C_P = \frac{N}{kg\ s} m_G\, c\ \frac{3}{4\pi} = \frac{N}{kg\ s} \frac{k_B T}{2\ V_{St}} \frac{3}{4\pi} = \frac{5}{2} \frac{F}{m} = \frac{5}{2} \frac{G * 1}{1^2} \tag{28}$$

Now, we will insert the constant H_0 where this constant has a different meaning - $H_0 = 2.33138*10^{-18}$ kg kg^{-1} s^{-1} is the constant describing the mass of reflected geons from the source mass M = 1 kg towards to the test mass m = 1 kg at the distance R = 1 m (it is known in astrophysics as $H_0 = 71.9388$ km s^{-1} Mpc^{-1}, today´s experimental value is 72.5 ± 1 km s^{-1} Mpc^{-1}). We will get:

$$C_P = H_0\, c\ \frac{3}{4\pi} = \frac{H_0}{m_g} \frac{k_B T}{2\ V_{St}} \frac{3}{4\pi} = \frac{5}{2} \frac{F}{m} = \frac{5}{2} \frac{G * 1}{1^2} \tag{29}$$

For the value $G = 6.6743*10^{-11}$ m^3 kg^{-1} s^{-2} we will get:

$$C_P = \frac{5}{2} \frac{F}{m} = \frac{5}{2} \frac{G * 1}{1^2} = 1.6685...\ {}^{*}10^{-10}\ N\ /\ kg \tag{30}$$

We want to name this constant as the Milgrom - Verlinde constant: it was known from the MOND literature that Mordehai Milgrom´s empirical value $a_0 \approx (1.2 \pm 0.2) *10^{-10}$ m s^{-2} might explain a lot of experimental data in astrophysics but there is still missing an interpretation for this empirical value. On the other site, Eric Verlinde with his great contributions on the entropic gravitational force opened a new path where we should search for an interpretation of this empirical value a_0.

We want to pass this concept into the hands of experienced Readers of this Journal dealing with the Big G and the MOND interpretation.

12. Entropic Force, Enthalpic, Force and Overstretching of the DNA Double-Helix

We were inspired by the famous quote of Richard Feynman: "I learned a lot of things in biology, and I gained a lot of experience". We could find in those Laboratories stimulating experimental data about entropic force, enthalpic force and overstretching of the DNA double-helix.

There were published a lot of experimental data describing the DNA double-helix stretching. There were observed three regions with entropic force, enthalpic force and overstretching. E.g., Joost van Mameren (2009) the Figure 4, D. Murugesapillai et al. (2017) the Figure 2, and many other papers.

We propose to make similar experiments for geons. It could be a new explanation for the so-called "missing dark matter".

13. Conclusions

1. We have combined knowledge of Old Masters, New Masters, and Dissidents in order to newly formulate events observed with heat and gravity.

2. We have postulated formation of geons in the Schwarzschild gravitation core in the Sun.

3. Geons can reversibly adjust their transverse vibration - the stretching speed - and thus dramatically change their heat content.

4. We have newly defined the Mareš - Šesták constant for the definition of temperature based on geons properties.

5. Inspired by the expression for the Bohm diffusion we have extracted values for amplitude, frequency, displacement law, and the quantum of the action for geons.

6. At room temperature we should observe heat effect of geons at 14 μm - the effective wavelength of geons at that temperature.

7. We have derived the ideal geon law and the geon heat quantum.

8. Geon Superheating in the Solar corona was interpreted as the geon inflation at low magnetic field strength.

9. Carnot heat engine efficiency was interpreted as the change of the geon stretching speed.

10. Mechanical Equivalent of Heat was interpreted as the ratio of the geon space distribution and 3 degrees of freedom of geons.

11. Fine structure constant was newly interpreted for dyons (photons) and geons.

12. Quantum of momentum of geons was defined.

13. Gravitation field strength was defined as the Milgrom - Verlinde constant.

14. We need more experimental data for the entropic force, enthalpic force and overstretching of the super-elastic double-helix of geons.

15. Nature might hide Her Beauty in plain sight protected by the mathematical camouflage.

16. We want to pass this model into hands of Readers of this Journal better educated in Mathematics, Physics and Thermodynamics.

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Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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