Universal Gravitation

And

Formulas of A Unified Interaction

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A Modern Physics Mini Textbook

Find out

What is the cause of gravity?

Why do bodies mysteriously fall with the same acceleration in a g-field?

Why is gravitation greater in the poles than in the equator?

Why is gravitation greater over the low ocean basins than over high continents?

Why don't massive mountains exhibit the gravitation-mass effect?

Why the "large" gravitational pull over lowlands than highlands on the Moon?

Why are orbits elliptical?

How to derive the shape of an orbit?

How to accurately predict orbital perturbations?

How to accurately predict trajectory and orbital parameters?

Why do satellites drift Westward?

Why is the Moon's center of gravity displaced Eastward?

Why the enormous gravitation and meager mass in the Universe?

How to shed light on dark matter?

Why hasn't the Hubble Telescope found black holes or, even, candidate regions?

Why the predicted "hottest" stars turned out to be "cool"?

Why couldn't the astronauts of the Space Shuttle light two candles in microgravity?

How to explain the demarcation between heat and work?

How to derive Maxwell-like equations for gravitational fields?

What is the relationship between Kepler's constant and the speed of light?

Why did Newtonian mechanics fail in the quantum domain?

Is temperature quantization more fundamental than energy quantization?

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The Cause of Gravity

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Universal Gravitation

A Unified Interaction

by

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Bodies and particles attract or repel each other in proportion to the fourth power of their Internally Screened Temperatures, or Temperature Gradients, (and not the product of their *masses*) and in proportion to the inverse square distance between their centers. The *hidden* Temperature-Interaction has not been recognized at all before. Bodies fall with the same acceleration in a gravitational field, say the Earth, because the field summons the bodies by virtue of the Temperature, and not their *masses*. Also, temperature quantization appears to be more fundamental than energy quantization.

INTRODUCTION

The deepest mysteries in physics include *free fall* and the *cause of gravity*. It is generally believed that the cause of gravity was found by Sir Isaac Newton in universal gravitation and, subsequently, by Dr. Albert Einstein, in general relativity. This is not the case. Newton wrote that he was not able to discover the cause of gravity. In response to critics, he wrote in the *Principia*, "*But hitherto I have not been able to discover the cause of those properties of gravity.*" Newton was not troubled by this: In *Opticks* (Query 31), he wrote, "*I scruple not to propose the Principles of Motion … and leave their Causes to be found out*," (my emphasis).

The most commonly asked question about gravity has been: "What is the *force* of gravity that causes the same acceleration in a gravitational field?" I had found it necessary to reword the gravity-question as follows: "What is this same *acceleration* that causes *many forces* in a gravitational field*?*"

This is sensible because there are as many forces in a given field as there are bodies in the field, but there is *only one acceleration*, the same acceleration, for all bodies in a field regardless of mass. If all 300 million people in one country jump simultaneously from tables to the floor, then there are 300 million *forces* acting on the people, but the same acceleration acts on all of them. As scientists strive for Grand Unification Theories, it seems more rational to look for *unification* in the *one* acceleration, or intensity of a field, than in the countless forces!

Newton combined *force* and *mass* in universal gravitation. Einstein bypassed the issue of *force* altogether: In general relativity, gravity is geometry. However, in both Newton's and Einstein's theories of gravitation, *mass* is the cause of gravity. When enormous gravitation is detected in the universe, scientists search for the massive bodies that cause the large gravitation. When those massive bodies are not discovered, mysteriously hidden masses, such as the black holes and dark unseen matter, are proposed. Matter is out there, but it is hidden.

Newton and Einstein's theories of gravitation do not explain some observed facts, and both theories contradict other facts. For example: Why is gravitation greater over the ocean basin than over high continents? Why don't massive mountains exhibit the gravity-mass effect? Why the "large" gravitational pull over lowlands, than highlands, on the Moon? Why the enormous gravitation and the inadequate mass observed and measured in the universe? Why hasn't the Hubble Telescope discover black holes, or even candidate regions for black holes? Why did the predicted *hottest* stars turn out to be *cool*? Why do orbits deviate from theoretical predictions? And granting elliptical orbits, why the large variations in orbital eccentricity of the planets and the moons? Also, what is the *cause* of orbital eccentricity? I found that attributing gravitation to the *heat*, and not the *masses*, of the interacting bodies gives physically sensible and numerically accurate answers to the above questions. Furthermore, the temperature-interaction clarifies many puzzles in quantum mechanics.

In this Report, I show that the *heat screened*, or *hidden*, inside insulating surface layers, such as the Earth's crust, is the cause of gravity. The mysterious free fall is explained by the same effect. The same mechanism works in the stars, planets, moons, and atoms. My theory gives accurate answers to anomalies, perturbations, observations and contradictions that remain unanswered, or unexplainable. Detailed Crucial Tests and Numerical Examples are included, along with the governing equations. I urge the reader to use a standard high school or college physics textbook side-by-side with this Report. That way, you will see how one Maxwell-like equation applies to all fields in physics.

Historical Note

The founders of modern classical mechanics, e.g., Descartes, Galileo, Gassendi, Newton, Leibniz and Huygens, debated vigorously the "cause of gravity," the "cause of motion," and related mechanical subjects. There was agreement in the 17th century that matter, or *mass*, was inert and that the inert and inactive *mass* could not be the *cause* of its own motion. Then, where did motion come from, especially gravitational motion? Everyone agreed, including Newton, that the origin of motion lay with God. In the beginning, God created *matter* and set it in motion.

In his extensive research of *free fall*, Galileo did not consider the *weight* of a body to be a *force*. Galileo referred to weight as the heaviness of a body, or a natural tendency to fall downward. For gravity to be considered a force, *supervisory intelligence* must act at some level. Take the example of the same acceleration acting on 300 million people in a country. 300 million forces will be acting on the 300 million people. *One acceleration, 300 million forces.* But, how does the Earth *know* by how much force to pull on each person? A supercomputer must exist in the Earth, in its gravitational field, or somewhere else in the Universe. The supercomputer must adjust the *force* on each person, according to each person's mass. An airplane travelling from New York to London undergoes changes in mass (fuel consumption) every second. The gravitational *force* acting on the airplane must change continually, but the gravitational *acceleration* acting on the airplane will be the same throughout the trip. When a wave strikes an obstacle near shore, many drops fly around with different, and changing, masses and trajectories. The supervisory intelligence must keep track of each drop, its mass, and its change of mass throughout its trajectory and adjust the *force* at every moment on every drop. Of course, all the drops experience the same acceleration throughout their trajectories. The need for *supervisory intelligence* to supervise the *forces* in a field greatly bothered the founders of classical mechanics.

Today, there are three major groups in physics and engineering. The first includes civil, mechanical, and materials engineers who design and build satellites, rockets, buildings, bridges, airplanes and cars. The primary tools of this group include Newton's equations and related derivations. The second group, which includes electrical, electronic and communications engineers and scientists, use the highly regarded Maxwell equations in their work. Maxwell's equations led to the great advances in communications in the twentieth century, including microwave, satellite and fiber transmissions. The third group of experts includes quantum and nuclear experts, and the products of this group are as diverse as the computer and nuclear energy. The last group uses the formulations of modern quantum mechanics. Generally, the mechanical experts, the first group, do not use quantum formulations and the quantum experts do not burden themselves with the mechanical formulations and philosophy.

Maxwell's electromagnetic equations held a great promise. If only the mechanical equations, i.e., Newton's, could be written in Maxwell-like equations. Einstein spent considerable effort and time trying to express gravitational equations in Maxwell-like form, but he was not able to do the task. In this Report, you will see how to express the gravitational equations in Maxwell-like equations.

Topic #1: The Cause of Gravity

It is generally known that hot bodies radiate heat and cold bodies absorb the radiated heat until all the bodies reach thermal equilibrium with their surroundings. Consider a sphere, such as the Earth, in a molten hot state, Fig. 1a. As heat radiates away, the surface cools down and hardens before the interior. If the sphere were made of pure metal, then the internal heat conducts continually to the surface where the heat radiates into space. Eventually, the metallic sphere becomes cold and solid throughout, right into the core. An all-metal planet or moon cannot retain any heat inside its surface. All internal heat will eventually be conducted to the surface and into the surrounding cold space and it becomes dormant, Fig. 1b. However, if an insulating surface layer, such as the Earth's crust, forms during the cooling process, then considerable heat can be *trapped* under the insulating surface layers. The trapped heat cannot make its way to the surface and into space. This situation is shown in Fig. 1c.

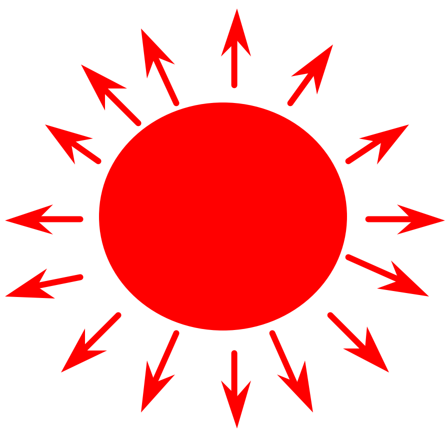


Fig. 1a Heat radiates unimpeded from exposed molten hot Earth-sphere into space

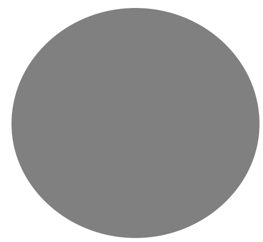


Fig. 1b A Metal Sphere radiates **all** its heat into space and becomes dormant

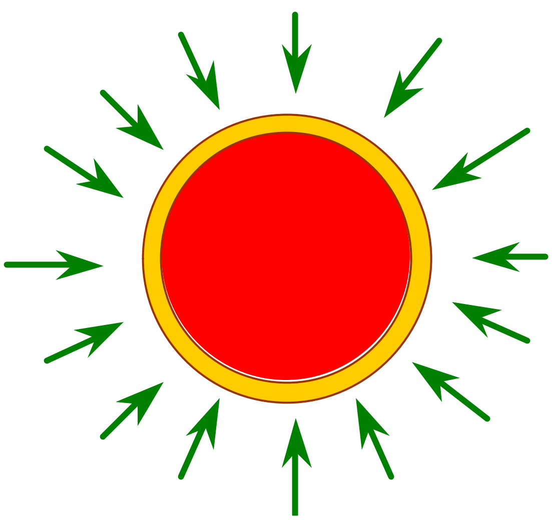


Fig. 1c Heat screened by insulating layer radiates ***gravitation*** into surrounding space

What does the heat trapped inside Crust-Covered Earth do? It acts as:

Insulated-Temperature-Conductor like insulated-electric-conductor

Obeys Gauss's Law

Intensity $\propto$ (Temperature)^4

Intensity $\propto$ 1/(distance)^2

First Maxwell-Like Equation for Gravitational Fields:

$$I(F) = \mathrm{A}\frac{T^4}{R^2}$$

Fig. 1 The Equation of ***Screened-Temperature-Gravitation*** is the first ever to work in classical, electromagnetic and quantum physics

What does the heat trapped inside the Earth do? When we stand on the surface of the Earth above pools or oceans of very hot lava, we do not feel the incredible heat raging beneath our feet. If the insulating crust were removed, the trapped heat will quickly scorch and melt our bodies. Can the heat trapped beneath the Earth's crust surreptitiously reach out and affect surrounding bodies? If so, how, and by how much? These questions have not been asked, nor answered, before. Persistent inquiry along these lines led to wonderful discoveries, including the governing equations.

I find that a sphere, such as the Earth, with insulating crust layer(s) acts like an *insulated-electric-conductor*, which obeys Gauss's law, where the internally screened-temperature, rather than the electric charge, is the interaction agent.

In essence, the high temperature screened, or hidden, within the Earth reaches out and attracts, or repels, bodies in accordance with the temperatures. The gravitating temperature attracts a small stone and a massive boulder with the same intensity, which we reckon as the constant acceleration of gravitation. Because the stone and the boulder are at the same temperature, both are attracted at the same rate. Variations of hundreds of degrees in the temperature of the attracted bodies hardly affect the acceleration. The temperature interaction mechanism shows that free fall is a natural process, which does not require supervisory intelligence to determine how much *force* is applied to each falling body. These and other important concepts will become clear, particularly, with my Crucial Tests and Numerical Examples, which follow.

Topic #2: Derivation of the Unified Formula

Let the screened temperature, *T*, inside a sph erical body set up a field of intensity $I(F)$ that can interact with the surrounding matter. The intensity of the field $I(F)$ at a distance *R* can be found directly from the Stefan-Boltzmann exact law of radiation, or $I(F) \propto T^4$, and the well-established inverse-square law, $I(F) \propto 1/R^2$. Introducing a constant of proportionality, **A**, then gives the following relationship:

$$I(F) = \mathrm{A}\frac{T^4}{R^2} \qquad (1)$$

This is the governing equation for all interaction fields. The temperature that is screened internally within the surface layer, such as the Earth's crust, determines the intensity of the field. The surface temperature and other factors, as will be developed in later Sections, also influence the strength of a field.

In a gravitational field, the intensity *I(F)* is itself the gravitational acceleration *g*, which is produced by the temperature, *T*, that is insulated by surface layer(s), say, the crust on the Earth, the Moon, or other bodies. The gravitational acceleration *g* is:

$$g = \mathrm{A}\frac{T^4}{R^2} \qquad (2)$$

Notice how *g* in my Eq. (2) is different from Newton's Law of Universal Gravitation, which attributes gravitation to the mass of the central body, or,

$$g = \mathrm{G}\frac{M}{R^2} \qquad (3)$$

In Newton's formula, Eq. (3), G is the universal gravitation constant and *M* is the mass of the central body, or the attracting body. The mass of the attracted body, *m*, (the apple in the Earth-apple system) is discarded in Newton's Eq. (3) by equating the gravitational attraction force ($F=\mathrm{G}Mm/R^2$) to the acceleration force, $F=ma$. In my formulations, *g* is obtained directly from the intensity of the field.

Topic #3: Constant of Proportionality, A

Consider my constant **A** in Eq. (2) and Newton's constant **G** in Eq. (3). The units of the two constants are as follows:

$$A = \frac{m^3}{s^2}\frac{1}{K^4} \tag{4}$$

$$G = \frac{m^3}{s^2}\frac{1}{M} \tag{5}$$

Both constants, **A** and **G**, contain Kepler's constant (the cube of the distance divided by the square of the period, m^3/s^2). Newton's universal gravitation constant, **G**, includes the mass **M**, which as noted above has inert and inactive properties. On the other hand, my constant, **A**, includes the temperature, which is an active quality, raised to the *fourth power*. Some readers will recognize that the quantity T^4 was essential in the development of quantum mechanics. This was a crucial parameter that was missing from Newtonian mechanics and which led to severe difficulties in the study of quantum phenomena. Because Newton's constant, **G**, did not contain an active factor, e.g., temperature, quantum mechanics abandoned classical mechanics.

To test the Unified Interaction Equations, or Eqs. (1) and (2), we need a preliminary value for the constant, **A**. This can be done from data relating to the Earth. The radius, R, of the Earth at the poles is 6.357×10^6 m. The gravitational acceleration, g, is 9.832 m/s^2. The other value needed to calculate the constant **A** is the screened-temperature within the surface of the Earth, which is responsible for the planet's gravitation. Reasonable temperatures for the interior of the Earth can range between 2,000^{o}K and 25,000^{o}K. For this Report, I have selected a temperature of 10,000^{o}K. In essence, the 10,000^o Kelvin temperature, which is shielded by the Earth's crust, is the "*cause of gravitational attraction*" of the planet. A working value for the constant **A** can now be found:

$$A = \frac{gR^2}{T^4} \tag{6}$$

$$A = \frac{(9.832 m/s^2)(6.357\times10^6 m)^2}{(10{,}000 K)^4} = 3.973257\times10^{-2} m^3/s^2K^4$$

Some readers may want to derive and check greater accuracy for the Constant A. Some readers may also want to examine different reasonable screened-temperatures for the Earth, e.g., 2,000^{o}K, 15,000^{o}K, 25,000^{o}K, or some other values. Whatever the interior temperature of the Earth turns out to be, the screened-temperature gravitation theory will work (see Topic #11: A Realistic Gravitation-Temperature for the Earth). Also, all the numerical examples in this Report work out equally well in the British System of Units (ft-lb-sec).

Example 1: The Apple-Earth Test

I begin the tests of my formula (Eq. 2) by calculating the gravitational acceleration *g* in the poles and the equator on the Earth's surface. The acceleration, *g*, in the Polar Regions, where R = 6.357x10^6 m, is:

$$g = \mathrm{A}\frac{T^4}{R^2} = \frac{(3.973254\times10^{-2}\,\mathrm{m}^3/\mathrm{s}^2\mathrm{K}^4)(10{,}000\mathrm{K})^4}{(6.357\times10^6\mathrm{m})^2} = 9.832\,\mathrm{m/s}^2$$

And the acceleration in the equator region, where R=6.378x10^6 m, is:

$$g = \mathrm{A}\frac{T^4}{R^2} = \frac{(3.973254\times10^{-2}\,\mathrm{m}^3/\mathrm{s}^2\mathrm{K}^4)(10{,}000\mathrm{K})^4}{(6.378\times10^6\mathrm{m})^2} = 9.767\mathrm{m/s}^2$$

The above values agree with the values derived from the law of universal gravitation, or Eq. (3). The difference between the polar and equatorial accelerations (9.832-9.767, or 0.065) is fully accounted for on the basis of the different surface temperatures in the polar and equatorial regions (see Crucial Test #1).

Example 2: The Earth-Moon Test

From the inverse square law, Newton used the distance to the Moon (60 Earth radii) to estimate the gravitational acceleration, *g*, at that distance, or,

$$g = \frac{9.8\text{m/s}^2}{60^2} = 0.00272\text{m/s}^2$$

which compares well with calculations based on the orbital speed of the Moon.

For the average distance of 382,400 km between the Earth and the Moon, the intensity of the Earth's gravitation, *g*, at that distance, based on my Equation (2), is,

$$g = \text{A}\frac{T^4}{R^2} = \frac{(3.973254\times10^{-2}\,\text{m}^3/\text{s}^2\text{K}^4)(10{,}000\,\text{K})^4}{(382.4\times10^6\,\text{m})^2} = 0.00272\,\text{m/s}^2$$

which compares well with Newton's result and with observations.

The acceleration derived above is the gravitational acceleration with which the Earth's internally screened-temperature (or, 10,000^{o}K) attracts a body at the distance of the Moon. The body can be the Moon (some hundred thousand billion billion kilograms), a Lunar craft (only a thousand kilograms), or an astronaut (less than 100 kg). Try Equation (2) with other planets and moons.

Crucial Test #1: The Difference of *g* in the Poles and Equator

The small difference between the accelerations in the poles and the equator, see Example #1, has not been fully accounted for with universal gravitation. Although the difference is small, it is relatively larger than other gravitational discrepancies that have received much attention. The Tabulation below shows how the unexplained *g* component is accounted for by the temperature difference between the poles and the equator.

Description	Newton's law of Gravitation	The Unified Equation
Acceleration at the pole	9.875m/s^2	9.832m/s^2
Acceleration at the equator	9.810 m/s^2	9.767 m/s^2
Acceleration difference Δ	0.065 m/s^2	0.065 m/s^2
Centrifugal *g* at the equator	0.034 m/s^2	0.034 m/s^2
Effect of Δ*T* (8^{o}C)	N/A	0.031 m/s^2
Unexplained component	1 part in 300	None

The values in Newton's law of Gravitation column are derived using data from physics textbooks, e.g., G=6.67x10^{-11} N-m^2/kg^2, and the mass of the Earth, *M*=5.983x10^{24}kg. The 1 part in 300 component is the unexplained value. The unexplained component is fully accounted for by surface temperature differences in my equations. Derivation of the temperature difference, Δ*T*, is described below.

So far, I have used the internally screened-temperature within the Earth's crust, which I propose to be responsible for the gravitational attraction. Apparently, surface temperature also affects the gravitational strength. To show this effect, I expand Eq. (2) to include the internally screened-temperature, T_i, and the temperature gradient, or difference, ΔT_s, between the surface temperatures at the desired locations, or,

$$I(F) = g = \mathrm{A}\frac{(T_i \pm \Delta T_s)^4}{R^2} \qquad (7)$$

This equation shows how the intensity of a central field, *I*(*F*), in this case the gravitational acceleration *g*, is affected by different surface temperatures.

The surface is generally cooler in the poles than in the equator. As a result, there will be a greater difference between the Earth's internal temperature and surface temperature in the poles. The greater temperature difference in the poles is responsible for the greater gravitational attraction in those regions. The acceleration in the equator is smaller because the temperature *difference* between the Earth's hot interior and the surface is smaller than in the poles.

To use Eq. (7), we need the temperature difference Δ*T* between the poles and the equator. Underneath the polar frozen ice, the temperature remains nearly 0 ^{o}C. As the ocean waters dominate the globe, their temperature makes a good reference. Water has a large heat capacity compared with other substances, and the daily and seasonal temperature variation is about 8^{o}C (14 ^{o}F). This is the basis for using a Δ*T* of 8^{o}C value in the previous Table. We can now find the effect of the different surface temperatures on the gravitational accelerations in the poles, g_p, and in the equator, g_e, from Eq. (7). Notice that I have taken the pole as a reference so that Δ*T* at the pole is 0 ^{o}K and Δ*T* at the equator is 8^{o}K.

$$g_p = \frac{(3.973254\times10^{-2}\,\text{m}^3/\text{s}^2\text{K}^4)(10{,}000\text{K - 0K})^4}{(6.357\times10^6\,\text{m})^2} = 9.832\text{m/s}^2$$

$$g_e = \frac{(3.973254\times10^{-2}\,\text{m}^3/\text{s}^2\text{K}^4)(10{,}000\text{K - 8K})^4}{(6.357\times10^6\,\text{m})^2} = 9.801\text{m/s}^2$$

$$\Delta g = 9.832 - 9.801 = 0.031\text{m/s}^2$$

This accounts fully for the observed gravitational difference between the poles and the equator regions. It can then be said that the effective gravitating temperature in the poles is 10,000 ^{o}K, while the effective gravitating temperature in the equator is 9,992 ^{o}K.

It can be deduced from the above that the hotter the outer surface of a body, the weaker is its gravitational attraction; and the colder the surface, the stronger the gravitational attraction, see Fig. 2**.**

The effect can be visualized by making the surface temperature difference, ΔT_s, equal to the internally screened-temperature, T_i, in Eq. (7). The gravitational attraction would then become zero! This means that if the Earth's crust is heated to 10,000 ^{o}K, the crust itself becomes a heat radiator (see Fig. 1). In such a condition, heat radiation from the surface would spread out unimpeded by an insulating crust; a condition similar to that shown in fig. 1a. In essence, the gravitational radiation of the Earth would be replaced by heat radiation. This effect is more discernible when regular materials are heated, say to melting, where the "bonding" of molecules and atoms is greatly affected.

In preparation for later Sections, the above observations indicate that when advanced instruments detect a star with a hot surface, it is likely that the gravitational attraction of the star is weak; whereas if the star's surface is cold, then its gravitational attraction is likely to be strong.

Screened-Temperature-Gravitation explains the difference in g between the poles and the equator:

g_{equator}=9.767 m/s^2
$g_{centrifugal}$=0.034 m/s^2
$g_{temperature}$=0.031 m/s^2
Total g=9.832 m/s^2

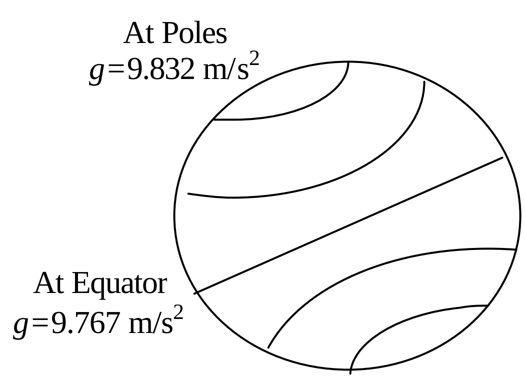


Fig. 2 The cooler surface temperatures in the poles explain why temperature-gravitation is smaller in the equator than in the poles

Crucial Test #2: The Flattened Orbit of the Moon

The Moon's orbital motion is very complex. A recent remarkable astronomy achievement took "*a quarter century devising, correcting, checking and polishing a single equation for the moon's motion that covers some 250 large pages*." This shows the complexity of the Moon's motion. One equation covering 250 pages is indeed intimidating.

At closest approach, the Moon is about 363,300 km away from the Earth, and at farthest distance, it reaches 405,500 km; or an excursion of some 42,000 km. Not only the Moon, but also nearly all orbiting bodies, including artificial satellites, exhibit irregular motions that defy simple predictions with the mass-based gravitational theories.

The elliptical orbits of Kepler and Newton explain the speeding up of bodies at closest approach, or perigee, and slowing down at farthest distance, or apogee. However, this does not answer the basic inquiry: Why the Moon, Mars, or other bodies move closer and farther from the attracting central body in the first place? No theory has answered the "*why*" question.

Kepler's painstaking study of Tycho Brahe's data revealed a sine wave variation in Mars' orbit. That led Kepler to describe the Sun as an eccentric magnet, now *attracting* and then *repelling* the planets. My theory provides the basis to explain Kepler's observations and related puzzling facts. The orbit of the Moon is considerably flattened, and this provides an excellent Crucial Test of my gravitational theory.

I showed above how the cooler temperatures in the poles could explain the greater gravitational pull there. The greater gravitational intensity in the poles reaches out into space. This is to say that a satellite placed in polar orbit will experience a greater pull when passing over the poles than when passing over the equator.

The lunar surface experiences great surface temperature variations in each orbit. The equatorial temperature on the Moon ranges from very hot 127^{o}C, during the Moon's day, to very cold –173^{o}C, in the lunar night. This adds up to 300^o peak-to-peak temperature variation. The daily and seasonal cycles on Earth produce variations of more than 100 degrees. Every lunar month, the cold regions on the Earth and on the Moon face each other, as shown in Fig. 3. When the cold regions are in conjunction, the gravitational attraction should be at its greatest and the Moon is pulled to closest approach. When the hotter regions face each other, the temperature-gravitational attraction must be at its weakest, and the Moon drifts farthest from the Earth.

Can the surface temperature variations on the Earth and on the Moon explain the flat elliptical orbit of the Moon? To answer this question, we need an expression for the radius vector, *R*, which can be derived from Eq. (2), or,

$$R = \sqrt{\frac{AT^4}{g}} \qquad (8)$$

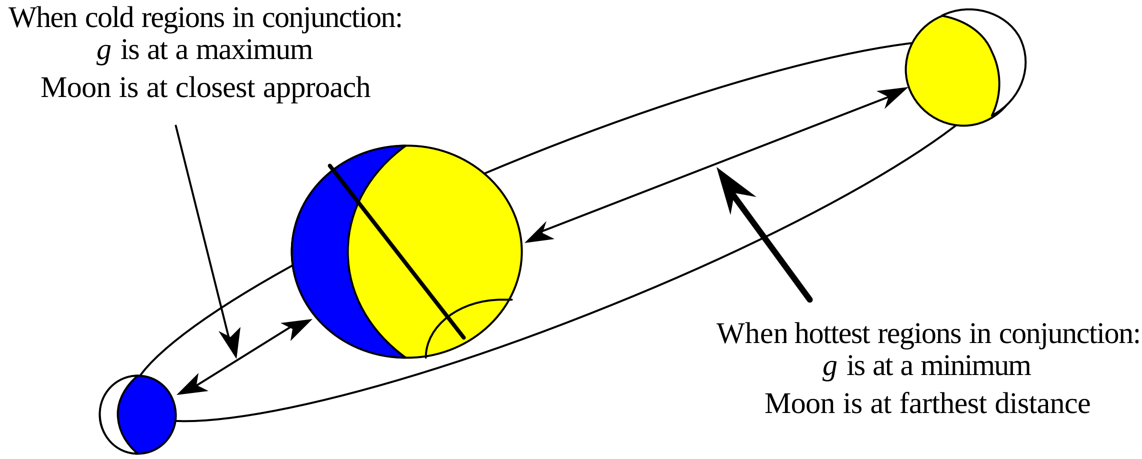


Fig. 3 Surface temperatures on the Earth and the Moon dictate the orbit shape

We now expand the temperature factor, T, to include the gradient, or the difference, in surface temperatures as follows; See Equation (7):

$$R = \sqrt{\frac{A(T_i \pm \Delta T_s)^4}{g}} \qquad (9)$$

Consider the Moon to move in a circle at the average distance of 382,400 km; where g is about 0.00272 m/s^2 (see Example #2). For a first approximation, let the temperature variation, ΔT, be the total difference in the surface temperatures of the Earth and Moon combined; e.g., $\pm 300^o$C. The least and greatest radii due to surface temperature variations can be estimated from Eq. 9 as follows:

$$R_{apogee} = \left[\frac{(3.973254\times10^{-2}\,\text{m}^3/\text{s}^2\text{K}^4)(10{,}000\text{K}+300\text{K})^4}{0.00272\text{m/s}^2}\right]^{\frac{1}{2}} = 405{,}500\text{km}$$

$$R_{perigee} = \left[\frac{(3.973254\times10^{-2}\,\text{m}^3/\text{s}^2\text{K}^4)(10{,}000\text{K}-300\text{K})^4}{0.00272\text{m/s}^2}\right]^{\frac{1}{2}} = 360{,}000\text{km}$$

Compare these answers with the modern estimates for the same distances of 363,300 km and 405,500 km. The temperature-gravitation-mechanism is thus the first mechanism to explain the elliptical shape of orbits on the basis of physical data.

It should be noted that there are no mass variations on the Earth that can account for the above orbital distance variations. On the basis of Newton's gravitation, it would take mountain peaks of some 300-km (nearly one million feet peaks) to explain the above effects, and mountains of such height do not exist on the Earth.

The spin and rotation of bodies also affect the gravitational attraction. When these effects are combined with my temperature-interaction, seemingly random occurrences, such as, the tides, earthquakes, and the weather, are better explained and predicted. While cyclic behavior has been recorded (for the daily tides, semi-daily tides, mixed tides, neap and spring tides, perigean and apogean tides, tidal bores and tidal currents), fluctuations for the same tides in the same location remain inexplicable when the constant *masses* of the Earth and the Moon are used. I have made many other calculations on these effects, and other scientists can already use my formulas to explain many aberrations from known temperature measurements.

Crucial Test #3: "*Large Gravitational Variations*" on the Moon

Before the Apollo Moon landing missions in 1969, Lunar Orbiters were sent to scout the Moon. One of the first puzzling discoveries made then was the unexpected large variations in the gravitational field of the Moon. For example, NASA reported "*Studies of the Orbiter motion, however, revealed* <u>*relatively large gravitational variations*</u>;" (Apollo Expeditions to the Moon, NASA, 1976, p. 99).

Strangely, the greater gravitational pull happened over the large flat regions, where there are no mass protrusions of mountains or peaks to explain the recorded observation. With no visible mass to account for the greater gravitation, hidden mass concentrations, which were later called *mascons*, were proposed. For example, from the same NASA reference; "*Anomalous concentrations of mass called mascons have been discovered in the great circular mare basins, detected by the way in which they distort the Moon's gravitational field.*"

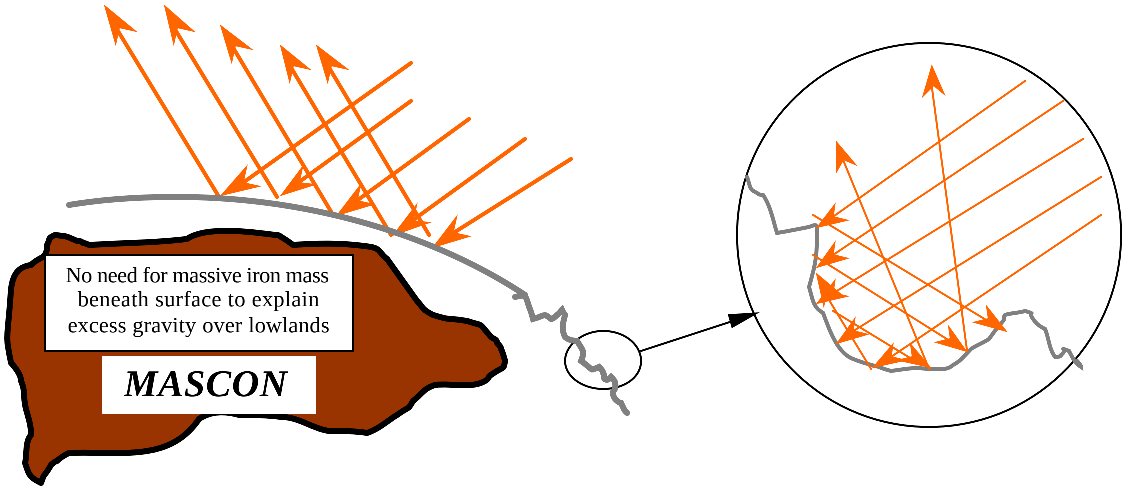
The *mascons'* theories speculate that large meteorites, composed primarily of heavy iron, collided with the Moon and somehow burrowed under the flat regions. So, the heavy mass required to produce the gravitational effect is present, but the mass is invisible, hidden under the surface. Similar theories based on mass or density distribution have been the primary tools used to explain gravitational anomalies measured on Earth. These theories are rather complicated and often lead to contradictions. My theory provides a powerful and simple tool to explain the observed anomalies.

The speeding up of the Lunar Orbiters over the flat lunar regions provides another Crucial Test of my theory. I showed in the previous Crucial Test how the temperature difference between the cold and hot regions on the Earth and the Moon can explain the flattened orbit of the Moon. But, what temperature variation can explain the *local* speeding up of the Orbiters over the flat regions? Actually, this is an interesting case.

The radiation and absorption characteristics of bodies are well understood. Radiation absorptivity of rough surfaces is greater than for smooth surfaces, and the reflectivity of smooth surfaces is greater than for rough ones. The crater regions on the Moon absorb more solar radiation by internal reflections than the flat regions; while the flat regions reflect more radiation into space and must be cooler than the crater regions, see Fig. 4. Because of the cooler temperature in the flat regions, greater gravitational attraction should be natural and expected, as observations and my theory show, and not peculiar or abnormal, as universal gravitation predicates.

To describe the above effect numerically, we must first determine the screened-temperature responsible for the Moon's own gravitational field. This is the temperature screened by the crust layer. By rearranging Eq. (2), the gravitating temperature, *T*, for the Moon, or any other central body, can be found from the following expression:

$$T = \sqrt[4]{\frac{gR^2}{\mathrm{A}}} \qquad (10)$$



Flat regions are cooler because most sunlight reflects back to space
Greater *g* pull

Craters are warmer because of internal reflections
Weaker *g* pull

Fig. 4 Gravitation over flat regions on the Moon is greater because of cooler surface temperature

The acceleration on the surface of the Moon is, g= 1.62 m/s^2 and the radius of the Moon is R=1.738×10^6 m. The Moon's gravitating temperature can then be estimated from Eq. (10), or,

$$T_{Moon} = \sqrt[4]{\frac{gR^2}{A}} = \sqrt[4]{\frac{(1.62\,\mathrm{m/s^2})(1.738\times10^6\,\mathrm{m})^2}{3.973254\times10^{-2}\,\mathrm{m^3/s^2K^4}}} = 3{,}331^{\circ}\,\mathrm{K}$$

The 3,331°K temperature is the internally screened-temperature that is masked by the Moon's crust, and which is responsible for the Moon's gravitational attraction. Compare this temperature with the 10,000 degrees I selected for the Earth, which produces a gravitational acceleration of 9.8m/s^2 at sea level. These values are preliminary, but the actual temperatures will not affect the theory when those temperatures are determined accurately.

Because of internal reflection of sunlight within the craters, the temperature in the craters can be 5°, 10° or 20° greater than in the flat regions. Let us estimate the temperature difference that will produce a 1% increase, or decrease, in the Moon's gravitational pull, e.g., 1.6362 m/s^2 instead of 1.62m/s^2. From Eq. 10,

$$T_{Moon} = \sqrt[4]{\frac{gR^2}{A}} = \sqrt[4]{\frac{(1.6362\,\mathrm{m/s^2})(1.738\times10^6\,\mathrm{m})^2}{3.973254\times10^{-2}\,\mathrm{m^3/s^2K^4}}} = 3{,}340^{\circ}\,\mathrm{K}$$

The result represents a surface temperature difference ΔT of 9 degrees (3,340-3,331). The 9^o ΔT on the Moon produces 1% Δg variation in the Moon's gravitational strength. This is another Crucial Test of the temperature-gravitation theory, where the theory is confirmed by observations.

Long before the Lunar Orbiters detected the *"relatively large gravitational variations"* on the Moon in the 1960s, similar anomalies were known on the Earth. Using Newton's gravitation, many studies and tests produced contradictory results. For example, the Himalayan Mountains are bulky mass concentrations; yet, the expected mass gravitational effect does not exist near the mountains. In some cases, the gravity in a valley situated next to a mountain was found to be less than on top of the mountain! Calculations based on force per unit mass indicate that the pull of gravity should be greater on the continents, which rise above sea level, than over the ocean basins. But, observations contradict calculations. There are also very "*sharp*," or "*notably large*," anomalies in small land areas, e.g., in the northwest around Seattle, Washington and along the Minnesota-Wisconsin border. The mass-gravitation-theories just simply do not account for many observations. My theory provides a simple tool to evaluate the anomalies, to map the gravitation potential over the planet, and to map underground temperatures. Such effort will lead to better prediction of underground resources, earthquakes, and the weather.

Crucial Test #4: Orbital Periods, Oscillations and Trajectories

Basic dynamics relationships are used to derive the orbital period, τ, and the frequency of oscillation, *f*, of planets, moons, satellites and other oscillators. I use the same procedures that can be found in standard textbooks to derive the period and frequency as function of temperature. For example, the orbital period is given by:

$$t = 2p\sqrt{\frac{R^3}{AT^4}} \qquad (11)$$

The equation can be used to solve problems of orbital, pendulum, bouncing, or other harmonic motion induced by a central body. To check Eq. 11, I calculate the average sidereal period of the Moon, as follows:

$$t = 2p\left[\frac{(382.4\times10^6\,\mathrm{m})^3}{(3.973254\times10^{-2}\,\mathrm{m}^3/\mathrm{s}^2\mathrm{K}^4)(10{,}000\mathrm{K})^4}\right]^{1/2} = 27.28\mathrm{days}$$

which is in agreement with observations.

The period of a spacecraft in low earth orbit, or about 200 km height, where, R=6.578x10^{6}m, is calculated next:

$$t = 2p\left[\frac{(6.578\times10^6\,\mathrm{m})^3}{(3.973254\times10^{-2}\,\mathrm{m}^3/\mathrm{s}^2\mathrm{K}^4)(10{,}000\mathrm{K})^4}\right]^{1/2} = 5{,}318\mathrm{seconds}$$

This period of 88.63 minutes is also in agreement with observation, e.g., the period of a Space Shuttle in low earth orbit.

Next, I calculate using the temperature-gravitation relationship the period of a satellite in a geostationary orbit at a height of 35, 803 km, where R=42.160x10^{6}m:

$$t = 2p\left[\frac{(42.160\times10^6\,\mathrm{m})^3}{(3.973254\times10^{-2}\,\mathrm{m}^3/\mathrm{s}^2\mathrm{K}^4)(10{,}000\mathrm{K})^4}\right]^{1/2} = 23.969\mathrm{hours}$$

which is in excellent agreement with the observed values.

The spin and rotation of the Earth produce temperature variations, which affect the orbits of satellites. Orbit perturbations are well known and complex methods using mass or relativity effects are used to predict the deviations. My theory gives excellent results for determining trajectories, orbital parameters and perturbations, which can improve the management of fuel consumption in launch vehicles, satellites, space probes and even aircraft.

The frequency of oscillation, *f*, is the reciprocal of the period of oscillation given in Eq. (11), or,

$$f = \frac{1}{2p}\sqrt{\frac{AT^4}{R^3}} \qquad (12)$$

This equation applies to a wide range of problems, including highly elliptical orbits; and with excellent results. The Moon's orbital period is near 655 hours. Strangely, the period varies by as much as 2 hours, *depending on the time of the year.* The *masses* of the Earth and the Moon do not change with the seasons to produce the observed variation! Also, *large masses*, such as mountains, do not move from place to place to account for the periodic difference. The reader may want to try to explain the 2 hours difference in the Moon's period with the temperature effect. Which temperature should be used? And, how many degrees of temperature variation are required to produce the observed orbital period?

Crucial Test #5: The Westward Drift of Satellite Orbits

It was noticed in the last thirty years that inclined satellite orbits drift westward. The leading explanation attributes the effect to an equatorial *bulge* (another *mascon*). The westward drift of satellites could not have been anticipated with Newton's universal gravitation. Also, one could argue that the effect of the equatorial bulge to the east of a satellite cancels out the effect of the western bulge; and no drift should occur.

The *westward* drift of satellites and a reverse *eastward* displacement of the Moon's center of gravity provide an important Crucial Test of my gravitation theory.

I showed earlier how the surface temperature on the Earth affects the gravitational attraction. A greater gravitational pull occurs over colder surface regions than over warm regions; as in the poles and equator, respectively.

The westward drift of satellites can also be explained with the temperature-gravitation theory. One has to imagine how the eastern side of the Earth, from the satellites' standpoint, comes out suddenly from the cold nighttime; whereas the west side undergoes gradual temperature variation, whether in the nighttime or during the day! This is a clear example of the gravitational effect that results from surface temperature difference ΔT, see Eq. (7).

Interestingly, the same temperature effect that produces the *westward* drift of satellite orbits may be responsible for an opposite effect in the Moon; the apparent *eastward* displacement of the Moon's center of gravity. The intrinsic connection between the two recently discovered observations has not been noted before. Also, the observations could not be derived nor predicted with the existing mass-gravitational theories.

Sir Isaac Newton demonstrated that the Moon is affected by the gravity of the Earth; and he calculated the Earth's gravitational acceleration, *g*, at the distance of the Moon (see Example #2). This particular demonstration was a cornerstone in Newton's universal gravitation. A wealth of data was collected for the Moon alone from the Apollo survey missions, the Surveyor landing sites, the impact of objects on the Moon's surface, and from accurate radar data. The recent lunar studies have shown that the center of gravity of the Moon is displaced from the geometric center: By about 2 km towards the Earth and 1 km *eastward*. The *westward* drift of satellites and *eastward* displacement of the Moon's center of gravity constitutes another important Crucial Test of my gravitation theory. The same temperature variation in the Earth's daily cycle accounts for both phenomena. As in previous examples, the calculations are simple and straightforward.

As it stands today, the *westward* drift of satellites is attributed to hidden *mascons* on the Earth and the *eastward* displacement of the Moon's c.g. is attributed to hidden *mascons* on the Moon. The temperature-gravitational effect eliminates the need to move the center of mass of the Moon from its center of gravity. In other words, the Moon's geometric center could actually be coincident, or nearly coincident, with its center of mass and center of gravity.

Crucial Test #6: The Mysterious "*Free Fall*"

"*Free fall*" is one of the deepest mysteries in physics. The fall of bodies of whatever mass with the same acceleration seems to require *supervisory intelligence*. Why do heavy bodies fall with the same rate as light bodies? Galileo and Kepler kept the mass out of their orbital and gravitation formulas. Newton included the mass, *m*, of the falling body in his law of gravitation ($F=GMm/R^2$); and he then excluded the same *mass* by using it in his Second Law of Motion ($F=ma$). That was a mathematical maneuver that had no counterpart in the physical world. In my gravitation-theory, acceleration is calculated independent of the mass of the *attracting* body or the *attracted* body.

To explain the *free fall* phenomenon using the temperature-gravitation theory, we will deal with the temperatures of the falling bodies themselves. Some of this was already demonstrated in previous Crucial Tests. The general equation for the two-body problem, say the Earth and a falling body, an apple, may be written as follows:

$$g = \mathrm{A}\,\frac{(T_{Ei} \pm T_{Es})^4 \pm (T_{Bi} \pm T_{Bs})^4}{(R_{E-B})^2} \qquad (13)$$

Where, T_{Ei} is the Earth's internally screened-temperature, T_{Es} is the Earth's surface temperature, T_{Bi} is the body's screened-temperature, and T_{Bs} is the body's surface temperature. Good first approximation can be obtained with only one temperature for the Earth, T_{E}, and one temperature for the falling body, T_{B}; as in Eq. 14. Here, $R_{\mathrm{E\text{-}B}}$ is the distance from the center of the Earth to the body, or practically, the Earth's radius.

$$g = \mathrm{A}\,\frac{(T_E)^4 \pm (T_B)^4}{(R_{E-B})^2} \qquad (14)$$

When I used the 10,000°K for the internally screened-temperature in the Earth, T_{E}, in the previous examples, I had in essence derived the gravitational acceleration, *g*, for bodies whose temperature, T_{B}, was implicitly taken to be absolute zero. The acceleration on the surface of the Earth for such bodies is 9.832000m/s², or, from Eq. (14),

$$g = 3.973254\times10^{-2}\,\frac{\mathrm{m}^3}{\mathrm{s}^2\mathrm{K}^4}\,\frac{(10{,}000\mathrm{K})^4 - (0\mathrm{K})^4}{(6.357\times10^6\,\mathrm{m})^2} = 9.832000\mathrm{m/s}^2$$

How does the actual temperature of the attracted body affect the above result? The average temperature of bodies on the surface of the Earth is about 20°C, or 70°F, or 293°K. Let us substitute the average temperature of bodies in Eq. (14):

$$g = 3.973254\times10^{-2}\,\frac{\mathrm{m}^3}{\mathrm{s}^2\mathrm{K}^4}\,\frac{(10{,}000\mathrm{K})^4 - (293\mathrm{K})^4}{(6.357\times10^6\,\mathrm{m})^2} = 9.831993\mathrm{m/s}^2$$

This is to say that the acceleration of bodies whose temperature is in the range of 0^oK to 293^oK is practically the same, i.e., 9.832 m/s^2; or a difference of a few millionths of a meter per $second^2$. Such difference is not easy to detect.

Next, consider bodies at higher temperatures, say, 500^oK and $1,000^oK$, respectively. Note that the bodies must remain in the solid or liquid states, and not turn into gases.

$$g = 3.973254\times10^{-2}\ \frac{\mathrm{m}^3}{\mathrm{s}^2\mathrm{K}^4}\frac{(10{,}000\mathrm{K})^4-(500\mathrm{K})^4}{(6.357\times10^6\mathrm{m})^2} = 9.831939\mathrm{m/s}^2$$

$$g = 3.973254\times10^{-2}\ \frac{\mathrm{m}^3}{\mathrm{s}^2\mathrm{K}^4}\frac{(10{,}000\mathrm{K})^4-(1{,}000\mathrm{K})^4}{(6.357\times10^6\mathrm{m})^2} = 9.831017\mathrm{m/s}^2$$

The above results are tabulated below to give a clear picture of why do bodies fall with constant acceleration. The reader should, for now, disregard the evaporation and ionization at higher temperatures. These effects are discussed under Advanced Topics.

Temperature of falling body ^oC	^oK	Acceleration m/s^2
-273	0	9.832 000
20	293	9.831 993
227	500	9.831 939
727	1,000	9.831 017

The Table shows that the acceleration is hardly affected by small changes in the falling body's temperature, and slightly affected by changes of hundreds of degrees. This explains why all bodies at normal temperature fall with the same acceleration!

Free fall is a natural process in which the Earth's gravitational field summons bodies by virtue of their temperatures, and not their mass. It is this interaction of temperatures that brings about the strange free fall effect.

The reader will note that I have not, to this point, mentioned *forces* or their relation to mass, and this is not by accident. The gravitational interaction, or communication, is between the temperatures of the interacting bodies; whether stars, planets, moons, satellites, apples, molecules, atoms, or other bodies or particles.

To see how the mass enters into gravitational interactions, consider this. Imagine a small ice cube and a large ice block thrown into a molten pool whose temperature is $10,000^oK$. The two ice masses will melt nearly instantaneously. But here, there is no common sense problem or need for *supervisory intelligence*. We can easily perceive that the large ice block absorbed more of "*something*," i.e., heat, than did the small ice cube. In gravity, large bodies absorb more of the same *something*, or heat, than do smaller bodies.

Topic #4: The Expanded "Free Fall" Equations

Galileo's equations for *free fall* are the hallmark of every physics textbook, or,

$$g = \text{Constant} \ = g \qquad (15)$$

$$v = gt \qquad (16)$$

$$s = \frac{1}{2} g t^2 \qquad (17)$$

where, s is the distance of fall, v is the velocity, t is the time, and g is the local acceleration. The acceleration "Constant" is itself a constant, or g. This is to say that Eq. (15), or $g=g$, is an identity. Without independent parameters to describe g, circular arguments were inevitable in physics and in engineering. With my expression for g, or Eq. (2), the excellent Galilean Equations can be expanded as follows:

$$g = \mathrm{A}\frac{T^4}{R^2} \qquad (18)$$

$$v = \mathrm{A}\frac{T^4 t}{R^2} \qquad (19)$$

$$\mathrm{s} = \mathrm{A}\frac{T^4 t^2}{2R^2} \qquad (20)$$

The philosophers of science will appreciate the dependable observations by Galileo, who reported on the propensity of *light* bodies to commence free fall motion more swiftly than *heavy* bodies. The observation was dismissed early in the twentieth century to be the result of the involuntary reaction of the human muscles to commands from the nervous system: The hand with the light body lets go before the hand holding the heavy body.

The formulations of Galileo and Newton do not contain terms that can explain Galileo's observation. The acceleration is constant; or the rate of change of velocity with respect to time, or dv/dt, is constant. My equations give physical and mathematical explanations to Galileo's observation, if it were true.

A body at street level can be thought of to be *insensibly* at 10,000^{o}K; that is, if the Earth crust layer were removed, the body would be in thermal equilibrium at the 10,000^{o}K temperature. On top of a very tall building, the same body would be, *insensibly*, at a lower temperature, say, 9,990^{o}K, depending on the height above street level. When the object is dropped from the top of the building to the street, it will undergo an *insensible* temperature change, from 9,990^{o}K to 10,000^{o}K. This says that when an object gets closer to a heat source, the object gets hotter. The rate of change of temperature (as experienced by the falling body) is not constant, or $dT/dt \neq 0$. A small body reaches its full potential to fall sooner than a large body. It is indeed incredible if Galileo made the observation.

Topic #5: The Solar System

I started with a screened-temperature for the Earth of 10,000°K, which is a round figure, but which is also a reasonable estimate. The gravitating temperature of the Moon was calculated to about 3,330°K. I have tried screened-temperatures for the Earth in the range of 2,000°K to 25,000°K. Of course, some numbers, including the constant A, change, but the theory remains completely consistent throughout.

What are the internally screened gravitating-temperatures for the other planets? Can the theory predict the gravitational fields on the planets? Is the theory supported by planetary behavior? The formula needed to calculate the gravitational temperature of a central body was derived in Crucial Test #3, or,

$$T = \sqrt[4]{\frac{gR^2}{A}} \qquad (10)$$

Using 1980's data for the surface acceleration and the radius of each planet, I obtain the following results:

The Gravitation Screened-Temperatures of the Planets

Planet	Acceleration m/s^2	Radius 10^6m	Screened-*T* °K
Mercury	3.578	2.433	4,800
Venus	8.874	6.051	9,500
Earth	9.807	6.371	10,000
Mars	3.740	3.380	5,700
Jupiter	12.010	69.758	42,300
Saturn	11.170	58.219	31,200
Uranus	10.490	23.470	19,500
Neptune	13.250	22.716	20,400
Pluto	2.210	1.750	3,600

The tabulated screened-temperatures are preliminary values, which represent the internal temperatures with which each planet attracts other bodies, including its own moons and rings or spacecraft in accordance with my formulations. [Note: The results in the Table do not include the effect of surface temperatures.]

I have obtained excellent results, using the temperature-interaction equations, with the many moons known today; including, derivations of the moons' orbital periods, the gravitating temperatures of the planets from the moons' data, the complex structure and behavior of the giant planets' rings, and other situations. A very interesting Crucial Test is the ability to correctly predict whether the orbit of a given moon is slightly or greatly elliptical on the basis of temperature distributions and axis inclination of the central body.

Topic #6: Gravitation Temperature of the Sun

The gravitation temperature of the Sun presented a difficult problem, which took several years to resolve. Using standard values for the Sun, e.g., surface acceleration of 274.4m/s^2 and radius of 0.695x10^{9}m, the internally screened-temperature responsible for the Sun's gravitation turned out to be only 240,000^{o}K, (see Eq. 10):

$$T_{\text{Sun}} = \left[\frac{(274.4\,\text{m/s}^2)(0.695\times10^9\,\text{m})^2}{3.973254\times10^{-2}\,\text{m}^3/\text{s}^2\text{K}^4} \right]^{1/4} = 240{,}327^{\text{o}}\,\text{K}$$

What does this temperature mean? Does it correlate to known temperatures on the Sun? Is there a screening-layer in the Sun? Where? The surface temperatures on the Sun range between 4,000^{o}K to 6,000^{o}K, and the thermonuclear temperatures are supposed to be in the range of 10^o million to 20^o million. I had written about the possible existence of solid layers beneath the visible atmosphere of the Sun more than ten years ago. But now, independent numerical verification of the gravitating-temperature was required.

I made many calculations and checked many equations over many years. An independent test of the Sun's gravitating temperature came from the inverse-square law itself. The intensities, I_1 and I_2, at two spherical fronts located at distances R_1 and R_2 from a radiating point source are related as follows:

$$\frac{I_1}{I_2} = \frac{R_2^{\;2}}{R_1^{\;2}} \qquad (21)$$

According to Stefan-Boltzmann law, the intensity of radiation varies as the fourth power of the temperature. Since the radius of the Sun and the distances to the planets are known; then for a given intensity at the Sun, an equivalent intensity at a planet's distance can be found *independently from my previous formulations*; or,

$$\frac{T_S^{\;4}}{T_E^{\;4}} = \frac{R_{SE}^{\;2}}{R_S^{\;2}} \qquad (22)$$

Where T_S is the temperature at the Sun's radius, T_E is the temperature at the Earth's distance, R_S is the radius of the Sun, and R_{SE} is the distance from the Sun to the Earth. The Sun's radius is 695,000km, and its distance from the Earth is 149 million-km.

From many computer runs, where I varied the surface temperatures and the cavity temperatures of different sources and radiation fronts, a clear picture and unexpected results began to emerge. The cases examined are too many to include in this Report. A sample for the case of radiation from the Sun is given in the next Table. Here, I use 4,000^{o}K because it is the minimum temperature *measured* for the surface of the Sun, 240,300^{o}K temperature because it is the calculated screened temperature responsible for the Sun's gravitation (see above), and 15^o million because this is the current accepted temperature for the core of the Sun:

***T*(at Sun) ^{o}K**	***T*(at Earth)^{o}K**
4,000	273
240,300	16,400
15,000,000	1,200,000

The temperatures at the Earth are obtained from Eq. (22), as follows,

$$T_E = \sqrt[4]{T_S{}^4 \frac{R_S{}^2}{R_{SE}{}^2}} \qquad (23)$$

The tabulated, and other, results were rather unexpected, but favorable. In some cases, the correlation is obvious:

1. For the minimum temperature known by measurement for the Sun's surface, about $4{,}000^o$K, the corresponding temperature at the distance of the Earth is 273^oK, or 0^oC, or 32^oF, which is about the minimum surface temperature on Earth.

2. For the calculated gravitating-temperature for the Sun, or $240{,}300^o$K, the gravitating-temperature at the Earth's distance is $16{,}400^o$K; which is in the range of the Earth's gravitation screened-temperature. Remember that I selected $10{,}000^o$K for the Earth's gravitating temperature because the number is a round figure.

3. The 15 million degrees thermonuclear temperature in the Sun is reflected in a temperature of about 1-million degrees at the Earth's distance. This is in the range measured for the atom's interior, as in atomic fission; potentially, the temperature screened at a primeval time within the atoms.

A hidden construction similar to the Chinese boxes or Russian dolls emerged. The gravitating-temperature for the Sun seems reasonable. It is worth noting that the radiation laws give slightly higher gravitating-temperatures for the Earth and the planets than when the gravitating-temperature is obtained directly from the planets' actual gravitation data with my equations.

The gravitating-temperature for the Earth, which is based on the above radiation formulas, or $16{,}400^o$K, is greater than my selected value of $10{,}000^o$K. The same is true of the temperatures for the other planets. It is as if the Earth and the planets have cooled down over time which, of course, should be expected. In the case of the Earth, a cooling down of $6{,}400^o$K. For comparison, had I selected $5{,}000^o$K as the gravitating-temperature for the Earth, the Sun's gravitating-temperature would then be $120{,}200^o$K and the Earth's gravitating-temperature would be $8{,}200^o$K; a cooling down of $3{,}200^o$K. Cosmologists and stellar evolution experts will find other interesting and potentially useful applications to the temperature-gravitation theory.

Further versatility of my theory can be seen from other observations. For example, Kepler's constant, κ, varies by less than 2% for all the planets, except for the planet Venus. For Venus alone, κ varies by more than 15%! There is nothing in Newton's universal gravitation or general relativity to explain the significance of this singular deviation. However, the large deviation is beautifully explained with my theory. The unusually dense atmosphere on Venus produces a nearly constant *surface* temperature on the planet. My equations predict very small eccentricity, and Venus has the smallest eccentricity of the planets. Other observational facts are directly recognized and directly correlated with, and predicted by, the temperature-gravitation theory.

Topic #7: One Acceleration – Many Forces

I now turn attention to the subject of forces. In free fall, or in the central-body-problem, the magnitude of the force can change not only because of change in mass, but also as a result of change of temperatures. This may not be crucial to cars, trains, airplanes and many machines. However, the effect is vital in electronics, particle physics, materials science, aerospace systems, and the study of stellar structure and stellar evolution.

Bodies of different mass exhibit different weights (or forces) because of the mass differences. The same bodies exhibit different weights (or forces) if taken from the equator to the pole, not because of differences in *mass*, but because of the *same* difference in acceleration experienced by all the bodies. The distinction is important. If a change in temperature changes the intensity of attraction or repulsion, then the same particle may appear to be different particles. The intensity of a field, *I(F)*, must take precedence over mass, weight or force. This is important in particle physics.

In the central-body-problem, I use Newton's second law of motion only after the acceleration, a, is determined from my Eq. (2), or,

$$F = ma \qquad (24)$$

$$a = \mathrm{A}\frac{T^4}{R^2} \qquad (2)$$

$$F = m\mathrm{A}\frac{T^4}{R^2} \qquad (25)$$

For greater accuracy, the temperatures of all interacting bodies should be considered; see other Sections for equations.

"Central *force* motion" as used in physics and dynamics is a misnomer, for there are as many forces as there are bodies in a field; but only one acceleration for all bodies of *equivalent* temperature in the field. Advanced dynamics equations, such as Lagrange's, Hamilton's and Hamilton-Jaccobi must be augmented accordingly. Notice, for example, that the force exerted by the Earth on the Moon does not involve the mass of the Earth, but it can include the gravitating temperature of both. This is shown in Eq. (27) below:

$$F = \mathrm{A}m_{\mathrm{moon}}\frac{{T_{\mathrm{E}}}^4}{R^2} \qquad (26)$$

$$F = \mathrm{A}m_{\mathrm{moon}}\frac{({T_{\mathrm{E}}}^4 - {T_{\mathrm{M}}}^4)}{R^2} \qquad (27)$$

Crucial Test #7: Escape Energy

The gravitational potential energy, U, of a body located at some distance R from a central body is derived by integrating the force expression from zero height to infinity; e.g., from the surface of the Earth to infinity. I follow the same steps and integrate the force in Eq. (25) to obtain the *maximum gravitational potential energy*, or,

$$U = -\frac{\mathrm{A} m T^4}{R} \qquad (28)$$

The potential energy from Newton's universal gravitation is,

$$U = -\frac{\mathrm{G} M m}{R} \qquad (29)$$

Where, G is the universal constant, M is the mass of the central body, m is the mass of the attracted body, and R is the distance between the two bodies.

How much work is required to move a 1-kg mass from the surface of the Earth to infinity? This is the energy required by a projectile to escape the Earth. Using my Eq. (28) and the classical physics Eq. (29), the answers are, respectively:

$$U = \frac{(3.973254\times10^{-2}\,\mathrm{m}^3/\mathrm{s}^2\mathrm{K}^4)(1\mathrm{kg})(10{,}000\mathrm{K})^4}{6.357\times10^6\,\mathrm{m}} = 62.50\times10^6 \text{ joules/kg}$$

$$U = \frac{(6.67\times10^{-11}\,\mathrm{N\text{-}m}^2/\mathrm{kg}^2)(5.983\times10^{24}\,\mathrm{kg})(1\mathrm{kg})}{6.357\times10^6\,\mathrm{m}} = 62.78\times10^6 \text{ joules/kg}$$

The results are in agreement. The energy required to escape the Earth's gravitational attraction is about 62 million joules per kilogram mass.

Notice that in the classical Eq. (29), *there is one, and only one, value for the escape energy per body!* The reason is that for a given mass m, the energy is constant; because G is constant, M is constant and R is constant! This was at the root of the difficulties encountered by Newtonian mechanics in quantum phenomena about one hundred years ago. The wide range of energies, frequencies and wavelengths observed in the quantum processes just simply could not be explained with an equation that gives only one energy level. And the slight variations in R alone could not explain the many energy levels observed in blackbody radiation, the photoelectric effect, etc.

With my formulations, the potential energy, U, changes with temperature, to the fourth power. This is exactly the relationship that was measured from heat radiation, atomic and molecular scattering and related phenomena. Furthermore, Planck's radiation law and other fourth-power temperature laws can be shown to be related to my formulations or derivable from them. The multitude of energy levels, frequencies and wavelengths in quantum effects are readily derivable from my equations as will be shown later.

Crucial Test #8: Escape Velocity

What is the initial speed, or escape velocity, v_o, required to boost a rocket out of the Earth's gravitational attraction? The reader should by now ask his or her own questions; e.g., what is the initial speed required to reach low earth orbit, geostationary orbit, lunar orbit, or elliptical orbit? Or, what is the speed required by the electron to escape the attraction of the nucleus? What is the kinetic energy required to escape a central body, whose surface temperature is cold, warm, or hot? Such questions will show the ease and capacity of my formulations. Again, standard steps from physics textbooks are used. The kinetic energy, K, of a body in motion is:

$$K = \frac{1}{2} m v^2 = \frac{\mathrm{A} m T^4}{2R} \tag{30}$$

Equating the kinetic energy, K, and potential energy, U, the escape velocity v_{o} is:

$$v_{\mathrm{o}} = \sqrt{\frac{2\mathrm{A}T^4}{R}} \tag{31}$$

The escape velocity from Newton's universal gravitation is:

$$v_{\mathrm{o}} = \sqrt{\frac{2\mathrm{G}M}{R}} \tag{32}$$

Using both methods, Eqs. (31) and (32), the equatorial escape velocity is found to be:

$$v_{\mathrm{o}} = \left[\frac{2(3.973254\times10^{-2}\,\mathrm{m^3/s^2K^4})(10{,}000\,\mathrm{K})^4}{6.378\times10^6\,\mathrm{m}}\right]^{1/2} = 11{,}162\,\mathrm{m/s}$$

$$v_{\mathrm{o}} = \left[\frac{2(6.67\times10^{-11}\,\mathrm{N\text{-}m^2/kg^2})(5.983\times10^{24}\,\mathrm{kg})}{6.378\times10^6\,\mathrm{m}}\right]^{1/2} = 11{,}187\,\mathrm{m/s}$$

The results are in agreement. But again, the reader will note that there is *only one* escape velocity in Newtonian mechanics. The reason is that the mass, M, of the central body is constant. For example, the mass of the Earth does not change. This limitation becomes more evident and, actually more severe, when the atom is considered. By contrast, my equations produce as many escape velocities, for a given body in a central-body-system, as there are temperature steps.

To help to visualize the concept further, think of a central body heated until the surface becomes as hot as the interior. The forces of attraction disappear, as the internal heat is no longer screened, and the primary attraction interaction turns into heat radiation. On cooling, the heat captured inside the insulating surface layer reaches out surreptitiously as gravitation. And this may just be a crude picture of the melting and solidification of normal materials.

Crucial Test #9: Work and Heat

There is a strange demarcation that separates two important concepts in physics, *work* and *heat*. The two energy processes appear similar, at least in numerical values and in units, but the two concepts are different. Students of engineering and physics are always cautioned not to confuse the two energy concepts. Heat is defined as an energy process that *involves* temperature changes. Work is defined as an energy process that *does not involve* temperature changes. The reason for the distinction has not been explained before. My theory gives qualitative and quantitative explanations.

The escape energy from the Earth is 62 million J/kg (Crucial Test #7). This is the work required to move 1-kg mass to infinity from the Earth's surface, or vice versa. To see how *work* relates to *heat*, consider the basic thermodynamic relationship,

$$Q = mC\Delta T \qquad (33)$$

where Q is a quantity of heat, m is mass, C is specific heat of the substance, and ΔT is the temperature which a body looses or gains depending on Q. For simplicity, let us consider water, or C=1.0, and note that there are 4,186 joules per kilocalorie, and one kcal is the quantity of heat that raises the temperature of 1-kg of water 1^{o}C. We then ask, what is the temperature change that 1-kg mass will undergo if it looses, or gains, 62.84 million joules? The answer is:

$$\Delta T = \frac{62.84\times 10^{6}\,\mathrm{J}}{4{,}186\,\mathrm{J/kcal}} = 15{,}012^{o}\,\mathrm{K}$$

The answer is in the range of the temperature responsible for the Earth's gravitation field. It is not a coincidence that it takes roughly the same temperature to accelerate a body to escape velocity as it takes to heat it to the same temperature. It takes 62 million joules to carry 1-kg mass from the surface of the Earth to infinity, and it takes the same energy to raise the temperature of the same mass by an amount that is equivalent to the temperature responsible for the Earth's gravitation! This observation can be paraphrased as follows:

1. It takes a certain amount of energy to move a 1-kg mass to infinity against the Earth's gravitational field, and

2. The same mass undergoes *insensible* temperature change equal to the gravitating temperature when moved the same distance.

Imagine the crust of the Earth is suddenly removed. Heat will then radiate unimpeded into space. A body placed at the surface of the exposed Earth absorbs heat until its temperature reaches about 10,000^{o}. The body is now a heat radiator at that same temperature. *This explains why gravity is transparent*. If the surface of the Earth radiates at 10,000^{o}K, then a body placed at the distance of the Moon will reach thermal equilibrium at about 1,300^{o}K. The heated body at the distance of the Moon now becomes a heat radiator at 1,300 degrees.

If another body were placed at infinity, it would not absorb any of the heat radiated from the Earth's exposed surface. There is no gravitational attraction, and the body would not fall towards the Earth if nudged slightly.

Adding a crust layer to Earth turns the planet into an insulated-temperature-conductor; i.e., the heat radiation turns into *gravitational radiation*. A body placed on the Earth's surface experiences a gravitational acceleration of 9.832 m/s^2, which is equivalent to saying that the body is *insensibly* at $10{,}000^o$. This is the temperature that the body would reach had the crust layer did not exist. If nudged slightly, the body at infinity would begin to fall towards the Earth, which is now a gravitation-temperature-conductor.

For every meter a body is moved above the Earth, whether the crust exists or not, the body experiences a temperature change – A real change if the crust is not in place, or an equal *insensible* temperature change if the crust is in place.

The reader may want to work out the *insensible* temperatures for different heights above the surface of the Earth, or other central bodies. As you do more numerical examples, the remarkable connection between *heat* and *work* becomes more apparent. For example, what are the insensible temperatures of bodies at street level, on top of the Empire State Building, in a cruising jet, or in an orbiting Space Shuttle?

Topic #8: Gravitational Attraction – Gravitational Repulsion

Contradictory results from Newton's gravitation have prompted many theories and tests, e.g., confirmation of the gravitation constant, G, re-testing the inverse-square law, rechecking the Eötvös inertial and gravitational mass experiment, searching for a *fifth force* or nuclear interaction, and looking for quantum or relativity theories of gravity. These efforts are supported by formidable equations; but the value of G does not check out, the forces do not agree with theory, and anomalies persist.

Many papers and letters in reputable physics journals have discussed the so-called gravitational "*repulsive force*." The *more repulsive*, or *less attractive*, force has presented serious problems, according to contemporary researchers. Kepler noted the effect as the *anima motrix*, or motive soul, or the *anima vis*, or motive force. Kepler's view was based on the behavior of Mars, which seemed to be pulled in, and then pushed away, in its orbit by the Sun. The modern views are based on sensitive measurements made in deep mines, boreholes, and on top of towers.

My theory accounts for the reported measurements and explains true gravitational repulsion. Some readers might have already noted this from previous Sections. From my Crucial Test #1, the smaller attraction in the equator represents a "*less attractive*" or a "*more repulsive*" force! The more repulsive acceleration in the equator is orders of magnitude greater than those reported in recent research. The problem with gravitation studies is that they use *mass* as the cause of gravity.

Typical anomalies reported by researchers from national research laboratories and universities include "$(-500\pm35)\text{x}10^{-8}\text{m/s}^2$ and $(8.3\pm1.3)\text{x}10^{-8}\text{m/s}^2$." These values are explainable with my equations. For example, the effect of a falling body's temperature T_B on acceleration was given in Eq. (14):

$$g = \text{A}\frac{(T_\text{E})^4 \pm (T_\text{B})^4}{R_\text{E-B}^{\ 2}} \qquad (14)$$

The temperature gradient with depth underground is about 3^oC/100m, and the gradient in the air is about 6^oC/1km. Let us use as a reference the gravitational acceleration, g_o, for bodies at an average temperature of 20^oC, or 293^oK. Then we calculate g_o for ΔTs of 3^oC from the average reference:

$$g_{293} = (3.973254\times10^{-2}\,\frac{\text{m}^3}{\text{s}^2\text{K}^4})\left[\frac{(10{,}000\text{K})^4 - (293\text{K})^4}{6.357\times10^6\,\text{m})^2}\right] = 9.8319927\text{m/s}^2$$

$$g_{296} = (3.973254\times10^{-2}\,\frac{\text{m}^3}{\text{s}^2\text{K}^4})\left[\frac{(10{,}000\text{K})^4 - (296\text{K})^4}{(6.357\times10^6\,\text{m})^2}\right] = 9.8319924\text{m/s}^2$$

$$g_{299} = (3.973254\times10^{-2}\,\frac{\text{m}^3}{\text{s}^2\text{K}^4})\left[\frac{(10{,}000\text{K})^4 - (299\text{K})^4}{(6.357\times10^6\,\text{m})^2}\right] = 9.8319921\text{m/s}^2$$

The acceleration difference Δg for typical ΔTs are tabulated below. The order of magnitude of my calculated Δg's is essentially the same as that reported in the recent research. It is important to note that in deep mines or on high towers, heat pockets can be below, on the side of, or above the measuring instruments.

D***T*** ^{o}C	D***g*** m/s^2
3	30×10^{-8}
6	60×10^{-8}
9	90×10^{-8}
12	120×10^{-8}
15	160×10^{-8}

The small acceleration differences are simply deviations from a reference g-value on the Earth's surface. The reported measurements are not true *gravitational repulsion*. True repulsion occurs when a body falls upward! For example, a helium-filled balloon. A more compelling example is the rising Cloud of an atomic explosion, where "*the upward motion accelerates and at 10 seconds reaches a maximum speed of 300 ft/sec at a height of 1500 feet;*" (American Institute of Physics, 1955). This is plain ***upward*** free fall motion. Here, g=-30ft/sec^2 as Galileo's Eqs. (16) or (17) would show.

Further versatility of my theory can be seen by inquiring into true gravitational repulsion. What happens if $\mathbf{T_E}$ and $\mathbf{T_B}$ in Eq. (14) are equal? Acceleration will be zero, and the body will neither rise nor fall. Compare this to the highly regarded oil-drop experiments of Milikan, Galileo's suspended wax-ball-in-water experiment or to water molecules suspended in mid-air.

Next, **what happens if $\mathbf{T_B}$ in Eq. 12 is greater than $\mathbf{T_E}$?** The body will fall upward! **This is gravitational repulsion.** The following tabulation gives a simple picture of gravitational repulsion for the Earth. Of course, at very high temperatures, substances are highly ionized.

Body Temperature (T_B) ^{o}K	***g*** **m/s^2**	Comments
0 to 1,000	9.832	**Maximum attractive gravitation**
8,000	5.805	**Attractive gravitation**
9,000	3.381	**Attractive gravitation**
10,000	0.000	**Zero gravitation**
11,000	-4.563	**Repulsive gravitation**
12,000	-10.555	**Repulsive gravitation**

These results help to visualize gravitational repulsion. The actual values will be different, and this requires expanded formulas that include the temperature of the *medium*, T_m, in addition to those of the interacting bodies. Related topics must also be included, such as the thermal properties of materials. It is rather incredible that Archimedes and Aristotle considered such advanced problems a long time ago.

Topic #9: The Theory of General Relativity

Galileo's free fall combined with Newton's gravitation required that each body be assigned two kinds of mass, inertial and gravitational. Newton checked the oddity with different materials. He wrote, "*I tried the thing in gold, silver, lead, glass, sand, common salt, wood, water, and wheat*." The tests did not help explain free fall or the cause of gravity. I showed in Crucial Test #6 on *Free Fall* that there is only one kind of mass, which is that defined by Newton in the fist words of the ***Principia***, "*The quantity of matter is the measure of the same, arising from its density and bulk conjunctly*." I also showed that the Earth summons bodies by the power of its gravitating-temperature and by virtue of the bodies' own temperatures, and not by the measure of their mass. The equivalence of the inertial and gravitational mass formed the basis of Dr. Albert Einstein's theory of gravitation, or general relativity.

General relativity is rather involved mathematically. The commendable analyses, however, do not give the cause of gravity or explain free fall. Like Newton's gravitation, general relativity also ascribes gravity to *mass*. The greater the mass, the greater the space-time curvature. In this basic sense, general relativity can be classified as a Newtonian theory of gravitation.

The analogy between universal gravitation and general relativity can be seen as follows. Rather than begin with Newton's equation of force, which includes the product of the masses, general relativity begins with an equation of potentials, where the central mass M is replaced by the density. The equation of potentials, or Poisson's equation, is directly related to Newton's law. It was therefore inevitable that the general relativity tensor attributes gravitation to the mass, via the density of matter.

To describe gravitation, Newton used the three basic quantities, space, mass and time, e.g., the meter-kilogram-second of the mks system. The three quantities can be thought of as the gravitational currencies. Each currency can be related to the other two provided that the rate of exchange is set. The rate of exchange was set from observations, and the three units are interdependent. Newton selected mass as the cause of gravity and described interactions accordingly. Mathematically, the interactions could be equally described using the other two currencies, i.e., space and time; a task that required particular mathematical aptitude. There is the analogy of purchasing an item with *dollars*, or paying for it with *pounds* and *francs*. General relativity works with ten variables, or *ten foreign currencies*; all of which are eventually related to the *pounds* and *francs*; and ultimately to the *dollar*. In short, a simple purchase in Newton's gravitation becomes a complicated affair in general relativity. This simple analogy shows how, in the end, space-time gravitation in general relativity is directly related to mass.

Intense gravitation requires immense quantity of mass in both Newton's and Einstein's theories of gravitation. Since the gravitational attraction in the universe far exceeds what the visible matter can produce, both theories lead to the same *mass concentrations*, or hidden *mascons*, that were proposed for the Moon and the Earth. Here, the mascons are abstract bodies, e.g., *black holes,* which are impossible to see; see Crucial Test #3 and the next Crucial Test.

Crucial Test #10: The Black Holes Mascons

Matter in the universe is utterly inadequate to explain the observed enormous gravitation. More than 90% of the *mass* of the universe is now considered to be "missing." In physics, this does not mean that the missing mass does exist, instead, the missing mass is supposed to be invisible. It is there, but we do not see it. The lopsidedness is simply the result of universal gravitation and general relativity, which require large quantity of *mass* to produce enormous gravitation. Similar reasoning led to theories of invisible mass concentrations (*mascons*) on the Moon and even in the Earth (see Crucial Test #3), even though measurements contradict the existence of these mascons. Simple experiments show that the massive Himalayan mountains' mascon does not produce the predicted gravitation. In such cases, the mascon is classified as an oddity.

The disproportionate mass and gravitation in the universe is also explained with invisible mascons; called *black holes*. In this case, unthinkable density is required, where millions of stars must be squeezed into the volume of a single star. Yet, the most recent observations with the Hubble Space Telescope (December 1993) indicate that neither black holes nor even candidate regions for black holes have been found where expected. Instead, *very small bright bodies*, according to the project chief scientist, are found in the regions where black holes were expected.

My theory gives a superb solution to the strong gravitation and inadequate mass. In this case, the Crucial Test is simple. Stars with interior temperatures of 10 million, 100 million degrees or hotter are common occurrence. If a star screened moderate stellar temperature, during formation and cooling, as opaque-gravitating temperature, then substantial gravitation would result. Such a star can be the same size, and can have the same mass, as the Sun. Its condition would also be the same as the Sun, namely, an insulated-temperature-conductor. What are the possible gravitational intensities of such stars? Using my basic Eq. (2) and the Sun as a reference, sample accelerations, a, are tabulated below:

$$a = \mathrm{A}\frac{T^4}{R^2} \qquad (2)$$

Screened-Temperature	Acceleration (Sun=1)
1^o million	295
5^o million	185,000
10^o million	3 million
100^o million	30 billion

There is no need to squeeze millions of stars into the volume of one. There is no need for black holes or even unseen dark matter. A star with a moderate opaque gravitating-temperature of 10^o million can produce 3 million times the attraction of the Sun from the same volume. Such stars are known to exist, and there is no need for *black holes* to explain the great gravitational attraction observed in the vicinity of such moderate sized stars. The gravitational pull of one star with 100^o million gravitating-temperature will *appear* to us as if 30 billion Suns were packed into the volume of one star.

The universe we see with our eyes and detect with instruments may actually be the universe that we have been searching for. There are other space-based observations that support, and are supported, by my theory. The Orfeus-SPAS experiments launched on the Space shuttle this year, 1993, have shown related puzzling gravitational phenomenon. The surface of two of the predicted "*hottest*" stars turned out to be cool! The mass-based gravitational theories keep on contradicting predictions and observations. As we showed with Crucial Tests, cooler surfaces like in the polar regions on Earth produce greater gravitational pull, and not the other way around. The gravitating-heat screened internally in the stars after the Big Bang should be the measure of gravitational strength, and when the surfaces are cooler, the gravitational field is stronger. In essence, stars should be viewed as insulated-temperature-conductors, just like the insulated-electric-conductors, obeying Gauss's law as described next.

Topic #10: Maxwell-like Equations for Gravitation

The highly regarded Maxwell's equations of electromagnetism are the model for unification of the *force fields*. The equations are at the root of the wonderful progress in electronics in the Twentieth Century. Einstein spent considerable time and effort to produce Maxwell-like equations for gravitation, but to no avail. The difficulties include the inherent dissimilarity of the mass, m, and the electric charge, q. This difficulty can be overcome with my theory. What must be unified, though, are the *intensities* of the fields; and *not the forces*. The electric, magnetic and nuclear fields are discussed in greater detail in separate reports.

Gravity pulls on each of us with one acceleration. But, because each person has a different mass, there can be as many *forces* as there are people in a group in the field. I have shown in detail how gravitation is a function of the fourth power of temperature, and not a function of mass. A brief derivation of the first Maxwell-like equation for gravitation is given here. Maxwell's equation; from which Coulomb's inverse-square law and Gauss's law for insulated conductors can be derived, can be written as:

$$\oint E.dS = q \qquad (34)$$

where, $\boldsymbol{E}$ is the electric field, q is a net electric charge enclosed by a surface, and dS is an infinitesimal element of area on the charged surface. In my formulations, I say that the intensity of a field $I(F)$, instead of the electric field E, is caused by the fourth-power of temperature, T^4, instead of by a charge, q. Using standard steps, I note that for a spherical Gaussian surface of radius R surrounding the screened-temperature, T, which is now the cause of the interaction, Eq. (34) can be rewritten as:

$$\oint I(F).dS = \mathrm{A}T^4 \qquad (35)$$

For a sphere, the closed integral of dS is simply the surface area, or,

$$\oint dS = 4pR^2 \qquad (36)$$

Then for a gravitationally radiating sphere, whose intensity $I(F)$ is constant in all directions, I obtain my first expression, or Equation (1), which I have used extensively throughout this Report, or:

$$I(F) = \mathrm{A}\frac{T^4}{R^2} \qquad (1)$$

An equation for all fields. An equation from which Maxwell's equation can be derived. The quantity 4π is for now included in the constant **A**. Other mechanics formulations follow from this simple equation as can be seen throughout this Report.

There are many experiments that confirm my formula, in addition to the Crucial Tests given in this Report. For example, there is the distinct behavior of flames that was carefully studied on the space Shuttle USML1's (Microgravity Laboratory) experiments in 1992. The flame from a linear strip spread out throughout the experiment enclosure. The reason is that the strip *cannot form a closed surface*, or *an insulated-temperature-conductor*! However, when a candle was lit, the flame formed a perfect sphere; i.e., the flame formed a gravitation-temperature-conductor. The situation was different and unexpected with two candles. As hard as one astronaut tried with the help of scientists in the control center on the ground, she could not light two candles placed side-by-side. The same experiment was done on the ground successfully before the mission. The same experiment is carried out daily in many homes and restaurants, when two candles are placed and lit side-by-side on a dinner table. In the Space Shuttle experiment, the wicks, their position, and the igniter were reexamined by the astronaut many times, and several candles were melted down, but the two adjacent candles would simply *not* light up together in zero gravity. Why? No one on the space mission suspected that lighting two candles side-by-side in space, or in zero gravity, was impossible. But, many attempts were made to light up the two adjacent candles, with no success.

My gravitation theory gives the answer. Trying to light adjacent candles in zero gravity is like trying to put two planets, say the Earth and Mars, side-by-side thousands of miles or kilometers apart. Here, the planets will fall towards each other. Another example would be to try to place a massive boulder several thousand miles from the surface of the Earth and hope that the boulder would stand in place. Without support, the boulder will fall to the Earth. On the other hand, the boulder can be moved at orbital speed around the Earth so that the centrifugal force would keep it separated from the Earth. In essence, what I am saying is that when a candle was lit up on the Shuttle, the candle formed a near-perfect sphere, which by virtue of the flame's temperature distribution created its own gravitational field. Every time the Astronaut tried to light up the second candle, the first candle's fire-sphere interfered with the formation of the second candle's fire-sphere. It was like trying to put two like-charges side-by-side. *Like charges repel*! On the ground, the Earth's gravitation field overwhelms those of the candles, and two side-by-side candles light up very easily. A good test of my theory would be to have a central candle and a second candle rotating around the first, and then to try to light the two candles. Researchers will discover other phenomena in the excellent USML videotapes that further confirm my gravitation theory. Such studies can help to plan future experiments and to identify dangerous conditions.

Crucial Test #11: Quantum theory, What is Quantized?

Quantum theory is the pinnacle of achievement of modern physics, though it contradicts basic intuition and it violates common sense. The theory's abandonment of causality was resisted by its founders, Max Planck and Albert Einstein; and its massless photon was disliked by Planck, Hertz, and Bohr. The theory produced correct mathematical answers to problems that completely disobeyed Newton's mechanics. The problems included the blackbody radiation and the photoelectric effect. I will try to give a concise description of the problem that was encountered by Newtonian mechanics. In parallel, I will show how temperature-gravitation could have made a smooth transition from classical to modern physics. Numerical examples are given.

Consider the blackbody radiation problem. Hot bodies emit *different* energy levels at different frequencies. Why did Newton's mechanics fail to account for such basic fact? To see the impasse, consider the following Table:

Newton's Formulations	**My Formulations**
$F = \frac{GMm}{R^2}$	$F = \frac{AmT^4}{R^2}$
$U = -\frac{GMm}{R}$	$U = -\frac{AmT^4}{R}$
$E = \frac{U}{m} = -\frac{GM}{R}$	$E = \frac{U}{M} = -\frac{AT^4}{R}$
$f = \frac{1}{2p}\sqrt{\frac{GM}{R^3}}$	$f = \frac{1}{2p}\sqrt{\frac{AT^4}{R^3}}$
$E = 2pf\sqrt{GMR}$ (37)	$E = 2pf\sqrt{AT^4R}$ (38)

Here, F is the central force, G is Newton's universal constant, M is the central body mass, U is the potential energy, E is energy per unit mass, f is frequency of oscillation, A is the temperature-gravitation constant and T is the screened-temperature responsible for the force field.

For any central body, G is a constant and M is a constant. For any particle at a distance, R, in a given field, the classical equations give ***one acceleration, one velocity, one frequency, one period, one wavelength, one force*** **and** ***one energy***.

The primary obstacle in Newtonian mechanics was, and still is, the inert and inactive qualities of mass. The mass, *M, cannot be quantized and active* at the same time. We cannot divide the Earth into small pieces and attribute the energy levels and frequencies to the pieces, separately or in combination. My equations, on the other hand, give the wide range of energy levels and frequencies as function of the active and dynamic parameter, the temperature T; which, apparently, can be quantized.

I will now develop, and compare, the classical formulations and my formulations further. The classical formulations are on the left side, and my formulations are on the right. The energy per unit mass, *E*, is given in the last line of the previous Table, or,

$$E = 2pf\sqrt{\mathrm{G}MR} \qquad (37) \qquad\qquad E = 2pf\sqrt{\mathrm{A}T^4R} \qquad (38)$$

It was noted in quantum effects that the ratio *E*/*f* is constant. From the above equations:

$$\frac{E}{f} = 2p\sqrt{\mathrm{G}MR} \qquad (39) \qquad\qquad \frac{E}{f} = 2p\sqrt{\mathrm{A}T^4R} \qquad (40)$$

The ratio *E*/*f* is Planck's constant *h* whose value, $6.625\text{x}10^{-34}$ joule-second, has been repeatedly verified. Planck's quantum hypothesis was that atoms of a hot body emit energy in small quanta, *E*, which Einstein put in the mathematical form:

$$E = hn \qquad (41)$$

where, ν is the frequency *f*. From the classical Eq. (39), we see that the only quantity that can be quantized is the mass, which I call ΔM. In my formulation, or Eq. (40), the quantized parameter is the temperature, or ΔT. Then,

$$h = 2p\sqrt{\mathrm{G}\Delta MR} \qquad (42) \qquad\qquad h = 2p\sqrt{\mathrm{A}\Delta T^4R} \qquad (43)$$

Note that the mass quantum ΔM has no active physical meaning, and that was why quantum mechanics abandoned Newton's formulations. Anyway, the quantities ΔM and ΔT, can be derived from Eqs. (42) and (43) as follows:

$$\Delta M = \frac{h^2}{4p^2\mathrm{G}R} \qquad (44) \qquad\qquad \Delta T = \sqrt[4]{\frac{h^2}{4p^2\mathrm{A}R}} \qquad (45)$$

I now derive the quantitative values for ΔM and ΔT using a typical light wavelength dimension of, say, $6.5\text{x}10^{-7}$m;

$$\Delta M = \frac{(6.6256\times10^{-34}\,\mathrm{J\text{-}s})^2}{4p^2(6.67\times10^{-11}\,\mathrm{N/m^2kg^2})(6.5\times10^{-7}\,\mathrm{m})} = 2.565\times10^{-52}\,kg$$

$$\Delta T = \sqrt[4]{\frac{(6.6256\times10^{-34}\,\mathrm{J\text{-}s})^2}{4p^2(3.973254\times10^{-2}\,\mathrm{m^3/s^2K^4})(6.5\times10^{-7}\,\mathrm{m})}} = 8.100\times10^{-16}\,{}^{\mathrm{o}}\mathrm{K}$$

One cannot begin to think what a quantum of mass ΔM means; where ΔM is $2.565\text{x}10^{-52}$ kg. A central body, whether a nucleus or the Earth, cannot be divided into great many small pieces, where each piece produces its associated energy, frequency, wavelength, acceleration, velocity, etc. But, how about the temperature quantum, ΔT, or $8.1\text{x}10^{-16}$ $^{\mathrm{o}}$K? I will show how temperature quantization gives rational qualitative and quantitative answers. Notice that I am still using the same value for the constant **A** that I derived from the Earth's data in Topic #3, and which was used with examples of apples, moons and satellites in the Earth's gravitational field.

First, let us quickly review how the temperature effect was introduced into quantum formulations. The energy-temperature link was developed in the radiation laws of Rayleigh-Jeans, Wien, and Stefan-Boltzmann law of radiation, or,

$$E = \sigma \cdot T^4 \qquad (46)$$

where, E is radiant energy, σ is the Stefan-Boltzmann constant, and T is the temperature of cavity radiancy. The same law also relates the radiant energy to wavelength as follows:

$$\int_0^\infty E_{\lambda T} d\lambda = \sigma \cdot T^4 \qquad (47)$$

In quantum mechanics, E is related to the fourth-power of temperature T^4 and to the frequency f in *separate steps*; and the overall quantum analyses require the inverse-square distance laws, both Coulomb's and Newton's.

The separate steps are bypassed in my theory, where I integrated the Stefan-Boltzmann radiation law directly into my basic formula, Eq. (1), (see Topic #2). This allowed us to relate the intensity of radiation *directly* to *acceleration, energy, frequency, wavelength, period, velocity, distance, force, work, heat, charge,* and other quantities, as function of temperature to the fourth-power and of the inverse square distance. Continuing the last Tabulation, it is seen that my basic equations give direct answers and solutions to quantum problems, whereas the classical formulations *do not*:

Classical Formulations			**The Unified Interaction**	
$E = 2\pi f\sqrt{GMR}$	abandoned	(37)	$E = 2\pi f\sqrt{A\Delta T^4 R}$	(38)
$E = hf$		(41)	already integrated	
$E = \sigma T^4$		(46)	already integrated	
$\int_0^\infty E_{\lambda T} d\lambda = \sigma T^4$		(47)	already integrated	
$E = \frac{U}{m} = -\frac{GM}{R}$		(29)	already integrated	
$E = \frac{1}{4\pi\varepsilon_o}\frac{q}{R^2}$		(48)	already integrated	
$h = h$		(49)	$h = 2\pi\sqrt{A\Delta T^4 R}$	(43)

I now return to my suggested temperature quantization. **Is something else, more fundamental than energy, quantized? Is temperature quantized?**

A temperature change ΔT can produce an energy change ΔE. What is a typical temperature quantum ΔT that can produce *a minimum energy quantum*, ΔE? I found a preliminary value for ΔT of 8.10×10^{-16} ^{o}K (see page 41); a small temperature step that may produce small quantum effects.

Let us call ΔT *a tempon*; a massless entity with the active, discernible, sensible, and causal qualtities of temperature. Does a *tempon* have a sensible meaning?

To answer the question, consider the following example. Bright sunlight that strikes a 1 cm^2 photocell produces 0.01 watts, or 0.01 joules per second, which is said to be carried by 3.27×10^{16}, some thirty million billion, *photons*, and to produce the same number of *photoelectrons*. From these values, one finds the current of electricity that will flow from the photocell. What is the meaning of thirty million billion *tempons* impinging on the metal surface? My temperature-gravitation theory gives an interesting answer:

$\Delta T_{\text{total}} = (\Delta T/\textit{tempon})\ (\textit{number of tempons})$

$\Delta T_{\text{total}} = (8.10 \times 10^{-16}$ deg/tempon$)(3.27 \times 10^{16}$ tempons$) = 26.49$ ^{o}C,

which is representative of the temperature that strikes a photovoltaic cell on a very hot sunny day! Multiplying the *temperature step* ΔT and the number of photoelectrons, the temperature 26.49 ^{o}C, which is responsible for the electric current, is obtained. Note that the *temperature quantum step* ΔT is obtained using Planck's constant, *h*, and my constant, **A**, in Equation (45).

The next examples use well established textbook data from the photoelectric effect for sodium, two hydrogen spectra, and X-ray tube data. Here, the experimental results give the energy E and the frequency f. The temperature-quantum, or *tempon*, or ΔT, can be calculated from these variables using the energy equation, or the first Equation in the previous Table, as follows:

$$E = 2pf\sqrt{A\Delta T^4 R} \qquad (38)$$

or,

$$\Delta T = \sqrt[4]{\frac{E^2}{4p^2 A f^2 R}} \qquad (50)$$

The results are tabulated below (Page 43). These cases demonstrate how quantization of temperature may indeed be more fundamental than energy quantization and how small steps of temperature can be responsible for the observed phenomena. The blackbody radiation curves; the results of scattering experiments; the complex specific heat of solids, the atomic structure, and related phenomena are directly derivable and greatly simplified with my formulations which combine energy, frequency and temperature in one basic relationship.

Testing the Temperature-Quantum-Step ΔT

Measured frequency F **(Hz)**	**Measured Energy** E **(joules)**	ΔT **(°K)** $R=\lambda$	ΔT **(°K)** $R = 6.5 \times 10^{-7}$**m**
The Photoelectric Effect Test			
6.00×10^{14}	3.97×10^{-19}	8.64×10^{-16}	$\mathbf{8.10\times10^{-16}}$
6.50×10^{14}	4.31×10^{-19}	8.83×10^{-16}	$\mathbf{8.10\times10^{-16}}$
7.00×10^{14}	4.65×10^{-19}	9.00×10^{-16}	$\mathbf{8.11\times10^{-16}}$
7.50×10^{14}	4.97×10^{-19}	9.15×10^{-16}	$\mathbf{8.10\times10^{-16}}$
The Lyman Series for Hydrogen Spectrum			
2.47×10^{15}	1.64×10^{-18}	1.23×10^{-15}	$\mathbf{8.11\times10^{-16}}$
2.91×10^{15}	1.93×10^{-18}	1.28×10^{-15}	$\mathbf{8.11\times10^{-16}}$
3.08×10^{15}	2.04×10^{-18}	1.30×10^{-15}	$\mathbf{8.10\times10^{-16}}$
3.16×10^{15}	2.09×10^{-18}	1.31×10^{-15}	$\mathbf{8.09\times10^{-16}}$
The Balmer Series for Hydrogen Spectrum			
4.59×10^{14}	3.03×10^{-19}	8.07×10^{-16}	$\mathbf{8.09\times10^{-16}}$
6.12×10^{14}	4.05×10^{-19}	8.69×10^{-16}	$\mathbf{8.10\times10^{-16}}$
6.94×10^{14}	4.58×10^{-19}	8.95×10^{-15}	$\mathbf{8.08\times10^{-16}}$
X-Ray Tube Data			
121×10^{19}	8.01×10^{-15}	1.03×10^{-14}	$\mathbf{8.10\times10^{-16}}$

In all of the above and related phenomena, I do not use *force* or *momentum* and I obtain accurate results. And that is the way it should be. The same accurate results are obtained with *force* or *momentum*, but using these quantities which depend on *mass* somehow obscures the physical meaning of the interactions. Galileo and Kepler excluded mass from their laws. The dependence of the interactions on *temperature* is what has not been recognized before.

The *tempon* I propose is not a particle, it is not matter, it does not have mass; it is simply a temperature step with active qualities. Contrast these properties and actions with those of the *photon*, the *pion*, the *muon*, and other particles that exchange forces and energy.

Once the nature of temperature quantization is recognized, quantum effects at the normal size emerge. For example, the distinct interference fringes observed on heated surfaces, like plates and cylinders. Scientists and engineers who have seen these effects or their photographs recognize the dependence of the spacing of the fringes on temperature. Numerically, the spacing, or wavelength, is directly related to the fourth-power of temperature, T^4, which is directly derivable from my equations.

The mechanisms responsible for some other important effects in physics, chemistry and biology remain *unsatisfactorily explained* to this date; and some of these are also clarified mathematically and physically with my theory and formulations. These are too many to even list in this Report.

My gravitation-theory restores the intuitive picture (*anschauliche Bilder*), visualization (*Anschauung*) and visualizability (*Anschaulickeit*), the loss of which was beautifully described by the distinguished Arthur I. Miller in *Imagery in Scientific Thought* (Birkh•user Boston Inc., 1984) on the development of quantum theory.

On a fundamental level, my gravitation-theory disentangles ambiguous instructions that must have troubled observant students and teachers for many years. The amiguities occur in the first steps of science and engineering education. This is illustrated in quotes from a Section entitled, "***Critique of Newton's Laws of Motion***" in *Halliday & Resnick's Physics Textbook* (1965). From Heinrich Hertz' *Introduction to Principles of Mechanics* (1894), "***It is exceedingly difficult to expound to thoughtful hearers the very introduction to mechanics without being occasionally embarrassed … I fancy that Newton himself must have felt this embarrassment***." Then, Leonard Eisenbud writes in the *American Journal of Physics,* March 1958, "***It is not unfair to say that Newton's laws operate by a method similar to that of a stage magician – Newton's laws tend to concentrate our attention on the empty concept of force.***"

Fualtfinding goes back to the seventeenth century, when the Cartesians insisted that inert matter (*mass*) cannot be the cause of its own motion, and the Atomists accepted the notion. The Laws of Motion by Sir Isaac Newton are certainly excellent tools, but not for the central-body problem. Students of science are instructed to search for the *one fundamental force* in nature that, alone, can explain "*the fundamental nature of everything in the universe.*" I propose *one fundamental cause* to underlie all interactions; and that is temperature. There are other challenging questions, which I will address, and hope others will, in the future. These include: Is temperature quantized? Can temperature be applied continuously? What is the exact relationship between temperature and the electric charge or the nuclear exchange particles?

Topic #11: A Realistic Gravitation-Temperature for the Earth

I used the round figure of 10,000°K for the Earth's gravitation-temperature throughout the Report to facilitate the many calculations required to verify the theory and its applications. But, whatever will be the measured internal screened temperature of the Earth, the theory remains intact and it will give accurate answers in classical, electromagnetic and quantum problems. The reader may want to try the temperatures of 1,000°K, 100,000°K or even one million degrees.

The interior temperature in the Earth is estimated to be in the range of 2,000°K to 25,000°K. What is the likely temperature responsible for the Earth's gravity?

I tried to keep my gravitation *insulated-temperature-conductor model* consistent with the well-established and verified model of the *insulated-electric-conductor*. This allowed the derivation of the Maxwell-like equation for gravitation (Topic #10) and the application of the Field-Intensity Equation (1) in many problems, including, quantum mechanics. Gauss's model for the insulated-electric-conductor requires the electric charge to be located immediately beneath the surface layer, and not to be concentrated in the center of a sphere. Based on this and other considerations, *I place the gravitating-temperature for the planets, moons, stars, and atoms just beneath the crust layer, and not in the center of those bodies.*

If the gravitating-temperature is located immediately beneath the crust layer in the Earth, then the higher range of temperatures, say, 25,000 °K or greater, would be unlikely. Such temperatures would melt the crust. It is more likely that the gravitating-temperature for the Earth will be in the low range, around 2,000 °K.

The cooling and solidification of hot lava and volcanic eruptions are the processes most responsible for the formation of the Earth's temperature-screening surface layer, or the thin crust layer. Careful measurements have been made around the world, and one reliable measurement of temperature of hot lava is 1,810°K. This value, or the round figure of 2,000°K, is more reasonable than the 10,000°K.

The constant **A** can be recalculated for the actual gravitating-temperature of the Earth using Eq. (6). Using consistent values of **A** and ***T*** will give the same accurate results for the Apple-Earth example, the Moon-Earth example, the Solar System cases, the Escape Velocity and Escape Energy. Using consistent values of **A** and ***T*** will give accurate results for accelerations, periods, frequencies, velocities, energy levels and other parameters in classical, electromagnetic and quantum physics.

Topic #12: Kepler's Constant κ and my Constants A and α

The numerical value of the constant **A** was dictated by the preliminary gravitating-temperature that I selected for the Earth, i.e., 10,000°K. A round figure of **0.04** can be used for **A** to obtain approximate results. What is important is the concept of how the screened-heat inside the Earth reaches out stealthily to cause gravity radiation.

Dividing the constant **A** by $4\pi^2$ produces another useful constant, which I call α, where,

$$\alpha = \frac{A}{4\pi^2} \qquad (51)$$

The numerical value of α is:

$$\alpha = \frac{3.973254\times10^{-2}\,\mathrm{m^3/s^2K^4}}{4\pi^2} = 1.006440\mathrm{m^3/s^2K^4}$$

Johannes Kepler is recognized for selecting the elliptical orbits for the planets to explain the speeding up and slowing down of bodies in orbit around a central body. Kepler spent considerable effort on oval orbits, with one focus instead of two foci, that has a causative agent, the *anima motrix*, in the Sun. Kepler in essence derived my theory of temperature-gravitation, but he assigned the causative agent to *magnetism*. The magnetic fields did not lead to workable mathematical formulations. Temperature held the answer. Kepler's constant κ is found in his third law of planetary motion, "*the square of the period of a planet about the Sun is proportional to the cube of the planet's distance from the Sun.*" Or, in mathematical notations,

$$\kappa = \frac{\tau^2}{d^3} \qquad (52)$$

The numerical value of Kepler's constant κ_S for the solar system can be found from the Earth's period of rotation around the Sun and distance from the Sun, e.g.,

$$\kappa_S = \frac{(365.25\mathrm{days}\times86{,}400\mathrm{seconds/day})^2}{(149\times10^9\ \mathrm{meters})^3} = 3.011\times10^{-19}\,\mathrm{s^2/m^3}$$

Kepler's constant for the Earth's system, or κ_E, can be found from the period of rotation of a satellite around the Earth and the satellite's distance from the Earth. For example, the period of a geostationary satellite is 23.969 hours, or 86,289.4 seconds and the orbital distance is 42.160×10^6 meters (see Crucial Test #4). Then, κ_E is:

$$\kappa_E = \frac{(86{,}289.4\mathrm{seconds})^2}{(42.160\times10^6\,\mathrm{meters})^3} = 9.936\times10^{-14}\,\mathrm{s^2/m^3}$$

I now offer the following remarkable observation: ***The inverse fourth-root of the product of Kepler's constant*** κ ***and my constant*** α ***is the gravitating-temperature of any central body in any central body system, or,***

$$T = \frac{1}{\sqrt[4]{a\,k}} \qquad (53)$$

Here is a numerical example. The numerical value of my constant α is the same for *all central body systems*, or 1.006440×10^{-3} m^3/s^{2}K^4. Kepler's constant for the Earth's system was calculated above to be 9.936×10^{-14}s^2/m^3. Using Eq. (53), the gravitating-temperature of the Earth is,

$$T = \frac{1}{\sqrt[4]{a\,k}} = \frac{1}{\sqrt[4]{(1.006440\times10^{-3}\,\mathrm{m}^3/\mathrm{s}^2\mathrm{K}^4)(9.936\times10^{-14}\,\mathrm{s}^2/\mathrm{m}^3)}} = 10{,}000.0^{\mathrm{o}}\,\mathrm{K}$$

This is precisely the gravitating-temperature that was selected for the Earth in Topic #3.

Here is another numerical example. Using Eq. (10), the gravitation-temperature of the Sun was found to be 240,000$^{\mathrm{o}}$K (see Topic #6). Using Kepler's constant for the solar system, κ_S, and my constant α (from the previous page), we find:

$$T = \frac{1}{\sqrt[4]{a\,k}} = \frac{1}{\sqrt[4]{(1.006\times10^{-3}\,\mathrm{m}^3/\mathrm{s}^2\mathrm{K}^4)(3.011\times10^{-19}\,\mathrm{s}^2/\mathrm{m}^3)}} = 240{,}000^{\mathrm{o}}\,\mathrm{K}$$

I had tried the above formulations with the moons of Jupiter and the other planets, the planets with the Sun, the Space Shuttle and satellites in earth orbits, the Lunar Orbiters and the Apollo spacecraft around the Moon. The procedure is a powerful tool to chart the gravitation footprint, especially, for bodies that do not have their own satellites.

To estimate the gravitating-temperature *T* of any body, Kepler's constant k **must be derived from the period and the distance of some orbiting body in the desired central-body-system; but my constant** a **will be the same for all central-body-systems.** Kepler's constant varies from one system to another, but my constant remains constant for all systems, whether galaxies, stars, planets, molecules or atoms.

When you try my formulations with problems in classical, electromagnetic and quantum physics, you will discover amazing results. The relationship, between Kepler's constant κ and my constant α, described above is such a result. I will include another example in this Report, which relates to the speed of light in free space.

James Clerk Maxwell calculated the speed of light from two seemingly unrelated constants that appear in the equations of the electric and magnetic fields. The calculation altered history, as it led to the discovery of radio waves by Heinrich Hertz in 1890. The "*emergence of the speed of light from purely electromagnetic considerations is the crowning achievement of Maxwell's electromagnetic theory;*" (Halliday & Resnick Physics, John Wiley & Sons, 1965, page 894). Maxwell started with Coulomb's Law, Eq. (54) and Ampère's Law, Eq. (55), which are given below.

$$F = \frac{1}{4pe_{\mathrm{o}}}\frac{qq_{\mathrm{o}}}{R^2} \qquad (54)$$

$$\oint \mathrm{B}.d\mathrm{l} = m_{\mathrm{o}} i \qquad (55)$$

Maxwell developed the following equation relating the two constants, the permittivity of an electric field, ε_o, and the permeability of a magnetic field, μ_o, to the speed of light, *c*, and he obtained the unexpected and accurate value of the speed of light.

$$c = \frac{1}{\sqrt{m_{\mathrm{o}} e_{\mathrm{o}}}} \qquad (56)$$

The magnitude and dimensions of the two constants can be found in standard physics textbooks, and the speed of light is:

$$c = \frac{1}{\sqrt{(4p \times 10^{-7}\,\mathrm{weber/amp - m})(8.85415 \times 10^{-12}\,\mathrm{coul^2/nt - m^2})}} = 2.998 \times 10^{8}\,\mathrm{m/s}$$

In Topic #11, I mentioned the realistic gravitation-temperature for the Earth of 1,810^{o}K, which is based on dependable temperature measurement of hot lava. For this temperature, my constant **A** can be recalculated using Eq. (6), see Topic #3, to be, **A**=37.020m^3/s^{2}K^4. All results in the earlier Topics and Crucial Tests remain the same when both *T* and the new value of **A** are used together. An interesting result is obtained with the constant **A** when it is based on the realistic temperature of 1,810^{o}K. This relates to the speed of light, *c*:

$$c = \frac{1}{\sqrt{\mathrm{A}k}} \qquad (57)$$

Or, the speed of light is the inverse square root of Kepler's constant κ multiplied by my constant **A:**

$$c = \frac{1}{\sqrt{(37.020\,\mathrm{m^3/s^2K^4})(3.011 \times 10^{-19}\,\mathrm{s^2/m^3})}} = 2.995 \times 10^{8}\,\mathrm{m/s}$$

A highly accurate estimate of the speed of light is c=2.997$\times$10^{8}m/s.

I have obtained other amazing results with the temperature-gravitation theory, and these will be included in future Reports. You may find other amazing results if you try the formulations of this Report in all fields of physics.

Conclusion

I have explained the Cause of Gravity, the mysterious Free Fall phenomenon, the Orbital Motions of natural and artificial satellites, Gravitational Repulsion, the Quantization of Temperature, and other important phenomena. With the temperature-gravitation theory, I explained away large Anomalies, Perturbations, and Contradictions that have not been accounted for with the Law of Universal Gravitation, the Theory of General Relativity, and the other theories of gravitation. I have supported my theory with Crucial Tests, and accounted for puzzling effects without circular arguments. I do not say that the mass of the Moon causes the tidal bulge on the Earth, and then say that the tidal bulge causes the Moon to deviate in its orbit. Rather, I use evident and accurately measured temperatures to explain phenomena, physically and mathematically. In this sense, the solar system, with its physically detached bodies, is an incredible *heat engine* that, as Sadi Carnot would say, is strictly governed by the *surreptitious and deceiving action of Temperatures* alone. The deceiving qualities of temperature explain why steam engines worked at less than one per cent efficiency until the temperature-action was understood and clarified.

I developed and verified with Crucial Numerical Tests the Governing Formulas for gravitation which turned out to be rooted in the highly-regarded Maxwell's equations, and which hold the key to the Unification of the gravitational, electromagnetic and nuclear fields.

I FOUND THAT the cause of gravity is the Temperature-Screened-Internally beneath the crust layer of the planets, such as the Earth, and that the Earth acts like an insulated-electric-conductor, with *temperature*, instead of mass or charge, the *Interaction Agent*.

THAT the mysterious *free fall* is a natural process in which the Earth's gravitational field summons bodies by virtue of their *temperatures*, and not *mass*.

THAT the internally-screened-temperature action is responsible for the gravitation of the moons, planets and stars, and also for the coherence of the molecules and atoms; where all of these bodies act like *insulated-temperature-conductors* and obey the mathematical rules of Gauss's law for insulated-electric-conductors.

THAT gravitation is affected by the *surface temperatures* of the interacting bodies. The difference of gravitational pull in the poles and the equator is fully accounted for by the temperature differences in those regions.

THAT *temperature quantization* is more fundamental than *energy quantization*; and that unlike the massless quantum of energy, the photon, a quantum of temperature, the tempon, has Active, Discernible, Sensible, Calculable, and Causal qualities.

The ongoing effort in physics to find a final theory, the theory of everything, grand unification theories or to discover the one force that *alone* explains the fundamental nature of everything in the universe can benefit from my work. There are as many forces in a given field as there are bodies in the field, but there is only one intensity associated with a given field. It then seems natural that unification must be sought after in the intensity of a field and not in the many forces in the field. Furthermore, any final theory must apply equally in classical, electromagnetic and quantum fields, and my theory is the first to ever do that.

The *temperature-interaction* is directly applicable in semiconductors, superconductivity advanced materials, thermoelectric effects, nuclear research and aerospace systems. For example, whereas the exact mechanism of junction heating and cooling in the widely used thermoelectric generators remains unsatisfactorily explained to this day, the temperature-interaction effect gives direct physical and mathematical answers.

The weather is primarily driven by the temperature-gravitation mechanism and forecasts can be better predicted with our formulations.

Report Background

In 1993, the Royal Embassy of Saudi Arabia invited the author, Ali F. AbuTaha, to debut a series of lectures on science and technology to be held at the Embassy in Washington, DC. AbuTaha prepared and submitted the above Report to the Saudi Embassy to be used with the Invited Talk. Unfortunately, after consulting a reporter and a scientist from Scientific American, with little or no background in physics, the Embassy canceled the invitation to AbuTaha. The Report was not written in a format for publication in reputable journals; and it collected dust for many years. Perhaps, physicists and others will study the Report and benefit from it. In addition to the Report, AbuTaha did extensive analyses and computer simulations of his proposed Universal Gravitation, which will be included on this Web Page in the future.