Universal Thermal Repulsive Force is One of Decisive Basis of the Existence of Microscopic and Macroscopic Matter and the Universe

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Abstract   Through briefing and some analyzing on previous results of related researches, this paper recommends a newly discovered a universal static thermal repulsive force and asserts the universal thermal repulsion is one of decisive basis of the existence of microscopic and macroscopic matter and the universe.

Keywords   Universal repulsive force, Solar system, Universe, Repulsive gravity, Cosmological constant, Dark matter, Negative matter, Dark energy, Cosmology, Pioneer anomaly, Universal thermal repulsive force

1. Introduction

Endeavors of exploration of cosmos universe and microscopic physical objects reveal a lot of anomalies and repulsive force effect besides Coulomb force and magnetic field force, such as anomalies in gravity, Pioneer anomaly, etc. To explain the anomalies, more and more scientists agree with the reasoning that if there were only gravity but no repulsive forces between the matters of the universe, the universe would not be able to remain static. The attractive gravity would cause the universe to collapse. Therefore, logical reasoning concludes that there must be a universal (thermal) repulsive force to balance the gravitational force.

Various theories of conjecture and hypothesis introduce a lot of concepts with more and more auxiliary assumptions such as warping of space time, cosmological constant, dark matter, negative matter, dark energy, vacuum density and etc to explain some anomalies about repulsive forces effects.

However, current conjectures well known by physical community are always full of self-contradictions or conflict each other. For example:

Einstein equations are no longer good enough to test gravitation in the solar system and at the galactic scale.

Experiments to directly detect dark matter particles in the lab have failed to produce positive results of its existence.

Normal baryonic matter and antimatter explain various cosmological anomalies have not been very promising so far.

The notion of antigravity must wait confirmation by experiment.

The cosmological constant of GRT cannot explain dark matter.

Luminous matter cannot be cancelled by dark matter.

There is no actual and factual direct evidence to support any of these theories and assertions.

"Some genuinely testable theories, when found to be false, are still upheld by their admirers, for example by introducing *ad hoc* some auxiliary assumption, or by re-interpreting the theory *ad hoc* in such a way that it escapes refutation. Such a procedure is always possible, but it rescues the theory from refutation only at the price of destroying, or at least lowering, its scientific status."

"It is quite normal for academics to try to refute prevailing textbook claims. If everyone agrees with what the textbooks or physics courses saying, then there will be no academic research, and there will be no scientific progress."

-Karl Popper *Conjecture and Refutation*

All these theories and assertions are unexceptionally introducing *ad hoc* some auxiliary assumption, thus result in lowering their scientific status.

In fact, due to the wrong paradigm and the inherited conclusions from the physics community, reasonable new theory such as the universal thermal repulsive force assertion could be ignored or overlooked unreasonably.

This paper recommends the newly discovered universal thermal repulsive force to replace or fill up the holes of prevailing arguments of universal repulsions and asserts the universal thermal repulsive force as one of decisive basis of the existence of microscopic and macroscopic matter and the universe.

Almost all anomalies and discrepancies related to universal repulsive force of microscopic and macroscopic matter and universe (except Coulomb force and magnetic field force) can be explained by the newly discovered

universal static thermal repulsive force.

Different from other phantom like arguments, we can continue to corroborate the universal thermal repulsive force theory by further fair research works and practicable experiments no need to introduce *ad hoc* some auxiliary assumption.

2. Reviewing the Induction and Derivation of the Newly Discovered Universal Thermal Repulsive Force [8]

2.1. Briefing the Theoretical and Practical Induction Background of the Universal Thermal Repulsive Force

The discovery of a universal static thermal repulsive force is based on analyzing the following main points (of anomalies or discrepancies):

2.1.1. If There are Elastic Collisions between Gas Molecules, the Collisions Must be Oblique Collisions that cannot Maintain Maxwell-Boltzmann Distribution Function

As the general elastic collision laws described, when most collisions are not head-on collision, there must be an angular (θ) collision between two particles. The collision of gas molecules (if really occurring), are all **oblique collisions!** Assuming that the gas molecules are really colliding continuously, the final result is that all the velocities of the gas molecules will tend to equal, and is equal to the mean speed i.e., $v_i \propto v \propto v_{ms}$, ($0 < i < \infty$). Thus, we know that Maxwell-Boltzmann's velocity distribution function can never be maintained and never exist.

Therefore, any further deductions of the gas properties that are based on Maxwell-Boltzmann velocity distribution function are disproven.

2.1.2. Molecules are not Elastic Rigid Balls According to Rutherford's Experiment and Only the Nucleus of Atom is Elastic Ball, so the Mean-Free-Path is Pseudo Science

It is worthwhile to notice that the effective diameter of molecules d used to calculate effective collision area is 10^4 times much larger than the Rutherford's gold foil experimental data of nucleus diameter.

When temperature is in the range of 200 -1000K, the relative velocities $\overline{v}_{relative} \leq 0 - 3000 \left(\frac{m}{s}\right)$ is much lower than the velocity of the protons in Rutherford's gold foil experiment that is $2*10^7$ m/s. Therefore, factually, there are no elastic collisions between gas molecules!

2.1.3. Bernoulli Equation and Its Applications Falsify the Boltzmann's Velocity Distribution Law

Motion of body is effect of action of force, so increase of temperature cannot directly cause increase of velocity of body.

Energy must be conserved. However, the kinetic energy $\frac{v^2}{2}$ in Bernoulli equation is different from the kinetic energy $\frac{8}{3\pi} v_{ms}^2$ in Boltzmann distribution. The Bernoulli Equation $\frac{p}{\rho} = \frac{v^2}{2}$ is an empirically verified truth, then the expression of $\frac{8}{3\pi} v_{ms}^2$ must be wrong. Therefore the Boltzmann distribution and gas molecule collision assertion must be wrong.

2.1.4. Dalton's Law of Partial Pressures and Amagat's Law of Partial Volumes Imply the Gas Molecules are Point Source of (Thermal) Repulsive Force

2.1.4.1. Dalton' Partial Press Law and Partial Volume Law Manifest the Actions of Universal Thermal Repulsive Forces

Dalton's law of partial pressure states that the total pressure is the sum of the partial pressures of the individual gases: $P_{total} = \sum_{i=1}^{N} p_i$.

The mole numbers of individual gases can be any number ($0 < n_i < n$), can approach to 0. Thus, n_i can be N, .. 3,2 and 1 (a single molecule). The p_i in the equation $p_i V = n_i RT$ is representing the static pressure of any numbers even one single gas molecule.

Therefore, every gas molecule is an independent point pressure source that must be in a force equilibrium state with same size of mechanical radius on which the molecules have same static pressure interacting each other to form the total pressure of the mixture of gases.

Amagat's law states that the partial volume, v_i, of an ideal gas (i) in a mixture of ideal gases is equal to the volume that gas (i) would occupy if it were alone and was at the pressure and temperature of the gas mixture: $V_i = \frac{n_i RT}{P}$ and $V_{total} = \sum_{i=1}^{N} V_i$.

Amagat's law shows that the total volume is proportional to the total number of molecules of gases. The mole numbers, n_i, of an individual gas can be any number ($0 < n_i < n$), can approach to 0. Therefore, n_i = N, .. 3, 2 and 1.

2.1.4.2. Typical Practical Evidence of Gas Molecule being Point Source of Thermal Repulsive Force

One assumption of the kinetic theory of gas is: "The number of molecules is large and the volume of the molecules is negligible when compared with the volume of the container." This assumption is interpreted as that there must be adequate enough numbers of gas molecules to maintain a probability of Boltzmann's distribution.

The gas-liquid condensation and evaporation process are the irrefutable direct practical evidences of gas molecules being point sources of thermal repulsive forces that are acting and re-acting each other. The repulsive force occurs even with handful number of gas molecules while there being no enough volume or enough numbers of molecules to maintain Boltzmann's distribution! The typical example is the air condition system.

In gas condensation process, until gas molecule number approaches to $N, .. , 3, 2, 1, 0$, the gas press is maintaining. In evaporation process, as soon as gas molecule number start off from $0,1,2,3, , N$, the gas press occurs immediately.

The chemical reaction produces gas instantaneously while producing pressure instantaneously, without pressure lag, not waiting until "number of molecules is large", and the explosion process of explosives is a typical example.

Infinitesimal gas molecule number (even single gas molecule) has press and volume, this fact verifies the gas press is thermal repulsive force press but not the effect of collision between gas molecules.

2.1.5. Sound wave with the Air Medium, Proves in Themselves that Air is a Continuous Medium with Bulk Modulus B and Contradicts to (and Falsifies) Boltzmann's Distribution

The elastic modulus is the ratio of the stress to the resulting strain $B = -\frac{\Delta F/A}{\Delta V/V_i} = -\frac{\Delta P}{\Delta V/V_i}$.

The speed of sound waves depends on the compressibility and inertia of the medium. If the medium has a bulk modulus B and density ρ, the speed of sound waves in that medium is $\sqrt{\frac{B}{\rho}}$.

Force and pressure are instantaneous values to produce wave and propagate wave that cannot be cumulated by momentums during a time intervals.

A cycle of sound wave of gas must be the process of transformation between potential energy of conservative restoring force and kinetic energy. Therefore there must be a repulsive conservative contact force of the continuum medium gas (with bulk modulus B,) i.e. there must be a universal (thermal) repulsive force (field) between gas molecules to transfer the compression and expansion of gas medium to propagate sound wave.

If Boltzmann's distribution law or the kinetic theory of gases is tenable, the gas molecules will move randomly mean that any molecule can move in any direction with equal probability and their motion is extremely chaotic.

Thus it will produce $\Delta P_x = \Delta P_{max-x} sin(kx - \omega t)$, $\Delta P_y = \Delta P_{max-y} sin(ky - \omega t)$ and $\Delta P_z = \Delta P_{max-z} sin(kz - \omega t)$ in x, y and z directions.

Then the sound wave will propagate not only in x (longitudinal) directions but also in all directions including y and z directions and any transversal direction.

Therefore, sound wave being a longitudinal wave also contradicts Boltzmann's distribution and manifests the existence of a thermal repulsive force of gas molecules.

2.1.6. Applications of Dynamic Gas Bearing and Static Gas Bearing in Industries Falsify the Gas Collision Assertion and the Boltzmann Distribution Law

1) It is only the viscosity (μ) of a gas that causes the pressure gradient in a circumferential direction ($\frac{dp}{dx} = \mu \frac{\partial^2 u}{\partial y^2}$) which is the basis and basic working conditions of the dynamic gas bearing.

2) It is the journal speed, u, that generates the shear stress; therefore, the shear stress generates the pressure gradient. The pressure gradient, i.e., the pressure difference between the (gaps), clearance generates load capacity!

If there is chaotic motion, or the velocities of the gas molecules are in the Boltzmann distribution, the laminar flow of the gas will be spoilt, or the pressure gradient in circumferential direction will be collapse! Then, the air bearing would not work!

2.1.7. Decisive Causal of Atmospheric Pressure being Weight of Gases Molecule Layers Contradicts the Gas Molecule Collision Assertion and Implies Existence of (Thermal) Repulsive Contact Force

In the atmosphere, we assume the mean effective mechanical volume, V_m, of gas molecule is a cube that contains the mechanical sphere of molecule, and $V_m = 8r_m^3$. For convenient, the $2r_i (r_{mi})$ in derivation is replaced by dh, therefore the expression is

$$\frac{dp}{p_i} = -\frac{g_i}{R_m T_i} dh \qquad (2.7.1)$$

Integration of (2.7.1) is

$$\int_{p_0}^{p_h} \frac{dp}{p} = \int_0^h -\frac{g_i}{R_m T_i} dh_i = ln\left(\frac{p_h}{p_0}\right) = -\frac{g_i}{R_m T_i}h \implies$$

$$\frac{p_h}{p_0} = e^{-\frac{g_i h}{R_m T_i}} \implies p_h = p_0 e^{-\frac{g_i h}{R_m T_i}}$$

From ideal gas equation we have $\frac{p_h}{\rho_h} = \frac{p_0}{\rho_0} \implies \rho_h = \rho_0 e^{-\frac{g_i h}{R_m T_i}}$

According to gas equation we have $\frac{\rho_h}{\rho_0} = \frac{\frac{n_h}{V}}{\frac{n_0}{V}}$ obtains $n_h = n_0 e^{-\frac{g_i h}{R_m T_i}}$

The expression manifests that the gas molecule distribution and pressure distribution are depended on accumulation of gas molecule weight of gas layers, but not on collisions between gas molecules.

2.1.8. Wind is Generated by the Thermal Repulsive Force

The fact is that when the temperature increases, the mechanical radius (volume) of the gas molecule increases, density (ρ) decreases, the hotter gas molecule become lighter, and it goes upward due to thermal repulsive force, i.e., due to buoyancy of molecules with higher density.

2.1.9. If There are Only the Centrifugal Forces to Balance the Universal Gravitational Forces between the Sun and Planets, then the Solar System will be in an Unstable Equilibrium

(1) Assume a system having one degree of freedom, r, evaluate the potential energy function V, mathematically:

If $V = V(r)$ is a minimum then $\frac{dV}{dr} = 0$ and $\frac{d^2V}{dr^2} > 0$, then the system is stable equilibrium.

If $V = V(r)$ is a maximum then $\frac{dV}{dr} = 0$ and $\frac{d^2V}{dr^2} < 0$, then the system is unstable equilibrium.

If $V = V(r)$ is a minimum $\frac{dV}{dr} = \frac{d^2V}{dr^2} = 0$, then the system is in neutral equilibrium.

Analyzing the equilibrium of the Sun-Earth system:

The potential gravitational force energy of Earth is $V_g = -G\frac{Mm}{r^2}r = -G\frac{Mm}{r}$.

Total energy of earth is $E_{kinetic} + E_{potential}$ where $E_{kin} = \frac{mv^2}{2}$ and $E_{pot} = -G\frac{Mm}{r}$.

Since E_{kin} is the energy of motion, is constant and derivative of $E_{kin} = 0$.

Then the derivative of potential energy is
$$V = V_g = -G\frac{Mm}{r} \implies \frac{dV}{dr} = G\frac{Mm}{r^2} .$$

Only when $r \propto \infty$, the derivative of potential energy V is equal to zero: $\frac{dV}{dr} = G\frac{Mm}{r^2} = 0 \;\; (r \propto \infty)$

The second derivative of V is $\frac{d^2V}{dr^2} = -G\frac{2Mm}{r^3}$, where the item $-G\frac{2Mm}{r^3}$ is less than 0 (< 0), then the system will be unstable.

Why the dominant model of the solar system is unstable under accurate theoretical analysis? Because the centrifugal force is non-conservative force, it does not result in potential energy and is irreversible.

Therefore, there must be another conservative repulsive force (opposite to or cancel the conservative gravitational force) between Sun and Earth that is ignored or overlooked by the dominant model.

Thus the systematic potential energy is the sum of (thermal) repulsive force energy and gravitational force energy.

$$E_{pot} \text{ or } V = E_{repulsive} - G\frac{Mm}{r}$$

The repulsive force potential energy $E_{repulsive}$ is inversely proportional to the distance r (i. e., $E_{repulsive} \propto \frac{T}{r}$). Therefore when $\frac{dV}{dr} = 0$ and $\frac{d^2V}{dr^2}$ is larger than zero (> 0), the solar system thus can be in stable equilibrium.

(2) This argument extends to explain the atom structure, if there are only the centrifugal forces to balance the Coulomb attractive forces between nucleus and electrons, then the nucleus-electrons system will be in an unstable equilibrium. Therefore there must be a universal thermal repulsive force to cancel Coulomb attractive forces to sustain electrons do not fall into nucleus.

A typical example is the manmade X-ray tube device.

The electrons in X-ray tube move at high velocity from the filament to the anode target. Upon striking the atoms in the target, the moving electrons with a high velocity at radial direction toward the nucleus without velocity at tangential direction and no reason to automatically to transform the radial direction velocity to tangential direction velocity to form orbital force to balance the Coulomb attractive force, but the electrons coming from the filament never fall in nucleus. The reaction of thermal repulsive forces between electron and nucleus must be the only cause.

2.1.10. The Reason of the Earth Orbiting the Sun in an Elliptical Orbit is the Universal Thermal Repulsive Force

The reason is that the northern hemisphere has significantly more land mass than the southern hemisphere. In summer season in the north hemisphere, the sunlight shines vertically on the Tropic of Cancer and the average temperature of earth is higher due to more land being heated. Therefore, the thermal repulsive force between the Sun and earth is increased. Under the influence of an imbalance of the thermal repulsive force and attractive force, the distance between Sun and earth increases to balance the longer distance position. This is the opposite for the southern hemisphere, where has significantly more ocean area than the northern hemisphere,

2.1.11. The States of Matter from Black Hole Through Solid, Liquid, Gas and Plasma Verify the Decisive Factor of Existence of Matter Being a (Thermal) Repulsive Force

The universal static thermal repulsive force can accurately explain the complement depiction of matter phase states. Let have a look at the data shown in **Table.2.1.11**.

Table 2.1.11. Matter state and size changes along temperature

State	Black hole	Solid state	Liquid state	Gaseous state	Plasma state
T (K)	Infinitesimal $\propto$ zero K	$T <$ molten point	molten point $< T <$ boiling point	boiling point $< T <$ plasma point	$T >$ plasma point
Place	far outer space	Planet	Surface of planet	Surface of planet and outer space	Star and space or manmade environment
R_{ea}	$< 10^{-20}$ meter	$\sim 10^{-10}$ meter	$\sim 0.9 \times 10^{-10}$ meter	$\sim 10^{-9}$ meter	$> 10^{-9}$ meter

No doubt, the effective radius or mechanical radius of atoms (R_{ea}) or molecules of matter in a certain state are proportional to their temperature, T. The higher the temperature is, the larger the mechanical radius of the atom or molecule.

In the extreme condition, when the temperature is approaching to 0 K, matter will exist in the black hole state. On the other extreme condition, when the temperature is extremely high (higher enough to approach to tens of thousands K), matter will exist in the plasma state. Hence, all the electrons escape from the nucleus to become independent point sources of the static thermal repulsive force field.

Therefore the universal thermal repulsive force is the major decisive factor that supports the existence of matter or substance; otherwise, all matters will collapse into a black hole state.

2.1.12. Diffusion Effect is the Action and Effect of a Universal (Thermal) Repulsive Force

Comparing with the atmospheric pressure distribution, we can verify that the vertical density distribution of small particles is an effect of thermal repulsive force field.

The vertical density distribution of small latex particles is $n(z) = n(0)e^{-mg\frac{z}{kT}}$, compare with the molecule number distribution of the atmosphere due to thermal repulsive force n_z or $n(z) = n_0 e^{-\frac{gz}{RT}}$, we can see clearly that both distribution functions are exactly same. Both work on the same physical law of the universal thermal repulsive force.

The background difference lies in that the small latex particles have a higher density and a higher thermal repulsive pressure than the liquid. If the small latex particles are not in liquid, the thermal repulsive force is not big enough to distribute in the form of $n(z) = n(0)e^{-m^*g\frac{z}{kT}}$.

However, the buoyancy force of liquid cancels the partial earth gravitational force and is equivalent to the decrease in the density of solid particles, therefore, the particle distribution is only the equilibrium of the universal thermal repulsive force and the gravitational force of earth which thus is the same situation as the atmosphere on surface of the Earth distributed in exponential form.

Therefore we can conclude that the vertical density distribution of small particles is an effect of thermal repulsive force field.

2.1.13. Solar Wind Indicates to a Thermal Repulsive Force of Sun being Exerted on Its Surrounding Plasmas

What is the cause of solar wind, what force expel the plasma clusters moving away from the Sun, only the universal thermal repulsive force!

2.2. Briefing the Derivation of the Universal Static Thermal Repulsive Force Gas Molecule Mechanical Model

2.2.1. Key Points can be Clarified and Conclusions can be Reached Upon above Analysis

The ideal gas equation $PV = nRT$ or $P = \frac{nRT}{V}$ is applied to express an adiabatic process, manifests that the energy transformation is reversible and is potential energy. The forces exerted on gas molecules each other are conservative repulsive forces but not the collision momentums. Therefore in adiabatic process, the pressure P in $PV = nRT$ is directly caused by a thermal repulsive conservative contact force of gas molecule.

2.2.2. Derivation of the Accurate Rational Gas Molecule Model from Physics Laws and Physical Phenomenon

Based on the ideal gas equation, $PV = nRT$, and the above conclusions about point source thermal repulsive force (field), the equation of single gas molecule can be written as $P_m V_m = R_m T$, where R_m is single gas molecule constant, P_m is partial pressure of molecule particle ball, V_m is volume of single gas molecule, T is temperature of the molecule in Kelvin.

Partial gas molecule pressure is then $P_m = \frac{R_m T}{\frac{4}{3}\pi r_m^3} = \frac{3R_m T}{4\pi r_m^3}$ $\Rightarrow$ Let $k_{mT} = \frac{3R_m}{4\pi}$, P_m reduces to (or mathematically expresses as): $P_m = k_{mT}\frac{T}{r_m^3}$.

Therefore, we know P_m is proportional to the temperature, T, and is inversely proportional to 3rd power of r_m, i.e., inversely proportional to the 3 times power of the r_m, i.e., $P_m \propto 1/r_m^3$.

Extends to the forces between stars and between stars and planets in the universe, the expression of thermal repulsive force is

$$F_{thermal-repulsive} = K_{t-r}\frac{1}{r^3}$$

Where the K_{t-r} is coefficient, r is the distance between the two stars or planets [8].

2.3. Briefing the Induction of the Universal Thermal Repulsive Force

2.3.1. Conclusive Points of Analysis Series 1

- If there are elastic collisions between gas molecules, the collisions must be oblique collisions that cannot maintain Maxwell-Boltzmann distribution function.
- Molecules are not elastic rigid balls according to Rutherford's experiment and only the nucleus of atom is elastic ball, so the Mean-Free-Path is pseudo science.
- Deformation of diaphragm of pressure sensor can only result from the pressure of (contact force of) a continuum medium.
- Bernoulli Equation and its applications falsify the Boltzmann's velocity distribution law.
- Dalton's law of partial pressures and Amagat's law of partial volumes and their empirical practices manifest infinitesimal gas molecule number (even single gas molecule) have press and volume.

Based on above 5 analysis results, we can induce that:

The assertion of collision of gas molecules is not truth and gas molecules are point source of (thermal) repulsive contact force.

2.3.2. Conclusive Points of Analysis Series 2

- Sound wave with the air medium, proves in themselves that air is a continuous medium with bulk modulus B and contradicts to (and falsifies) Boltzmann's distribution.
- Applications of dynamic gas bearing and static gas bearing in industries falsify the gas collision assertion and the Boltzmann distribution law.
- Decisive causal of atmospheric pressure being weight of gases molecule layers contradicts the gas molecule collision assertion and implies existence of (thermal) repulsive contact force.
- Wind is generated by the thermal repulsive force.

Based on above 4 analysis results, we can induce that:

Gas is continuous medium sustained with (thermal) repulsive contact thermal repulsive force interacting each other between gas molecules and exert onto sea water and other contacting solid matters. The repulsive force is proportional to temperature of the medium (gas).

2.3.3. Conclusive Points of Analysis Series 3

- If there are only the centrifugal forces to balance the universal gravitational forces between the Sun and planets, then the solar system will be in an unstable equilibrium.
- If there are only the centrifugal forces to balance the Coulomb attractive forces between nucleus and electrons, then the nucleus-electrons system will be in an unstable equilibrium. There must be a universal thermal repulsive force to cancel Coulomb attractive forces to sustain electrons do not fall into nucleus.
- The states of matter from black hole through solid, liquid, gas and plasma verify the decisive factor of existence of matter being a (thermal) repulsive force.

No doubt, the effective radius or mechanical radius of atoms (R_{ea}) or molecules of matter in a certain state are proportional to their temperature, T. The higher the temperature is, the larger the mechanical radius of the atom or molecule.

- Diffusion effect of small latex particles is $n(z) = n(0)e^{-mg\frac{z}{kT}}$, cannot be defined as microscopic actions because the latex particles are not small as molecule scales; instead, it is macroscopic actions. Diffusion effect is the action and effect of a universal (thermal) repulsive force.
- Solar wind indicates to a thermal repulsive force of Sun being exerted on its surrounding plasmas. Only the universal thermal repulsive force is the cause of solar wind, and the force to expel the plasma clusters moving away from the Sun.

Winds of atmosphere and Solar wind of plasmas are driven by microscopic or macroscopic force? Definitely they are macroscopic forces.

In fact, the universal thermal repulsive force acting on the atmosphere cannot be considered as microscopic force, because gas molecules are acted by gravitational force of the earth and universal thermal repulsive force simultaneously, otherwise, the atmosphere will not be cumulated on surface of earth and distributed exponentially.

Based on above 5 analysis results, we can induce that:

The universal thermal repulsive force is not only applicable in gas molecules but also applicable in macroscopic fields. It is not only a repulsive force of intermolecular.

Equilibrium, in the orbiting motion in microscopic and macroscopic domain, cannot simply be attributed to the centripetal force balance with the attractive forces because kinetic energy of centripetal motion is not vector.

The thermal repulsive force between gas molecules can be easily extended to be interpreted and explained as universal (thermal) repulsive forces because we can easily find that the force are acting and reacting between macroscopic matters and microscopic particles. The thermal repulsive force is contact force and is acting-reacting between nucleus and electrons, acting-reacting between Sun and surrounding plasma, between gas and sea water, between solid matter and gas molecules, between macroscopic particles such as latex, between the Sun and the planets, etc.

Therefore the universal thermal repulsive forces are universal forces that apply at both the macroscopic and microscopic fields.

3. Deducing and Extending the Applicability of the Universal Thermal Repulsive Force to Universal Macroscopic Cosmic Matters

3.1. Prevailingly Discussed Macroscopic Cosmic Universal Repulsive Forces must be Universal Thermal Repulsive Force

3.1.1. Briefing Some Viewpoint of Repulsive Force in Einstein's GRT

3.1.1.1. [5] (1.10 General Relativity)

"Einstein's general theory of relativity goes further by including the effects of accelerations on what we observe. Essential conclusion is that the force of gravity arises from a warping of space time around a body of matter (**Fig.1.17**). As a result, an object moving through such a region of space in general follows a curved path rather than a straight one, and may even be trapped there."
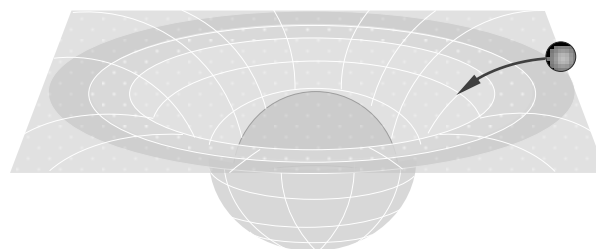

Figure 1.17. General relativity pictures gravity as a warping of space time due to the presence of a body of matter. An object nearby experiences an attractive forces as a result of this distortion much as a marble rolls toward the bottom of a depression in a rubber sheet

The second postulate of GRT suggests that a gravitational field is equivalent to an accelerated frame of reference in the absence of gravitational effects.

A gravitational field may be "transformed away" at any point if we choose an appropriate accelerated frame of reference, the curvature of space–time that describes the gravitational effect at every point to replace Newton's gravitational theory.

If the concentration of mass becomes very great, as is believed to occur when a large star exhausts its nuclear fuel and collapses to a very small volume, a black hole may form. Here, the curvature of space–time is so extreme that, within a certain distance from the center of the black hole, all matter and light become trapped.

Questioning

1 What cause the curvature of space–time? Is mass or volume of mass? It will be self-contradiction if the curvature of space–time is proportional to volume of mass rather than mass.

Therefore "collapses to a very small volume" is not the cause of disappear or decrease of universal repulsive force.

2 Since the gravitational force is inversely proportional to two power of distance between the two objects, so one cannot "choose an appropriate accelerated frame of reference" other than the gravitational field of the system of the two objects.

3 When Coulomb forces and magnetic field forces exert on charged electric mass or magnetic mass, they also generate accelerations.

Can the Coulomb forces or magnetic field forces be "transformed away" at any point if we choose an appropriate accelerated frame of reference and the curvature of space–time that describes the gravitational or attractive effect at every point to replace Coulomb forces and magnetic field forces?

Therefore, the assertions of curvature of space–time and cosmological constant causing gravitational force and universal repulsive force are untenable.

3.1.1.2. [10] (A Repulsive Force in the Einstein Theory)

The repulsive force originates from a metric with the varying gravitational mass of a system. The repulsive force occurs at some distances from the quasi-spherical system which depend on time lapsed from the beginning of the change of the mass. The concept of anti-mass was invoked by Albert Einstein himself.

3.1.1.3. [11] On Repulsive Gravity

The reduction of the gravitational mass of the system due to emitting gravitational waves leads to a repulsive gravitational force that diminishes with time but never disappears.

Cosmological constant, term reluctantly added by Albert Einstein to his equations of general relativity in order to obtain a solution to the equations that described a static universe. The reason is that if all matter attracts each other than a static universe would not be able to remain static. The attractive gravity would cause the universe to collapse.

The cosmological constant is required in cosmological equations in order to reconcile theory with our observations of the universe.

The field equations of Einstein's theory of general relativity are given in the form

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R + \Lambda g_{\mu\nu} = kT_{\mu\nu}$$

where $T_{\mu\nu}$ is the energy-momentum tensor, $g_{\mu\nu}$ is the metric tensor, $R_{\mu\nu}$ is the Ricci curvature tensor, R is the scalar curvature and Λ is the cosmological constant.

Questioning

The "space" in the "warping of space time" is vacuum or a medium?

If the "space" is vacuums, how can it have elasticity or tension or something like bulk modulus result in the so called "warping"? If vacuum has density, what is it comprised and how to test it?

If the "space" is a medium, why the existence of medium ether must be denied?

The mass that results in "warping of space time" is originally determined by the effect of gravity of Newtonian, if GRT replaces the gravity of Newtonian, how to determine the mass of matter?

If "warping of space time" is proportional to volume of matter, then according to Rutherford's experiment, only the volume of nucleus can be determined. What is more, how to determine the volume of gas molecules and plasma?

None of the parameters $T_{\mu\nu}$, $g_{\mu\nu}$, $R_{\mu\nu}$, R and Λ is measurable or testable.

3.2. Briefing Some Assertions of Cosmic Repulsive Force Other than GRT

3.2.1. [8] (Vacuum Density, Repulsive Force between Celestial Bodies and the Cause of Gravity)

Many results show that the total mass of galaxies is always much larger than luminous mass of these galaxies. Some researchers assert it is due to existence of dark matter in various galaxies.

It will have an acceleration that is in the reverse direction of the first mass repulsive force. The vacuum has a negative mass which has repulsive force. Every material, in addition to gravity, has a repulsive force that is developed by the compressed vacuum crust around the material or its negative mass.

The repulsive force is inversely proportional to the distance between the sphere surface and the particle. Then the repulsive force between the two masses can be formulated as follows:

$$F_1 = F_2 = E\frac{(-m_1)(-m_2)}{r^2}$$

F: The force of repulsion between the star and the planet, m_1: Negative mass mass1, m_2: Negative mass mass2, *r*: The distance.

Questioning

Is there any way to verify or test the existence of negative mass which has repulsive force?

3.2.2. [9] (Central Universal Force Field to Explain Solar Orbital Radial Acceleration and Other Universal Phenomena)

The existence of a force field is originating from the center of the universe. To achieve that, a model of the universe

with equal amounts of mass and anti mass repelling each other and preserving a universal radial gravitational field is presented.

Therefore, the vacuum has a negative mass which has repulsive force. Every material, in addition to gravity, has a repulsive force that is developed by the compressed vacuum crust around the material or its negative mass.

Questioning

The paper introduces ad hoc auxiliary anti-mass, dark matter, anti-matter spherical shells.

The assertion of induction of vacuum mass cannot explain repulsions between gas molecules, repulsions between electrons and nucleus.

The explanation about orbital motion of planets is not concrete.

No existing evidence and no tools for measurement of negative mass, anti-mass, dark matter, anti-matter are provided or suggested.

3.3. Almost All Anomalies and Discrepancies Related to Repulsive Force of Microscopic and Macroscopic Matter And Universal (Except Coulomb Force and Magnetic Field Force) can Be Explained By the Newly Discovered Static Universal Thermal Repulsive Force

For example:

1. Pioneer anomaly

The Pioneer anomaly can be explained by universal thermal repulsive force assertion that the spacecraft is always built on a priority measure of thermal insulation, therefore the body is always colder than normal matter such as earth and planets, thus the thermal repulsive force between Pioneer and the Sun is lower accordingly that will manifest gravitational force from Sun is larger than normal matter.

2. Anomalies in gravity

For satellites in high orbits (12- or 24-hours periods) a kind of anomaly has been observed. Period times seem to be somewhat larger than expected based on radius of orbits. This fact has been regarded as an indication to a decrease in the gravity constant, G, for larger distances.

This anomaly most likely due to the temperature change and the formula of thermal repulsive force is changing proportional to the distance between satellites and earth (inversely proportional from 3 times power to 2 time power), therefore result in thermal repulsive force balance with gravitational force readjusted.

3. Solar eclipses anomalies

Changes in gravitational force occur on the surface of the Earth during a solar eclipse of a nature that deviates significantly from that expected merely through the superposition of the gravitational influences of the Sun and the Moon at alignment.

This anomaly can be explained by thermal repulsive force. During the solar eclipses, the heat radiation from the sun to the earth is partially blocking by the moon that decrease the temperature of earth result in the decrease of thermal repulsive force between sun and earth respectively.

4. The observable universe being expanding at an accelerating rate

The cause is the universal thermal repulsive forces, which are larger than gravitational force. Because temperatures of any matter in universe including black holes are higher than absolute 0 K, therefore definitely exert universal thermal repulsive force which is proportional to the absolute temperature K and numbers of point source of the force.

5. What is the antigravity force that caused the Big Bang and expansion of universe?

It is the universal thermal repulsive force!

Limited by the length of the article, we cannot explain prominent anomalies one by one in this paper.

3.4. No explanation made Sense of the Repulsion in GRT

Introducing one more auxiliary cosmological constant factually implies the assertion of warping of space time causing the gravitational force is untenable. If the gravitational force is due to a warping of space time, then a repulsive force should be due to negative warping of space time? Einstein introducing anti-mass and cosmological constant more or less implies his GRT is untenable.

All of the propositions in the hypothetical judgment of GRT cannot bear or pass the examination of testability, or falsification or refutability.

3.5. We have to Change and Open Mind to Give the Universal Thermal Repulsive Force Higher Priority

It is always overlooked that the absolute temperatures of all macroscopic and microscopic matters are higher than zero (0) K which is a measureable physical quantity. Phenomena show that the distance between universal repulsions acted matters or particles are proportional to their temperature and inversely proportional to two or three powers of distance between the matters or particles.

How many stars are in the Milky Way and the center of the universe? Countless! Increase of temperatures of some these stars and planets will increase the universal thermal repulsive forces between these stars and planets and Solar system, in turn result in the expanding of the universe. Thus the Big Bang and expansion of universe are not strange and can be explicable by universal thermal repulsive force.

Universal thermal repulsive force theory never introduce phantom things and any *ad hoc* some auxiliary assumption but is an concrete quantitative measurable and testable physical value, the universal thermal repulsion is measured and scaled by temperature of matters. It can bear testing and verifying directly and indirectly.

Therefore the universal thermal repulsive force assertion is worth to be considered to give it higher priority than other universal repulsive force assumptions.

If physicists of mainstream physics community treat the

newly discovered Universal Static Thermal Repulsive Force fairly, it is believable that they will find that other prevailing prominent conjecture assertions with *ad hoc* some auxiliary assumption including GRT are most likely going astray and fall in endless involutions with no way to extricate themselves, except explained and calculated by using the newly discovered Universal Static Thermal Repulsive Force (field). While paying all closest attentions to the research of the theory one is engaged in, one may expect to do some comparative researches with the universal thermal repulsive force account.

4. Conclusions

1. None of the parameters of GRT such as $T_{\mu\nu}$, $g_{\mu\nu}$, $R_{\mu\nu}$, R and Λ is measurable or testable.
2. No evidence, tools and methods are provided for measuring and testing the *ad hoc* some auxiliary assumption parameters in prevailing researches of universal repulsive force such as repulsive gravity, cosmological constant, dark matter, negative matter, dark energy, and etc.
3. All of the propositions in the hypothetical judgment of GRT and other assertions related to universal repulsive force cannot bear or pass the examination of testability, falsification or refutability.
4. The recommended newly discovered Universal Thermal Repulsive Force by this paper is derived based on rigorous theoretical logical reasoning and concrete practical phenomena without introducing any *ad hoc* some auxiliary assumption. It can bear further comprehensively testing. It has an omnipotent explanatory power that only Newtonian mechanics can be compared and is far beyond that of GRT.

It is believable that most of macroscopic and microscopic anomalies related with universal repulsive forces can be explained by the Universal Static Thermal Repulsive Force most fully and most of anomalies of cosmology related to universal repulsion can be explained by the newly discovered universal thermal repulsive force.

At least, the Universal Static Thermal Repulsive Force

theory provides a brand new innovative thinking mode or a new route or new approach in study of microscopic and macroscopic universal repulsions.

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