Formulas of the Unified Interaction *

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

A Unified formula for all fields. The *Internally-Screened-Temperature* (e.g., by Earth's crust) determines the **Intensity of the field I(F).** **Analogy: Insulated-Electric-Conductor** with ***Temperature***, instead of electric charge, being the ***cause*** of interactions. *(1)

$$g = A\frac{T^4}{R^2}$$

IN Gravitation, I(F) is itself the acceleration g. In essence, Earth, Moon, etc. are insulated-temperature-conductors that obey Gauss's law. Use Preliminary T for Earth of 10,000 °K. *(2)

$$g = G\frac{M}{R^2}$$

Universal Gravitation; Eq. (3); and General Relativity attribute gravitation, g, to mass, M. (3)

$$A = \frac{g R^2}{T^4}$$

$$A = \frac{(9.832\ \mathrm{m/sec^2})(6.357 \times 10^6\ \mathrm{m})^2}{(10{,}000\ ^{\circ}\mathrm{K})^4} = 3.9732537 \times 10^{-2}\ \mathrm{m^3/s^2K^4}$$ *(4)

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

This is the first equation ever that fully explains the difference in g between the poles and equator. Try it with ΔT of 8°C; which is representative of ocean temperatures. *(5)

$$R = \sqrt{\frac{A\,T^4}{g}}$$

This is the first equation ever to explain orbital motion. Try it to derive the greatly flattened ellipse of the Moon. Notice $\Delta T > 300$°C between day and night sides on Moon explains high eccentricity. Low ΔT on Venus explains lowest eccentricity, etc. *(6)

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

Also, calculate precise orbital parameters and drift of satellites. The radius vector of an orbiting body changes as temperatures change over the surface of the central-body. *(7)

$$T = \sqrt[4]{\frac{g R^2}{A}}$$

Find out the gravitating-screened-Temperatures of stars, planets, moons, and other bodies. Use known surface g's, radii R's, and our constant A to find answers. Try to explain inadequate mass in the universe. *(8)

$$\tau = 2\pi\sqrt{\frac{R^3}{A\,T^4}}$$

Check orbital periods with precision. Try for Low Earth Orbits, Geostationary, elliptical, moons, planets, and other bodies. Why would satellites move faster over poles than over the equator? *(9)

$$f = \frac{1}{2\pi}\sqrt{\frac{A\,T^4}{R^3}}$$

In central-body problem, oscillation is completely independent of *mass*. Find the effect of temperature on f. Use with pendulum, orbital, and all central-body oscillations in **quantum domain.** *(10)

$$g = A \frac{(T_{Ei} \pm T_{Es})^4 \pm (T_{Bi} \pm T_{Bs})^4}{(R_{E\text{-}B})^2} \quad *(11)$$

Teachers, explain the mysterious ***Free Fall.*** Use T(Earth) = 10,000°K, and for bodies in free fall; Calculate g in the poles for bodies whose temperature, T_B, is 0°K, 20°C, or 100°C.

Answers: 9.832000, 9.831993, 9.831977 m/s^2! Use Eq. (12)

$$g = A \frac{(T_E)^4 \pm (T_B)^4}{(R_{E\text{-}B})^2} \quad *(12)$$

"***Free fall is a natural process in which the Earth's gravitational field summons bodies by virtue of their temperatures, and not their mass.*** What happens if $T_B = T_E$? What happens if $T_B > T_E$?

$$g = g \quad (13)$$

$$v = gt \quad (14)$$

$$s = \tfrac{1}{2} g t^2 \quad (15)$$

The widely used and taught ***Free Fall*** Equations.

Galileo, Kepler, Huygens, Descartes and other scientists made clear distinction between ***weight*** and ***force***.

Do you see the problem? The identity; $g = g$!

$$g = A \frac{T^4}{R^2} \quad *(16)$$

$$v = \frac{A T^4 t}{R^2} \quad *(17)$$

$$s = \frac{A T^4 t^2}{2 R^2} \quad *(18)$$

Substitute g from Eq. (2) or (16) in Galileo's Excellent Equations.

Try these equations with Free Fall Motion.

Calculate distance, s, velocity, v, and acceleration, g, for different conditions.

Include internal and surface Temperatures of interacting bodies, and try with advanced motion problems.

$$\frac{I_1}{I_2} = \frac{R_2^2}{R_1^2} \quad (19)$$

$$\frac{T_S^4}{T_E^4} = \frac{R_E^2}{R_S^2} \quad *(20)$$

$$A = \frac{m^3}{s^2} \frac{1}{K^4} \quad *(21)$$

In addition to crucial numerical tests, we verified The Unified Interaction Equations using completely independent methods.

The gravitating-temperatures for the Sun, planets, & moons can be obtained from known surface gravity and radii; Eq. 8.

Or, we use the Inverse-Square Law for a point source and Stefan-Boltzmann law, or Eqs. 19 & 20 with excellent correlation.

Then, we tried the Constant in Kepler's Third Law and obtained excellent results. The units of Kepler's constant appear in our constant A, or m^3/s^2; as well as the temperature K.

And there were several other independent tests.

$\mathbf{F} = m\,\mathbf{a}$

$g = G \dfrac{M}{R^2}$

$F = G \dfrac{M m}{R^2}$

Mass-based Gravitation theories do not answer, or cannot explain, satisfactorily many observations: (23)

- Why is g greater in the poles than in the equator?
- Why is g greater over the ocean basin than over high continents?
- Why don't massive mountains exhibit the mass-effect? (3)
- Why "***large***" g pull over lowlands than highlands on Moon?
- Why do Satellites drift *Westward*?
- Why is the Moon's c.g. displaced *Eastward*?
- Why the enormous g and inadequate *mass* in the Universe?
- Why hasn't Hubble found black holes or even candidate regions?

$F = m \dfrac{AT^4}{R^2}$

$F = \dfrac{A\, m_{moon}\, T_E^4}{R^2}$

$F = \dfrac{A\, m_{moon}\, (T_E^4 - T_M^4)}{R^2}$

The Temperature-Interaction Mechanism explains all of the above, and other anomalies, disparities, perturbations, and contradictions on the basis of accurately measured Temperatures. *(24)

Our formulas treat ***force*** only after the gravitational acceleration is determined completely independent of the ***mass***. *(25)

A star with gravitating screened-temperature of only 10^{0} million produces gravitational pull 3 million times stronger than the Sun! *(26)

$U = -\dfrac{A\, m\, T^4}{R}$

$U = -\dfrac{G M m}{R}$

Many energy levels can be calculated with our Energy Equations. Energy changes as Temperature changes! *(27)

Newton's mechanics failed in the quantum domain because the *Mass M* cannot be quantized. only one energy level, baesd on a constant *Mass M*, can be derived. (28)

$K = \frac{1}{2}\, m\, v^2 = \frac{1}{2} \dfrac{A\, m\, T^4}{R}$

The kinetic energy formula in the Unified Interaction is a powerful tool to predict the behavior of rockets, satellites, or atomic particles. *(29)

$v_o = \sqrt{2 \dfrac{A\, T^4}{R}}$

$v_o = \sqrt{2 \dfrac{G M}{R}}$

The escape velocity v_o for a projectile or a particle. Our formula gives accurate predictions for launch vehicles, satellites, and space probes; as function of local or seasonal temperature variations. *(30)

Only one velocity v_o can be found from classical formulations for a body or a particle in a central-body system. (31)

$\oint \mathbf{E} \cdot d\mathbf{S} = q$ $\oint \mathbf{I(F)} \cdot d\mathbf{S} = A\, T^4$ $\oint d\mathbf{S} = 4\pi R^2$ $I(F) = A \dfrac{T^4}{R^2}$	**Our Eq. (33) is the first Maxwell-like equation for a gravitational field;** and can form the basis for unification of the fields. Eq. (32) is Gauss's law for an insulated conductor. In Eq. (33), we say that the intensity of the field I(F), not the electric field E, is caused by the fourth-power of temperature, T^4, not by a charge q. Then, for a Guassian surface (now Earth, Moon, etc.), I(F) is given by our Eq. (1).	(32) *(33) (34) *(1)
$E = 2\pi f \sqrt{GMR}$ $E = 2\pi f \sqrt{AT^4 R}$	The energy per unit mass, E, in classical Eq. 35 varies only as function of *frequency*; Because G is *a constant*, M is *constant*, and R is *constant* [see Eqs. 27, 28]. E in our Eq. 36 is related to the frequency f <u>and</u> to the temperature T, which can have many values.	(35) * (36)
$\dfrac{E}{f} = 2\pi \sqrt{GMR}$ $\dfrac{E}{f} = 2\pi \sqrt{AT^4 R}$	The ratio E/f (Planck's constant h) is not derivable from G, M, and R. E/f, or h, is derivable with our Equations.	(37) * (38)
$E = hf$	**The basic quantum Equation relates only the Energy E and Frequency f, but not the temperature T.** See Equations 36 and 46.	(39)
$h = 2\pi \sqrt{G\, \Delta M\, R}$ $h = 2\pi \sqrt{A\, \Delta T^4\, R}$	A small mass ΔM cannot produce separate energy levels and frequency. A temperature quantum ΔT, which we call a ***tempon***, can produce an energy jump at a given frequency. What is the size of a typical ***tempon***?	(40) *(41)
$\Delta M = \dfrac{h^2}{4\pi^2 G R}$ $\Delta T = \left[\dfrac{h^2}{4\pi^2 A R}\right]^{1/4}$	For typical light wavelength (6.5×10^{-7} meters), a temperature quantum, or ***tempon***, is calculated to be 8.10×10^{-16} °K. Eq. (43) successfully applies to blackbody radiation, the photoelectric effect, atomic spectra, and other phenomena. A Temperature quantum jump ΔT is physically sensible and mathematically accurate.	(42) *(43)
$E = \sigma T^4$ $\int_0^\infty E_{\lambda T}\, d\lambda = \sigma T^4$	The temperature T is treated separately in quantum theory. Our formulas integrate Stefan-Boltzmann law, and combine energy E, frequency f, and temperature T, in one workable law.	(44) (45)
$E = \left[2\pi \sqrt{A \Delta T^4 R}\right] f$ $\Delta T = \left[\dfrac{E^2}{4\pi^2 f^2 A R}\right]^{1/4}$	The Unified Interaction restores causality, promises to unify the fields, explains many anomalies, gives accurate results. Many Crucial Tests and numerical examples with the Equations appearing here are given in our first report **The Unified Interaction - Part One: The Cause of Gravity.**	* (46) *(47)

The following Tabulations from our report **The Unified Interaction - Part One: The Cause of Gravity** are given as guide to use and verify our Equations and for correlation with other formulations. Notations are similar to those used in most standard physics and engineering textbooks.

COMPARISON OF NEWTON'S FORMULATIONS AND THE UNIFIED INTERACTION

Newton's Formulations	**Our Formulations**
$F = \frac{G M m}{R^2}$	$F = \frac{A m T^4}{R^2}$
$U = -\frac{G M m}{R}$	$U = -\frac{A m T^4}{R}$
$E = \frac{U}{m} = -\frac{G M}{R}$	$E = \frac{U}{m} = -\frac{A T^4}{R}$
$f = \frac{1}{2\pi} \left(\frac{G M}{R^3}\right)^{½}$	$f = \frac{1}{2\pi} \left(\frac{A T^4}{R^3}\right)^{½}$
$E = 2\pi f \sqrt{GMR}$	$E = 2\pi f \sqrt{AT^4 R}$

COMPARISON OF QUANTUM FORMULATIONS AND THE UNIFIED INTERACTION

$E = [\,2\pi \sqrt{GMR}\,]\, f$ **(abandoned)**	$E = [\,2\pi \sqrt{A\Delta T^4 R}\,]\, f$
$E = hf$	**already integrated**
$E = \sigma T^4$	**already integrated**
$\int_0^\infty E_{\lambda T}\, d\lambda = \sigma T^4$	**already integrated**
$E = \frac{U}{m} = -\frac{G M}{R}$	**already integrated**
$E = \frac{1}{4\pi\epsilon_0} \frac{q^2}{R}$	**already integrated**
$h = h$	$h = 2\pi \sqrt{A\Delta T^4 R}$

Kepler's Constant K and Our Constants A and α

Practice our previous formulations with the screened-temperature of Earth of 10,000 °K.

Then for Advanced Studies: Use a more reasonable screened-temperature for the Earth, e.g., 1,810 °K.

Calculate our Constant A for $T = 1{,}810$ °K [see Eq.(4)], or,

$$A = \frac{g R^2}{T^4} = \frac{(9.832 \text{ m/sec}^2)(6.357 \times 10^6 \text{ m})^2}{(1{,}810 \text{ K})^4} = 37.020 \text{ m}^3/\text{s}^2\text{K}^4 \quad (4)$$

Then consider our other constant α, calculated as follows:

$$\alpha = \frac{A}{4\pi^2} = \frac{37.020 \text{ m}^3/\text{s}^2\text{K}^4}{4\pi^2} = 0.938 \text{ m}^3/\text{s}^2\text{K}^4 \quad (49)$$

Calculate Kepler's constant, K, for any other central-body-system; e.g., for the Sun;

$$K = \frac{(365.25\text{days} \times 86{,}400 \text{ s/day})^2}{(149 \times 10^9 \text{ m})^3} = 3.0106 \times 10^{-19} \text{ s}^2/\text{m}^3$$

Then note that the gravitating temperature, T, for any central-body-system is the product of the inverse fourth-root of Kepler's constant K and our constant α; or,

$$T = \frac{1}{\sqrt[4]{K\alpha}} \quad (50)$$

Compare the results with others calculated with our Eq. (8); or with the radiation law Eq. (20).

From our report "The Cause of Gravity," note the following:

"We next note that Kepler's constant, K, for the solar system divided by $4\pi^2$ produces the following very interesting result: Approximately the speed of light, c;

$$c = \frac{1}{\sqrt{(4\pi^2 K)}} = \frac{1}{\sqrt{(4\pi^2)(3.0106\times10^{-19})}} \approx 2.9 \times 10^8 \text{ m/s} \quad (52)$$

This result which is within 3% from the presently accepted value for the speed of light (2.997×10^8 m/s) was rather astounding and intriguing." . . . .

$$c = \frac{1}{\sqrt{(A\,K)}} \quad (53)$$

From which,

$$c = \frac{1}{\sqrt{(37.020)(3.011\times10^{-19})}} \approx 2.995 \times 10^8 \text{ m/s} \quad ***$$

A highly accurate estimate of the speed of light, or c = 2.997×10^8 m/s. This eliminates the 3% error in the value that was derived earlier purely on the basis of Kepler's constant K, see Eq. (52).