CTG Capacitance Theory of Gravity, Book II

MORTON F. SPEARS

Gravity, though geometric,
Actually is more electric.

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FIGURE LEGEND

Prologue

Electrical capacitance is real, not ethereal. For many years, one has been able to walk into almost any radio store and purchase specified capacitances in packaged capacitors ranging in ratings from a few millionth-millionths of a farad up to a hundredth of a farad or so. Now, with modern technology, single capacitors are readily available with over a farad capacitance in a package about the size of a standard checker piece.

But what is capacitance and what is a farad? Capacitance is the property that establishes a particular charge-to-voltage ratio when electrical energy is applied between two or more separated entities, as between metal plates or spheres, for examples. Somewhat akin to the philosophical question of whether a sound exists when there are no ears close enough to hear, one may ask if capacitance exists when there is no electrical charge or voltage. It does. The capacitor units one buys from the shelf in the store have capacitance values whether electrical energy is present or not.

Basically, capacitance stands by itself and is geometry and substance dependent; that is, its value in farads is rigidly determined by the size, shape and spacing of substances with certain electrical properties. The

farad value of real capacitance* cannot change unless one of these parameters changes. When a capacitance does change in farad value with the magnitude of applied electrical energy, with age or with temperature-change, one or more of the geometry or substance properties is changing.

Just as real as the capacitances from the store, every particle, atom, molecule and clusters of each have capacitance values to background space and to each other. The minuscule farad values of these capacitances affect the charge-initiated force fields acting on particles in substances and, as a consequence, affect the magnitudes and directions of the forces applied. This is basic, and can readily be demonstrated in a laboratory.

Yet quantum particle physics and general relativity, both searching for a perfect model of the universe, overlook capacitance which is often a very important driving effect. Instead new physics theories have been generated which utilize: hard-to-visualize space-time curvatures, a pro-liferation of made-up particles with peculiar properties, many dimensions beyond the four dimensions which themselves are not fully understood, special empirical constants, and the negation of classical physics when the space dimensions are very small.

Modern physics aspires to understand and explain gravity, but with-out including the fundamental capacitance properties of the substances acted on, a correct presentation does not seem possible. Instead, the understanding will always be empirical, gleaned from many experi-ments which will constantly change the make-up of the model of the universe . It is much like predicting the hydrodynamic properties of a new boat design without considering the existence of water.

Hopefully, the presentation in this book is convincing enough to inspire someone competent to continue the process of considering capaci-tances of particles in the overall approach to gravity and to other basic forces as well.

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* The so called Miller-effect capacitance is an exception which is an artificial capacitance produced by electrical energy amplification and feedback.

Abstract

Many of the concepts of *CTG Capacitance Theory of Gravity* are amplified in this second book about the subject. More analogous electro-magnetic experiments are presented which demonstrate how *static* (as differentiated from *motional*, or *relativistic*) gravity works.

Proximity effects and relative-to-the-background permittivity effects are deduced and explained for particles acting on each other, modifying some of the deductions of the first book.

Use of a standard electrostatic force expression is developed for gravity. The expression is used in a simple form for approximate results, or in a more complicated form, for precise results which take into account the aberrations observed for gravity.

Responses to critics are presented with expanded explanations for the questioned portions of the theory.

Introduction

Last year I wrote and published a book entitled *"CTG Capacitance Theory of Gravity"*. One hundred and forty copies were disseminated, mostly in the United States and Great Britain. Afterwards I waited eagerly for constructive comments, either positive or negative, with respect to the ideas presented.

So far I have received no feedback that has helped to strengthen or weaken the basic premise that gravity is a capacitance phenomenon triggered by electrostatic charges which provide the energy.

The negative comments I have received to date have been mostly to do with my presentation. Some wrote, however, that they simply do not believe in particles or fields or any present conception of the aether, or other things of that nature. Some believe that if I researched enough, I would find others who have championed the same theory that I have — and failed after a fatal flaw surfaced.

Two professors of physics wrote separately that a fatal flaw really exists in the theory because the dimensions used in the equations did not (in their view) result in dimensional balance. One was satisfactorily won over by my written explanations, but the other never responded. Both had not

noticed in my first book (page 36) that the gravity force in the MKS system is not in the usual *newton* (coulomb-volt per meter) dimension, but in a new *gravit* (coulomb-volt per daraf), dimension, and that a force in newtons is equal to a force in gravits multiplied by one daraf/meter (or by one newton/gravit). For an illustration of this point, let us say there is a one pound tomato. All weights are provided in dimensions of this tomato. The result, then, is that a weight in pounds equals the number of tomatoes multiplied by one pound per tomato. One can change to MKS or any other dimensional scale without error. For MKS, the selected tomato is equivalent to 0.4536 kilograms; or the number of kilograms equals the number of tomatoes multiplied by 0.4536 kilograms per tomato. Appendix B provides more detailed information on this subject.

Although there are many pages and two vector diagrams (pages 23 and 28) in the original CTG publication derived to show the difference between electrostatic (Coulomb) forces which cancel out between objects, and gravity (capacitance) forces, which do not, the explanations were not comprehended by one of the physics professor critics of the book. If one reader failed to understand the explanations, there are probably more in the same boat; therefore, this text includes more detailed explanations of that and other phenomena.

The most thorough analysis of the first CTG book has come from a well respected hydrodynamics engineer from England, Dr. Trevor Silvey. He questioned whether the capacitance loading effect between the proton and other entities within the atom might not change my capacitive circuit analysis a bit, and wondered about the effects of the motions of the separate particles. He also questioned the validity of the equations derived on page 43, since gravity would then appear to be proportional to the square of the radius of the particle being acted upon. All his points were good ones. In reply, I offer the following:

First, there *is* a proximity effect between particles which lowers the resulting gravity force acting upon them. This new CTG text delves into the proximity effect which, as one example, shows up in the table for the masses of elements.

Second, the small motional relativity change of gravity is not addressed in the original text, and is only superficially described in this one. Instead, *static* gravity is emphasized.

Third, if one considers "quantum" identical particles, they cannot change in radius, and forces on objects made up of them are sums of the forces on the individual particles. In other words, the total force on an object

is proportional to the number of the particles, not to the overall radius. Gravity works like that.

There is one technical surmise in the original CTG book that I have now determined to be totally incorrect; that is, the rather significant reduction of effective radius of a particle (actually for the second time) as, for example, when a piece of iron is buried in the earth. I did not realize at that time that the proximity reduction of total capacitance with closely spaced sub-atomic particles that has already taken place in atoms is quite appreciable and that relatively far spacing of the particles in molecular structures then has very little effect. Therefore, burying a piece of iron in the earth will not measurably change its gravity properties, although burying the electrons, protons, and neutrons in iron reduces the total capacitance (mass) appreciably (by a factor of 0.99064 from Reference [3]) from that of the capacitances or masses added separately. Later in this book there is quite a bit of explanation devoted to the particle proximity phenomenon.

The first part of this newer presentation of CTG is devoted to more detailed explanations and experimental examples of capacitance forces, most of which mimic gravity. These forces can all be expressed in terms of charge times a voltage gradient — the electrostatic (or Coulomb) force as charge times volts-per-meter; the capacitance (or gravity) force as charge times volts-per-daraf. The *daraf* is a unit of elastance, or the inverse of capacitance; that is, 1/farad. Voltage gradients are commonly used and understood in physics and electrical engineering. *Volts-per-meter* in a medium, is called an electric field, E; *volts-per-ohm* in a medium is called an electric current I (in amperes); *volts-per-daraf* in a medium has not had its own unique designation, but exists just the same, for example, as a voltage gradient between two plates of an air-spaced capacitor. The *volts-per-daraf* entity has been designated the *Q-field*, or Q_f, for CTG. The *volts-per-daraf* Q-field coexists with the volts-per-meter E-field in the capacitor in the concept of causing a voltage "drop", just as the volts-per-ohm current coexists with the E-field in a medium causing a voltage "drop". In a cylindrical resistor the total voltage from pole-to-pole (end-to-end terminals) is the current (volts-per-ohm) times the *ohms*; the *distance* from pole-to-pole is incidental. In a similar-shaped capacitor, the voltage from pole-to-pole is the Q-field (volts-per-daraf) times the *darafs*, the *distance* is incidental.

Physicists and engineers know a lot of things that the E-fields and the I-fields can, or cannot, do, but never having thought very much about Q-fields, no significance has been attached to them. E-field energy is

important for binding the materials in the Universe together, for the propagation of radio waves and light, and for many other electromagnetic phenomena. I-field (or current) energy is used for heating, cooking, lighting, and countless other applications, as well as for producing the magnetic H-field with its own variety of uses. But of what use is the Q-field? The contention in CTG is that Q-field energies and forces are a distinctive way to approach and understand the origin of gravity. This is the thrust of the first CTG book, and progresses in this text. However, later in this text, it is shown how gravity can also be treated just like capacitance-electrostatics, using only terms in mathematical expressions with common universally accepted dimensions.

The fundamental similarity is for the forces;

$$F_c = C_{12}(V_{12})^2/2r_{12} \text{ and}$$
$$F_g = C_{12}(V_{12})^2/2r_{12},$$

where F_c is a capacitance (electrostatic) force between plates or particles, and F_g is a capacitance (gravity) force between particles. The treatments for electrostatic and gravity C_{12} capacitances, V_{12} voltage differences, and r_{12} distances between particles (or plates) are detailed in the text. These details help to explain how gravity can vary with the make-up of interacting substances, and with the make-up of the path between any interacting substances.

Because (to my knowledge) there are few, if any, papers pertaining to the ideas contained in this material, the number of references cited is sparse.

No particular effort has been expended to bring the form, expression or grammar of this presentation in-line with any set standards. For example, much to the chagrin of my technical colleagues that have worked with me, I have used the word "*blob*" to portray a small piece of any kind of substance with a random shape or size. To me, it seems the best and shortest word to depict repetitively a "*lump of something*", as it is defined by Webster. Therefore, I have persisted in its usage, even though some readers may agree with my colleagues.

I would like to express my appreciation to those brave souls like Larry Burke and others, who have stuck with me through this CTG gravity theory. In addition, my family has been particularly understanding, since it might be hard to appreciate why one would give up a perfectly good reputation earned over many years in engineering to pursue a new niche in physics, which sometimes brings about vehement reactions and personal attacks by

others holding different viewpoints. A special thanks goes to Steve Hathaway who has been ready to set up quickly and ingeniously any experiments desired, and to Jack Sullivan who has often worked through his lunch hours during our company's busy times to provide the illustrations needed. The hardest worker of all for this second CTG presentation has been Carole Stoehr who has miraculously typed all this material on a business-oriented word-processor without many of the vital scientific symbols, yet somehow made this text come out in legible form. My sincere thanks to all of you.

Chapter 1

The Basic Configuration–The Bi-Pole

If one constructs an electrostatic pole pair consisting of a positive pole and a negative pole and spaces the poles just far enough apart in a medium so that they cannot arc across the intervening space to short-circuit, and the poles are "braced" in their separated positions so that they cannot move toward each other, one has created a common dipole. Dipoles as such are generally understood, as are the fields and forces surrounding them. However, this paper wishes to examine in a different way some of the not-so-well-understood actions of charged pairs in various surrounding media. A surrounding medium might be air, distilled water, oil, pure vacuum space, or anything for that matter. To emphasize the difference between the "old" and "new" ways of observing two-pole phenomena, pole pairs are designated "bi-poles" rather than "dipoles" throughout this text whenever appropriate.

Let's make, in the hardware sense, a real live bi-pole. The poles, themselves, consist of two light-weight hollow metal balls about one centimeter in diameter, separated center-to-center by about five centimeters, and are fastened together as an assembly by a thin insulating rod of, say, glass, polystyrene, ceramic or any good insulator. (Vacuum space would be

the best separator, but practically it's not good for model making.) Let's suspend the assembly by two small diameter (0.008 inches, or #32, is small enough) copper wires; each electrically connected to the top of one of the metal balls; then secure the wires to an insulator block approximately 45 centimeters up from the balls. Allow enough space for the assembly to swing freely as a pendulum, with a generous spacing from other objects. Energize the two metal balls through the wires, so that a DC potential difference of some 15,000 volts or so is developed between them. The two ball poles, since they are of the same general size, may be energized for convenience at plus 7,500 volts relative to ground for the plus pole, and minus 7,500 volts relative to ground for the minus pole.

Next, make an insulated second pendulum with the bottom weight at the end of a length of dental floss at least 60 centimeters long, which has at its lower end, a "blob" of any substance you choose (metal, plastic, paper, chewing-gum, whatever). Make sure, if the blob is electrically conductive, that it is small enough not to short out the bi-pole. Holding the dental floss with the hand some distance up from the blob (and far enough up to prevent getting an electrical shock from the bi-pole pendulum wires), bring the blob near the bi-pole at the base of its pendulum. You will notice something immediately (see Figure 1-1). The blob of substance is at first (that is, before it is electrically charged) pulled toward the bi-pole, and the bi-pole is pulled toward the blob. This attraction happens, no matter from which direction the blob approaches the bi-pole. If you allow the blob to become charged by touching either the plus or minus ball, it tends to push away from the ball it just touched, but overall it still pulls toward the bi-pole assembly (pulling harder toward the oppositely charged ball). The point is: A bi-pole attracts other objects at a distance through a medium.

So far, none of this is new stuff, and can be explained in one way or another by everyday electrostatics. But, actually, bi-pole attraction is also how gravity works!

Every proton-electron pair in a substance is one of many bi-poles that pull in all substances near and far. Even protons by themselves and single neutrons consist of bi-pole pairs; up and down quarks in protons or neutrons form bi-pole pairs, for example. Of course the described pendulum demonstration is a gross oversimplification. No one can be expected to believe the analogy to gravity based on what's been presented so far. In fact, all kinds of objections are undoubtedly rampant in some reader's minds. There are questions of electrostatic shielding and attenuation not observed for gravity; questions of polarization through a medium by plus and minus

FIXED MOUNT

DENTAL
FLOSS

2 COPPER WIRES

BLOB
SAMPLE
B

BI-POLE
ASSEMBLY

BLOB B PULLING TO BI-POLE
AND VICE-VERSA
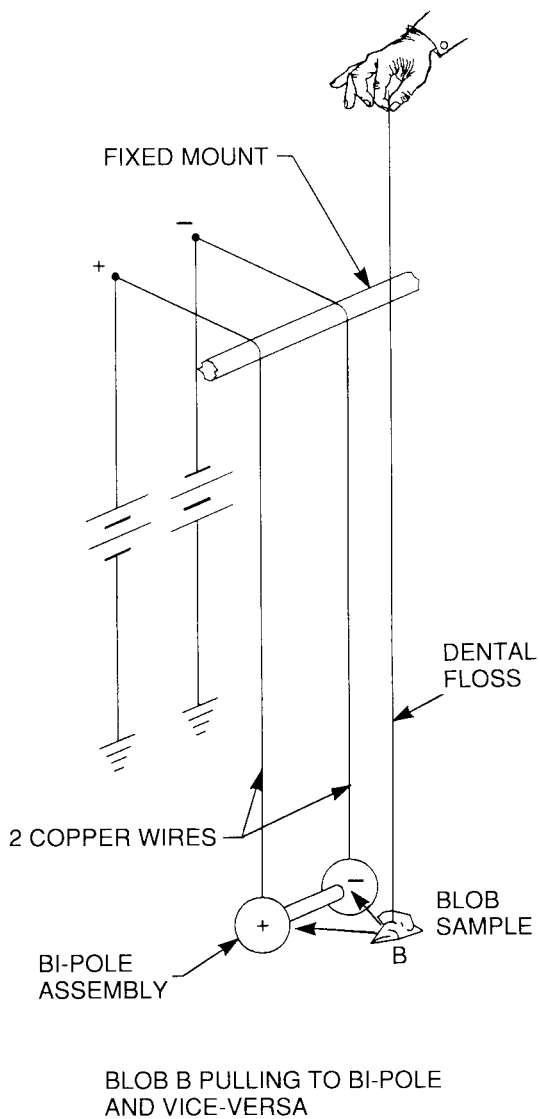
FIGURE 1.1.   EXAMPLE OF ELECTROSTATIC BI-POLE ATTRACTION

electric fields; distortions of time and space with gravity; mass equivalence for acceleration and gravity; the concept of graviton particles; and all sorts of aberrations, such as those envisioned with antimatter, neutrinos, black holes and other such esoteric entities.

Hold on! Please be patient. Fuller explanations are coming. For credibility, the new concept is presented one small step at a time, each fully backed up by relevant practicable experiments.

Chapter 2

The Intermediate Space

For the simplest of capacitors, one envisions two conductive plates separated by some kind of electrical insulator. The insulator in the space between the plates may be a solid, liquid, gas, or even just vacuum. However, the insulator, in fact, doesn't have to be all non-conductive; it can consist of combinations of conductive, semi-conductive, and non-conducting materials in all sorts of geometrical configurations. Let's consider the following situations.

Suppose there are two thin metal plates in air, separated by a distance d_{12} as shown in Figure 2.1 (a). The "idealized" capacitance between the plate poles (which neglects field paths to the edges or to the backs of the plates) is $C = \varepsilon_s A_p / d_{12}$ where ε_s is the effective permittivity of the space between the plates, and A_p is the area of each plate which faces the other plate. Suppose a square bar of area A_p of conductive metal with a length of $d_{12}/2$ is placed between Plates 1 and 2, as shown in Figure 2.1 (b). A technician is assigned to measure the capacitance of the two capacitors (a) and (b), but cannot see how they are constructed. He (or she) is familiar with Capacitor (a), but knows only that something was added in the intermediate space of another capacitor just like Capacitor (a) to make Capacitor (b).

V_{12}

P1 | P2

F_{a12} F_{a21}

+ −

CAPACITOR (*a*)

d_{12}

$d_{12}/4$ | $d_{12}/2$ | $d_{12}/4$

P1 | P2

F_{b1M} M F_{b2M}

+ −

V_{1M} V_{M2}

CAPACITOR (*b*)
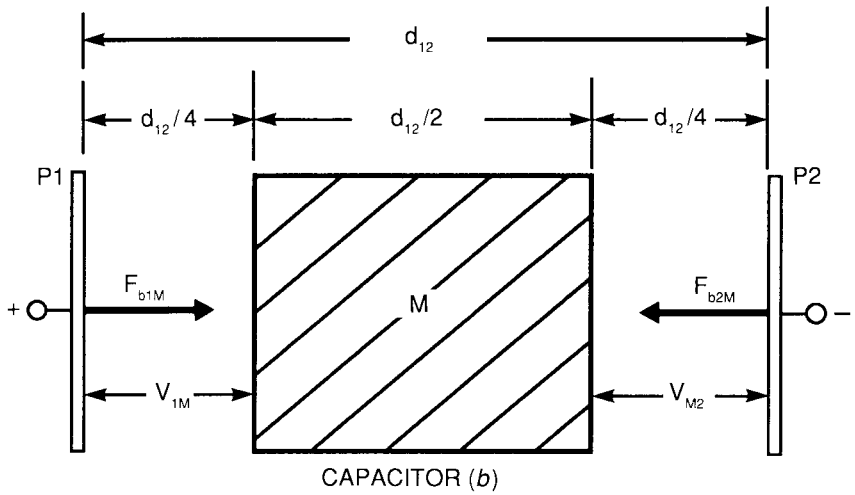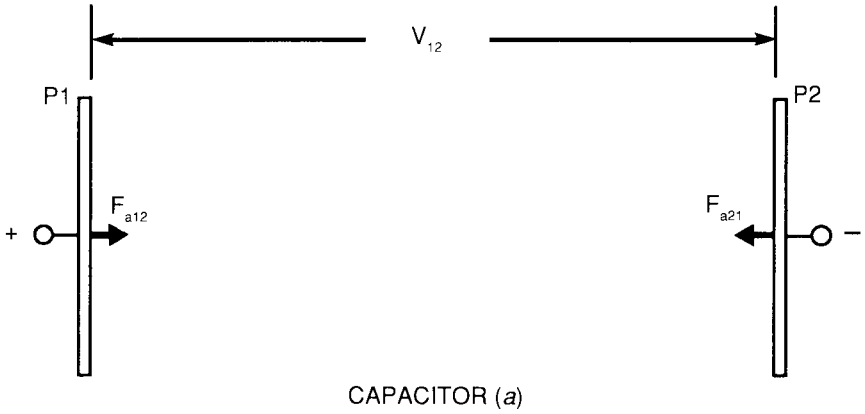
$$C_b = 2C_a \qquad V_{1M} = V_{M2} = V_{12} / 2$$

$$C_{1M} = C_{M2} = 2C_b = 4C_a$$

$$F_{a12} = - F_{a21} = C_a \left(V_{12} \right)^2 / 2d_{12}$$

$$F_{b1M} = - F_{b2M} = C_{1M} \left(V_{1M} \right)^2 / 2 \left(d_{12} / 4 \right)$$

$$\text{Apparent } F_{b12} = - F_{b2M} = F_{b1M} = 4F_{a12} = - 4F_{a21}$$

FIGURE 2.1. IDEALIZED CAPACITANCES AND FORCES BEFORE AND AFTER INSERTION OF METAL PIECE M BETWEEN TWO PLATES

Since Capacitor (b) measures about twice the capacitance of Capacitor (a) ("idealized" assumption only), and nothing is known about the shortening of the field path within Capacitor (b), a logical assumption is that the permittivity between Plates 1 and 2 has doubled because of the insertion of a material with a dielectric-constant of two.

Next, the technician is assigned to observe the forces between the plates with a constant potential difference across the plates of Capacitor (a) and Capacitor (b). It is found that the two plates of Capacitor (b) pull together appreciably harder than the two plates pull together for Capacitor (a). This appears reasonable, since the force ought to be related to the increased energy and capacitance with increased dielectric-constant in the spacing between the plates. But where is the extra force really exerted? We observers "in-the-know" can see that both Plate 1 and Plate 2 of Capacitor (b) are actually pulling to the added metal piece M, and of course, by Newton's Third Law, the ends of the added piece M are pulling back on the Plates 1 and 2. Let's do some experiments to see if this kind of thing *always* happens.

Imagine looking down on several sets of suspended pendulum poles made up of metal square cross-section pieces as shown in Figure 2.2. Inserted somewhere between the plus and minus pole pairs in Figure 2.2 (a) through (d) are metal pieces designated M, which in each case increases the capacitance between the plus pole and the minus pole. Notice that there are always attractive forces between the pole pairs and the metal pieces, even though the force lines are not just directionally oriented pointing between the positive and negative poles of the bi-poles.

Next, consider adding only a microscopic speck of metal exactly half-way between the two energized poles as shown in Figure 2.3. A capacitance increase is caused, even though the increment ΔC_{13} may be too small to be measured in the laboratory. Also, there is an apparent tiny increased force ΔF_{13} between the poles due to the presence of the metal speck. Referring to the sketch and to the equations in Figure 2.3, the forces from the speck to each pole are actually $C_{12}V_{12}^2/2d_{12}$ to Pole 1 and $C_{23}V_{23}^2/2d_{23}$ to Pole 2, and by substitution in the equations as shown, the apparent force increase between Poles 1 and 3 is $\Delta C_{13}V_{13}^2/2d_{13}$.

The speck of metal between Pole Pieces 1 and 3 has increased the *effective* dielectric-constant of the space between the poles from 1.00 (for vacuum, or just over 1.00 for air) to $(C_{13} + \Delta C_{13})/C_{13}$ times the original dielectric-constant. The *effective* permittivity of the space medium is also increased accordingly, so that $\varepsilon_s = \varepsilon_0(C_{13} + \Delta C_{13})/C_{13}$.
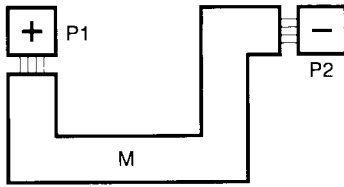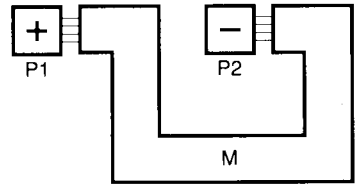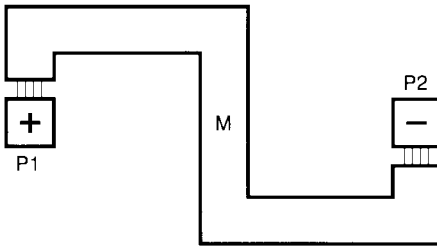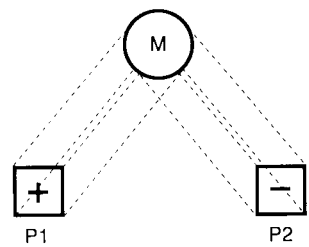
FIGURE 2.2. INCREASED BI-POLE FORCES DUE TO INSERTIONS OF
M PIECES, ATTRACTING EACH POLE TO M, AND M TO EACH POLE
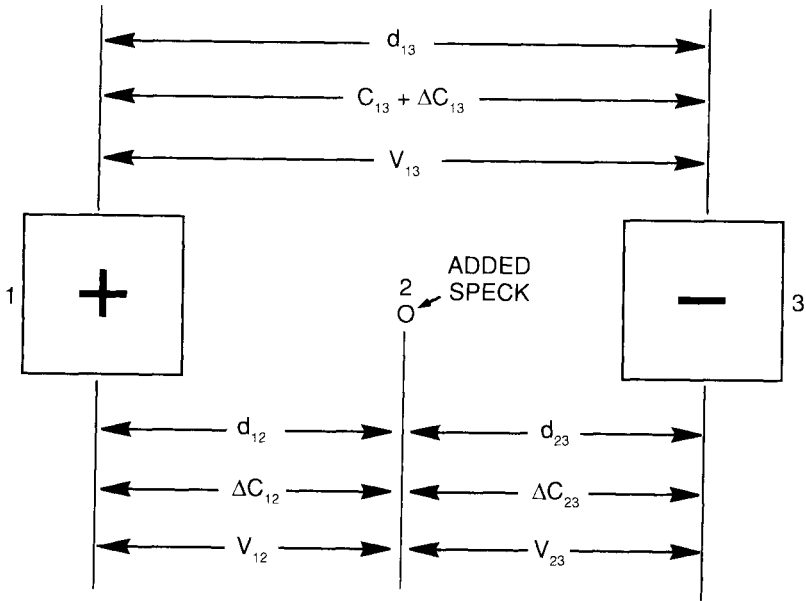
$$\Delta C_{13} = \Delta C_{12} \Delta C_{23} / (\Delta C_{12} + \Delta C_{23})$$
$$\Delta C_{12} = \Delta C_{23} = 2\Delta C_{13}$$
$$V_{12} = V_{23} = V_{13} / 2$$
$$d_{12} = d_{23} = d_{13} / 2$$

Apparent $\Delta F_{13} = \Delta F_{12} = \Delta F_{23}$
$$= \Delta C_{12} (V_{12})^2 / 2\, d_{12}$$
$$= \Delta C_{23} (V_{23})^2 / 2\, d_{23}$$
$$= \Delta C_{13} (V_{13})^2 / 2\, d_{13}$$

FIGURE 2.3.   ADDED CAPACITANCES AND ATTRACTION FORCES DUE TO
A CONDUCTIVE SPECK ADDED BETWEEN TWO POLES

The illustrations shown so far are based on metal piece additions close to, or in between, the poles of an electrostatic bi-pole, but suppose these added pieces are not so positioned. Actually a piece of metal of any size, shape, or description located anywhere increases the capacitance between the poles of any charged pole pair exposed "in the open", and causes tiny attractive forces from the bi-pole toward that metal piece. It can then be truthfully said that the intermediate space of a bi-pole which determines its capacitance and forces encompasses the entire universe.

An example of a small metal particle attracted to a bi-pole is shown in Figure 2.4 (a). One can imagine how minuscule such forces must be. As small as they are, the gravitational forces from a single bi-pole are *much* smaller than the electrostatic forces, but in many respects, they work in the same way, to be explained further on. However, two things can readily be tried: 1.) Make the metal particle larger and notice that the capacitance and the attractive force to each pole of the bi-pole increases, and 2.) move the particle farther away and notice that the capacitance and the attractive force to each pole decreases. It is enough for now to show qualitatively that the forces vary directly as some function of capacitance and inversely as some function of distance.

As in Figure 2.4 (b), suppose a second identical microscopic speck is added in the capacitance space of the bi-pole, far enough away from the first speck to be (say, at least) one hundred times the distance of the largest dimension of either of the two specks away from it, yet close enough together to appear as a single cluster entity in a much larger frame of reference. If one measures the total attractive force from the bi-pole to the cluster, it will be just about twice the force caused by a single speck. In reality, however, from each charged pole of the bi-pole there are two forces directed, one each to the two specks, and the total force between the cluster and the bi-pole is the directional vector sum of all four individual forces.

It follows, that if a far-away piece of material consists of a cluster of one hundred widely separated conductive specks, for example, the attractive force from a bi-pole to the material is the vector sum of a hundred forces from each pole, or two hundred forces appearing to add up to one hundred times the force of a bi-pole attracted to a single speck.

In summary of this chapter, the important thing to remember is that electrostatic bi-poles attract conductive objects located anywhere. The greater the capacitance between each pole of an energized bi-pole and a single conductive particle, the greater the attractive force. Also, when there are many identical conductive particles making up a far-away object, the

(*a*) Single Particle Attraction

Single Particle

P

F_a F_a

F_a

+

F_a

–

(*b*) Two-Particle Attraction

2P

Two miniscule particles
together with >100
effective diameters separation

F_a F_a

F_a

+

F_a

–
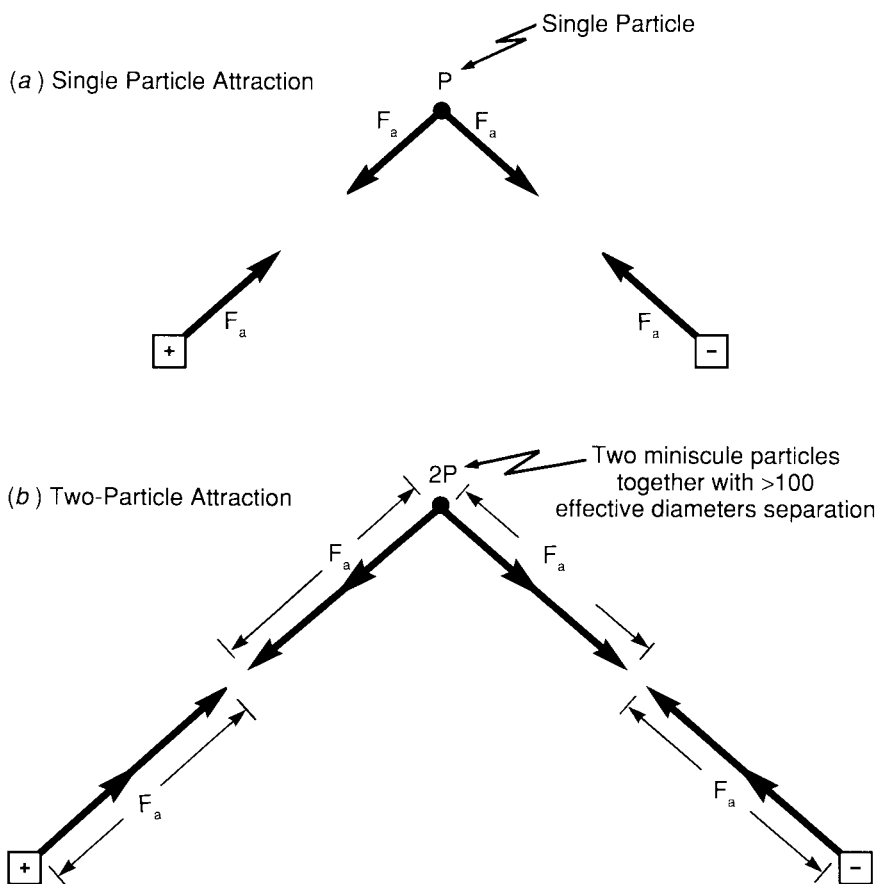
FIGURE 2.4. ATTRACTIVE FORCES BETWEEN BI-POLES AND PARTICLES

attractive force to a bi-pole will be proportionately greater according to the number of these particles, provided that the particles are adequately separated and the material object is far enough away to appear directionally as if a single force vector links the material object to each pole. Metal single particles or multi-particle objects change some of the electrical characteristics such as the pole-to-pole capacitance of a bi-pole by effectively changing the medium in which the bi-pole is immersed. Further on in this text it is shown how all objects are attracted to bi-poles by gravity, and how associated media changes take place. The greater effective permittivity and greater effective dielectric constant due to particles anywhere in a bi-pole's intermediate space, for example, are designated as "artificial permittivity" and "artificial dielectric constant" because they are produced artificially by shorting out small bits of the field's path length rather than by insertion of a uniform dielectric between the poles.

Chapter ③

Is Gravity AC or DC?

One can logically assume that most atomic and nuclear bi-poles encountered in nature are not only in some kind of motion, but are randomly oriented in pole-to-pole alignments that may rotate in any given plane. To illustrate that a swirling bi-pole attracts an object with a nearly steady-state force, the magnetic form of the bi-pole is used for implementing some simple demonstrations in this chapter. Not that electrostatic bi-poles wouldn't work for the purpose, it's just that keeping the poles energized with wires through slip-ring brushes complicates analogous experiments. The magnetic force demonstrations are so easy to prepare that anybody can do them with a minimum of equipment; namely, a table, a small circular bar permanent magnet, and a small iron or steel ball. In the rotating magnet experiments, a hand drill with a non-magnetic bit attaches to and holds the bar magnet, and a piece of string is glued to one end of the ball to form a hanging pendulum. String stops should be provided to prevent the ball which is undergoing attraction from colliding with the spinning magnet.

In Figure 3.1, one is looking down on a table with six views of a rod magnet approaching a small iron ball on the table's surface. In illustrations (c1) and (c2) a wooden mounting block raises the ball center level to the level of

the center of the magnet which has its lower end resting on the table. In all six configurations, when the magnet gets close enough, the ball, after overcoming friction at its base, is pulled toward the magnet. This is not unexpected; many thousands of physicists can tell you why.

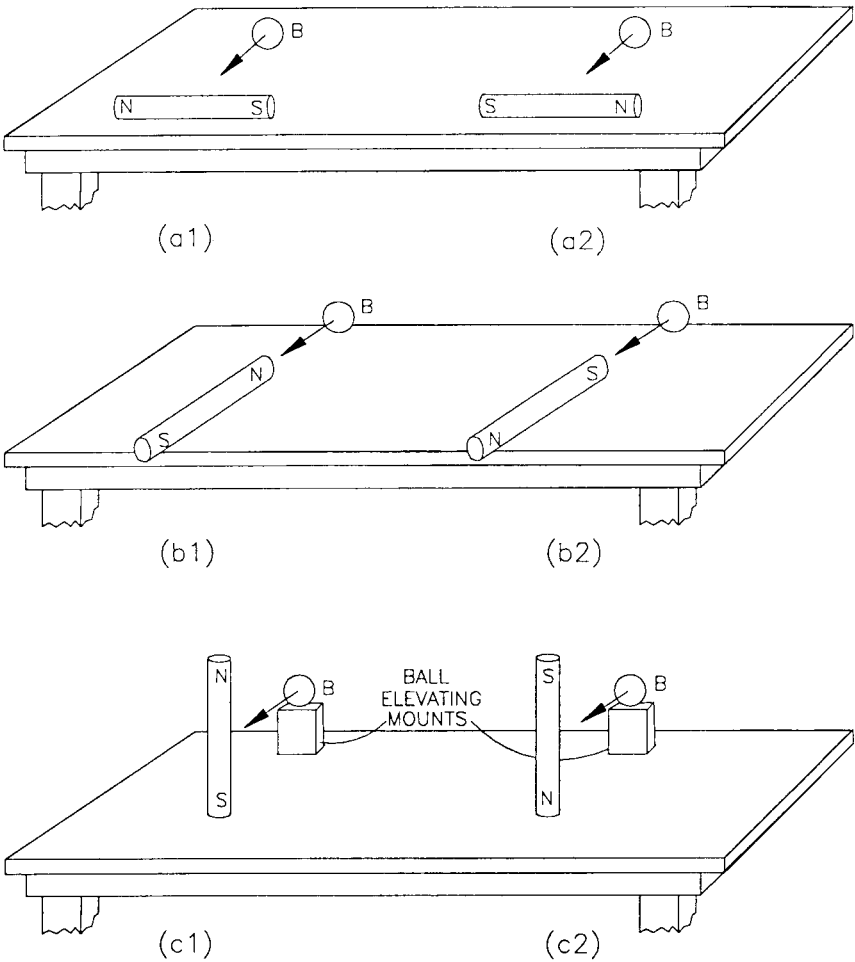(a1)   (a2)

(b1)   (b2)

(c1)   (c2)

FIGURE 3.1. BI-POLE MAGNET ATTRACTING A STEEL BALL

The same phenomenon also happens if one uses an electrostatic bi-pole to attract a conductive ball. The attraction can be explained by "basic" electrostatics; however, not all physicists explain the forces in the same "basic" way. Some try to apply only Coulomb's Law, even though the attracted object is uncharged. With due diligence, using electron displacements in the attracted material, the forces in a few simple configurations can be calculated to obtain seemingly plausible results. Such forces, however, can be accounted for much easier by using capacitor relationships, as will be shown in the sections to follow.

Next, what happens if magnetic bi-poles are rotated in any or all planes while they are in the vicinity of an iron ball? To implement such experiments, the iron ball is hung as a pendulum (with string stops) and the bar magnet is rotated near-by, first clockwise and then counter clockwise in perpendicular planes as shown in Figure 3.2. Sure enough, attraction always occurs between the ball and a rotating bi-pole as illustrated along the right hand side of Figure 3.2 by three plots of attractive force magnitude F_a versus rotation angle. Notice that the attractive force F_a is a constant with angle for the (a) and (c) rotations, but varies with angle for the (b) rotation. In (b) rotation F_a is greatest when the North and South poles are closest to the ball; nevertheless, the force F_a is always attractive. If the spacing is increased between any spinning magnet and the attracted ball, the force is lessened, and for (b) type rotations the F_a force variation gets less pronounced. Picture the bi-pole magnet rotating very fast. Because of inertia effects, the iron ball basically responds only with constant attraction to the magnet since the force variation ripples are smoothed out. But even more to the point, when comparing single magnetic bi-pole attractions to those of multiple atomic or nuclear bi-pole attractions, in the latter instance there are literally billions upon billions of bi-poles spinning randomly in (a), (b), and (c) type rotations relative to the attracted object. The many forces which include all random phases of force ripple then add at the attracted object to a steady-state (DC) force.

In Figure 3.2 (d), an alternating pole electro-magnet is shown attracting the ball B. Even though the north and south poles swap positions, there is a steady-state (DC) component of force (averaged over time) which is proportional to the square of either the root-mean-square coil current or the root-mean-square source voltage.

All of the magnetic bi-pole illustrations in this chapter with slight modifications apply also to electrostatic bi-poles pulling on conductive balls with the same qualitative attractive force results, see Figure 3.3. By

(a)

(b)

(c)

(d)
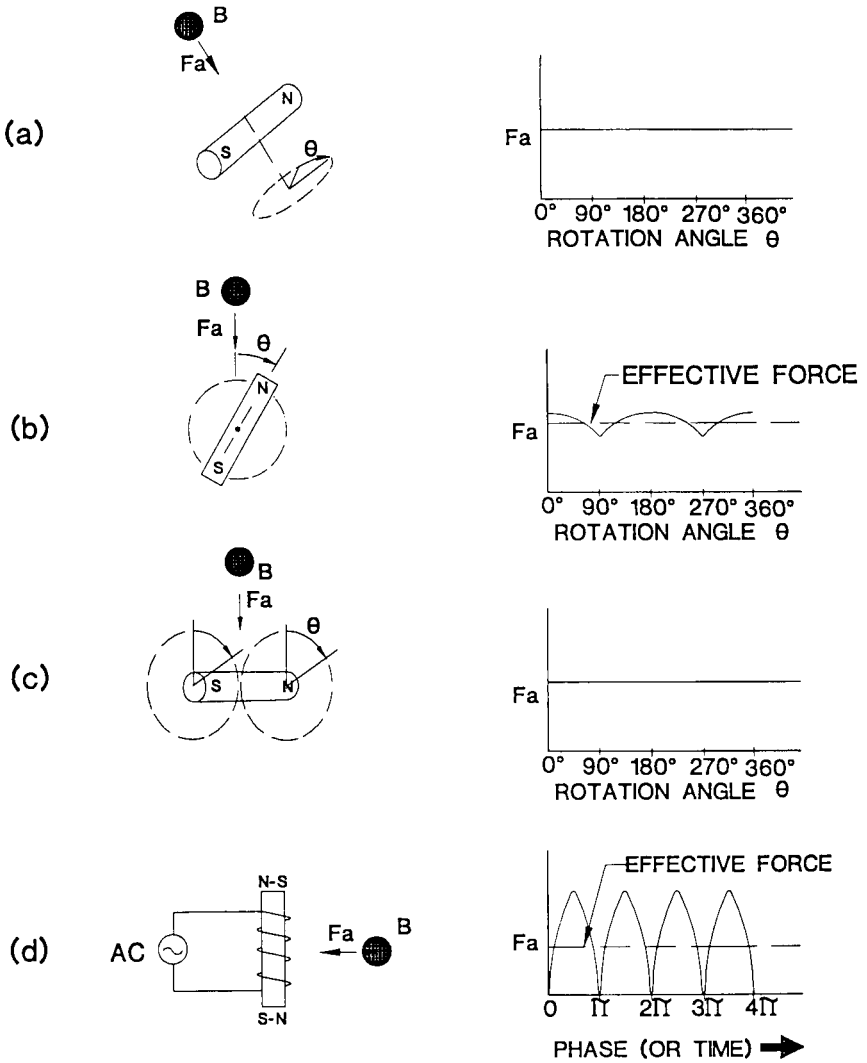
FIGURE 3.2. MAGNETIC ATTRACTION FORCES WITH THREE PLANES
OF BI-POLAR ROTATIONS AND ALTERNATING POLARIZATION
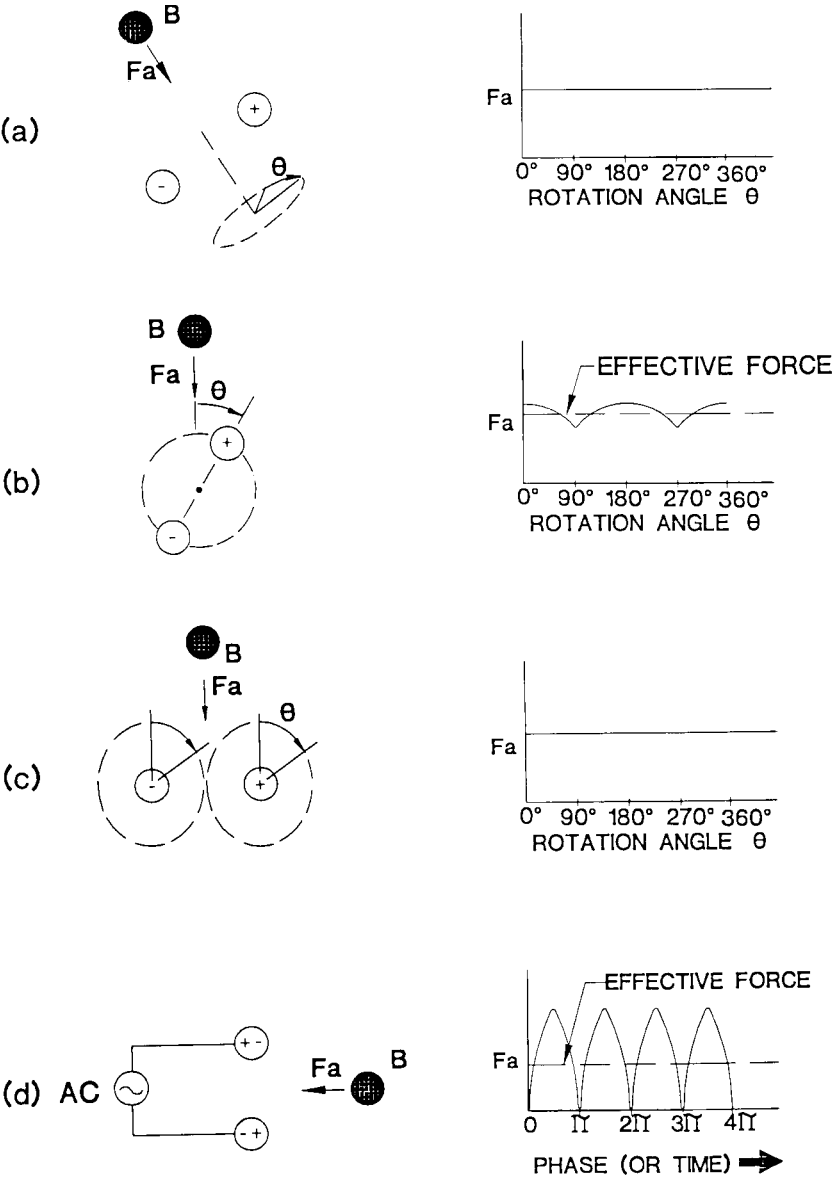
FIGURE 3.3.   ELECTROSTATIC ATTRACTION FORCES WITH THREE PLANES OF BI-POLAR ROTATIONS AND ALTERNATING POLARIZATION

this time the reader may understand at least one way that proton-electron poles, for example, attract "conductive" particles. The rules do not change drastically just because the poles are minuscule in the dimensional order of, say, 10^{-15} meters, spaced at 10^{-10} meters or so from one another. Since each positive pole radiates a positive electric field and each negative pole radiates a negative electric field, and there is a concentrated multiplicity of proton-electron dipoles with all conceivable orientations for any selected bit of material, the net *electric field* from the bit of material is effectively canceled to zero at great distances. However, magnetic and capacitive *forces* produced from bi-poles as exemplified in this section do not cancel at great distances. More on this phenomenon in Chapter 7.

Figure 3.3 (d) illustrates that a rippled DC attractive force pulls a conductive particle towards a bi-pole energized by sinusoidal AC. The effective DC force is proportional to the square of the voltage. The (d) configuration force does not exactly represent the forces that a spinning bi-pole produces as shown in configurations (a), (b), and (c), but is representative enough to use for most bi-pole electrostatic force demonstrations in the laboratory. In this respect a motionless non-rotating AC bi-pole has one great advantage over a similar DC bi-pole in that *residual* electron-displacement polarization in the medium around the bi-pole, or in any attracted objects, *does not* take place. Any such polarization is undesirable because it introduces stray charges and potentials that produce erroneous forces. Consequently, AC power is preferred and used throughout this report for demonstrations of bi-pole forces that are basically DC in nature.

In all illustrations so far, the forces have been attractive; but this doesn't have to be so. Conductive (low resistance) attracted balls have been used for the electrostatic examples and high-permeability (low reluctance) attracted balls have been used for magnetic examples. We will start to get to the "meat" of the CTG gravity conception in the next chapter when the attraction-only aspect of gravity is discussed.

Why Attraction–Why Not Repulsion?

If one can judge by the literature pertaining to gravity, or to gravity physics, there are a lot of puzzlements as to why gravity always attracts one object to another. One question often brought up is whether antimatter, for example, might not reverse things by repelling matter or other antimatter. (CTG, by the way, predicts that antimatter attracts, or is attracted, just like matter, because both are comprised of bi-poles.) Actually, though, gravity doesn't always attract, even in our hum-drum classical physics existence with everyday forms of matter. If you put a block of wood in water, for example, it is pushed "upwards" away from the earth against attractive gravity. (I can see the incredulous look of horror on the reader's face. Doesn't this guy understand anything? Archimedes correctly buttoned down buoyancy forces, and how they act, over 2200 years ago.) The upward force on the block of wood is equal to the weight of water displaced by the wood, and acts against the weight of the wood as though the force were concentrated at the block's center of buoyancy. Yes, but what *initiates* the buoyancy force? It's gravity! Gravity force tries to pull down both the water and the block of wood, but it pulls down the water "a bit harder". In light oil, a wood block pushes upward with less force that it does in water. If a

block is made of iron, it sinks downward through water or oil towards the earth. In a sea of mercury, water, as well as any blocks made of wood or iron, are all pushed upward, opposite to the earth's gravity attraction.

What's the point of reiterating what is so readily understood in today's technology? Hopefully, it may facilitate understanding closely analogous forces generated by multiple bi-poles acting in various media on various objects.

First, let's go back to all of the earlier illustrations depicting bi-pole attractions and see what happens when some of the characteristics of the intermediate space around and between the objects acted upon are altered. For example, as shown in Figure 4.1, an electrostatic bi-pole may be energized quite easily with a few thousand volts of 60 hertz AC in pure distilled water which has a resistivity of 400,000 ohm-centimeters or more. As in air, all metal blobs will attract to the bi-pole immersed in the water. Plastic blobs impregnated with enough metal particles are also attracted. But, if one makes the blob out of a "good" electrical insulating material (such as teflon, nylon, silicon or even frozen distilled water), the blob is repelled by the bi-pole. The word "good" in the sentence above means that the electrical insulating material used for the blob has a greater resistivity in the volume that it occupies than the surrounding medium which it has displaced; in this case, it displaced distilled water.

When light (Wesson) oil is used as the intermediate space, as in Figure 4.2, a 60 hertz powered bi-pole will repel relatively fewer materials because of the greater resistivity of the oil compared to that of any blob. A ball made of a "very good" insulating material such as pure polystyrene is one example of a blob that is repelled. The words "very good" here means that the electrical resistivity is greater for the polystyrene than for the oil, and that is why the polystyrene blob is repelled.

If an energized bi-pole is immersed in a perfect vacuum as its intermediate space, all objects are attracted to it, none are repelled. That, however, is only because we can't find any materials with greater "impedivity" than that of vacuum space. Relative "impedivity", not the actual "resistivity", is the real property that determines the magnitude and directivity of a bi-pole force. In all of the electrostatic force examples discussed so far, the blob's pure resistance impedivity (in ohm-meters) shunts any of its own reactive impedivity (in ohm-meters) to such an extent that the impedivity consists almost entirely of short-circuiting resistivity. In vacuum space, where the resistivity is very great, perhaps infinite, the reactive property of "permittivity" determines the "field impedivity" to electrical fields passing

TO A

AC LINE   10,000 VOLTS

TO C

BI-POLE ASSEMBLY

BLOB

A

B

C

TANK
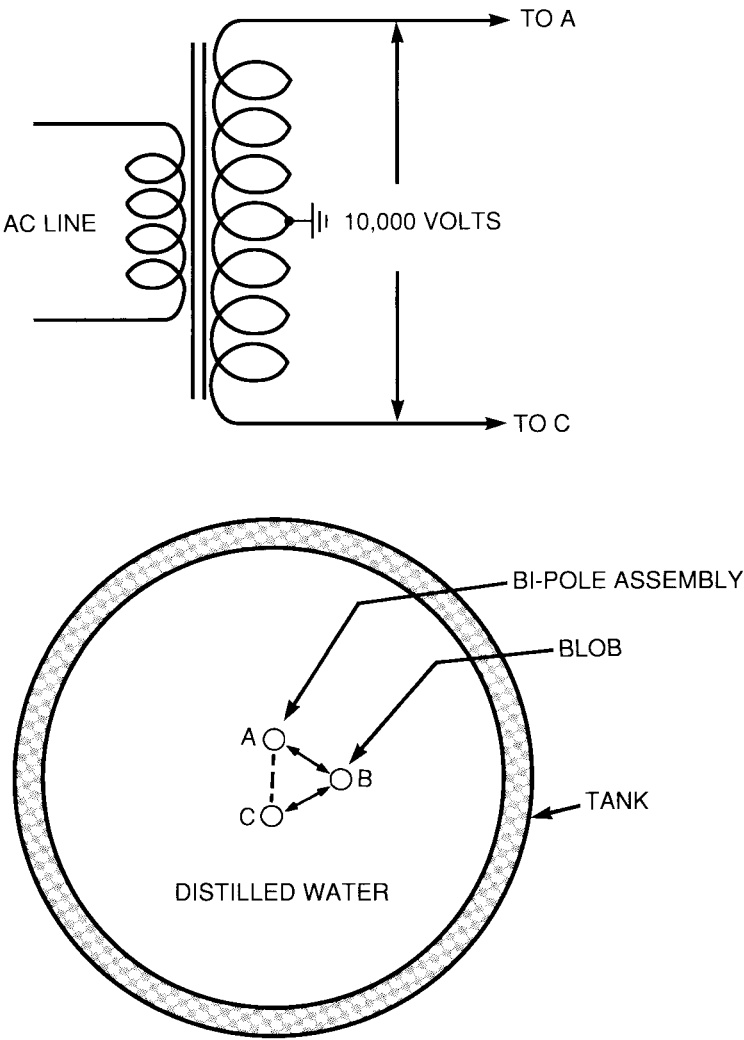
DISTILLED WATER

NOTES:
1.) AC Bi-Pole Assembly may be fixed or supported as a pendulum.
2.) B Blob may be floated on surface or supported as a pendulum as appropriate.

FIGURE 4.1. BI-POLE ATTRACTION OR REPULSION IN DISTILLED WATER

TO A

+

10,000 VOLTS
AC or DC

AC LINE

TO C

BI-POLE ASSEMBLY

BLOB

A ⟶ B

TANK

C

WESSON LIGHT OIL
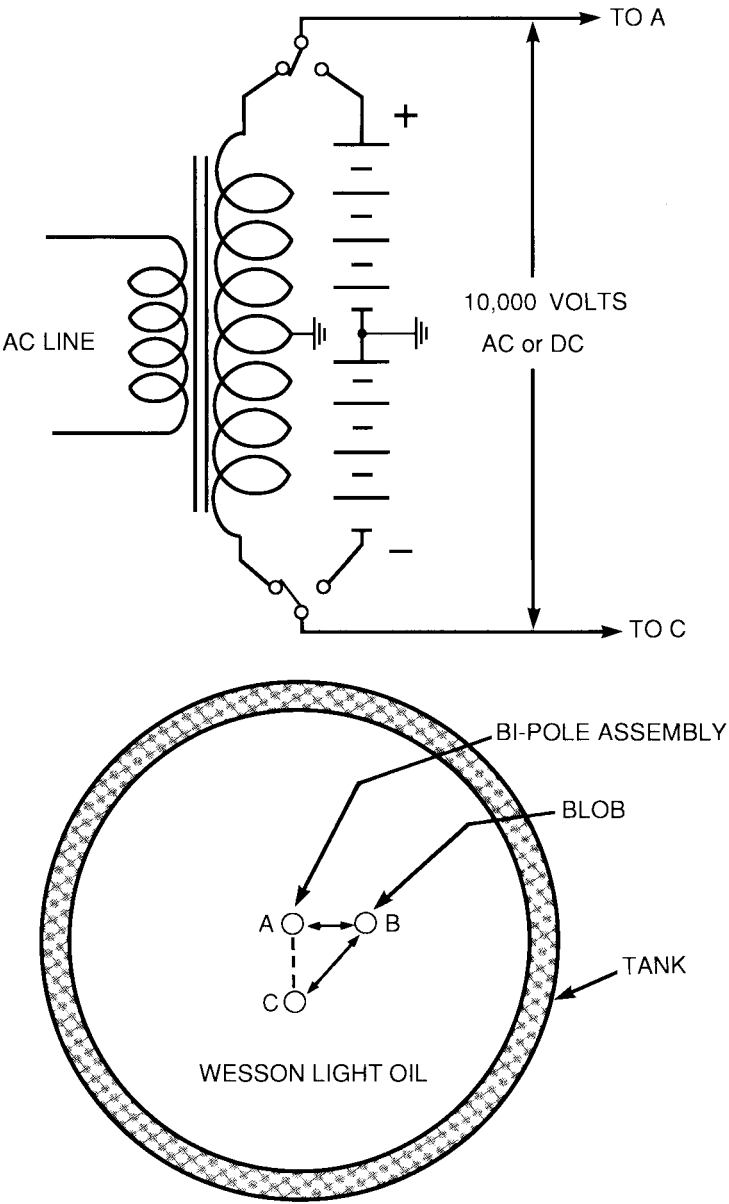
NOTES:
1.) AC or DC Bi-Pole Assembly may be fixed or supported as a pendulum.
2.) B Blob may be floated on surface or supported as a pendulum as appropriate.

FIGURE 4.2. BI-POLE ATTRACTION OR REPULSION IN OIL

through. To illustrate that relative field impedivity of any blob to its surrounding medium always governs the magnitude and direction of a bi-pole force, the following examples of simple experiments are provided.

With a bi-pole assembly immersed in a light Wesson oil and configured as shown in Figure 4.2, construct the blob from a piece of lead-zirconium-titanate ceramic called PZT-5H, available commercially as a capacitor space-filler which has a dielectric constant of about 3100 and a "very good" insulator resistivity of about 10^{13} ohm-centimeters. One finds that with DC bi-pole energization, the PZT-5H blob repels from the bi-pole; but, with 60 hertz AC energization, it is attracted to the bi-pole. In the DC case, the greater field impedivity of PZT-5H due entirely to the greater resistivity of PZT-5H with respect to the oil (10^{13} ohm-cm as compared to 5×10^8 ohm-cm), determines that the blob is repelled. In the AC case, the PZT-5H presents lower impedivity to the field than the oil does, because the PZT-5H dielectric constant of about 3100 is so much greater than the oil's dielectric constant of about 3, which results in 60 hertz blob and oil impedivities of about 9.7×10^6 ohm-cm and 5×10^8 ohm-cm respectively.

Can we show the same thing magnetically as we just did electrostati-cally? You bet. Substitute blobs of bismuth for iron balls in the magnetic force experiments sketched in Figures 3.1 and 3.2. The bi-pole magnet repels the bismuth blob rather than attracting it, because the permeability of a bismuth blob is less than for the surrounding medium it has displaced. In terms of field impedivity, a bismuth blob has a greater reluctance impedivity to magnetic fields than that of the air (or vacuum) space that the bismuth displaced. The iron or steel balls shown in Figures 3.1 and 3.2 attracted to north-south bi-poles because of greater permeability and less reluctance impedivity than that of the air (or vacuum) space that the iron displaced.

Can we show these same effects for gravity? You bet. All objects are pulled in a background of vacuum, because they all have a lower field impedivity than the same volume of empty vacuum space. Consider any object as composed of a piece of vacuum space loaded with tiny relatively low impedivity particles consisting of protons, electrons and neutrons. Back in Chapter 2, it is shown how a bi-pole capacitance is increased when small particles are inserted in its intermediate space. This means that an increase of effective permittivity for that space results. The effective permittivity of the particle-filled medium is greater than that of empty vacuum space. The greater permittivity provides a lesser impedivity to the electrostatic fields from the atomic and nuclear bi-poles, and mutual attraction occurs between the bi-poles and the greater permittivity objects.

In air, all objects with more electrons, protons, and neutrons per volume than the air (greater effective permittivity than that of air) are attracted to nuclear and atomic bi-poles (and by gravity too). Rocks, blocks of wood, feathers, iron, water, mercury, and colder air are all attracted. A balloon filled with helium, however, is repelled. Well, not really. Actually, the air and balloon are both attracted by such bi-poles. The air is attracted just a "little bit harder" because it has more particles per volume than the helium balloon. This is exactly what's been happening all along in the electrostatic and magnetic examples of the last few sections, and also what happens with gravity. All those attracted blobs are pulled just a "little bit heavier" than the medium around them. All those repelled blobs are pulled just a "little bit lighter" than the medium around them. Archimedes can smile in his grave; his displacement principles discovered before 200 BC apply to electromagnetic forces as well as to gravity forces.

Next, if one substitutes the parameter "artificial permittivity" for either "effective permittivity" or "permittivity" and uses this term wherever "density" is applicable, then, the action of the nuclear bi-pole pulling on objects, and the action of gravity pulling on objects, are equivalent. (And in actuality, they are one and the same.) The introduced "artificial" term simply means that, for very minute fields, small relatively low impedance particles added in a given volume of space increases its effective permittivity in an artificial manner by short-circuiting some of the field path lengths. An explanation for this is back in Chapter 2. The more particles, and the larger the particles there are in a constant-volume concentration, the more the attractive pull to other similar concentrations with bi-poles. In other words, in a given volume, the larger the density (or artificial permittivity), the larger the mass (or artificial capacitance) which attracts to any other mass (or artificial capacitance).

If the above is understood, the block-of-wood-in-water analogy used at the beginning of this section should also be understood. A concentration of bi-poles (gravity) pulls relatively "harder" on greater density (or greater artificial permittivity) objects that fill up a given volume. Water has more density in a unit volume (mass) than wood. Water has more artificial permittivity in a unit volume (capacitance) than wood. Thus, for the CTG approach, *capacitance* is closely analogous to *mass* with bi-poles (of plus and minus charge) supplying the energy. And in the same sense that gravity always attracts between two masses, bi-poles always attract between two capacitances, whether real or artificial.

The Effective Radius Concept

In Chapter 4, the close analogy of an object's *mass* (in Newtonian gravity) and *capacitance* (in CTG gravity) was portrayed. One might wonder: how can this be when the capacitance (to background space) is a function of a single dimension of length ($4\pi\varepsilon_0 R$ for a conductor sphere of radius R) while mass is a function of density times three dimensions of length (volume)? The answer is straightforward and simple. With the CTG approach, each per-particle capacitance to space in an object is a function of only one dimension, but the object's total "artificial capacitance" (to space) is a function of both the size and number of the particles making up the object. Assuming all particles of uniform size and separated from each other by distances which are great with respect to the particles' sizes, the total capacitance is the total number N of particles multiplied by the capacitance of each particle. Since N is proportional to the total volume of the object within which the particles reside, it follows that the total capacitance is then proportional to the total volume of the object.

Using metal balls to represent particles, one can verify the above contentions quite easily by measuring the capacitance of one metal ball to space, then the capacitance in parallel of several metal balls to space. If

identical balls are at least 15 centimeters in diameter, and are well isolated from earth ground and each other, the single and parallel capacitances can be measured between the balls and background space using earth ground as a close approximation to background space. To measure these capacitances one needs only an inexpensive commercially-available, battery-operated capacitance meter with a sensitivity of about 1 picofarad. What one finds is that when the balls are far apart, the total capacitance (in parallel) is the number of balls N times the capacitance C_B for one ball. If the balls are brought closer together, the total capacitance drops and is not an integer number times the single ball's capacitance. For a simplified example (Figure 5.1), when only two balls are brought together and are just touching, their total capacitance to background space (ground) reduces from $2C_B$ to about $\frac{4}{3}C_B$. If one combines both balls in a spherical volume equal to that of the two balls, the capacitance drops still more to $2^{1/3}C_B$, or about $1.26C_B$.

The close-spacing capacitances of multiple balls is a crude representation of what one can imagine happening with particles on a nuclear scale inside the proton and neutron (forming quarks) producing the total capacitance (or mass) as a non-integer multiple of a single particle's capacitance (or mass).

Suppose a particle or any sized blob is not spherical at all, but an odd-shaped lump of something or other. It can still be categorized by its capacitance to space. Furthermore, it can be considered as if it were a perfect metal sphere of a radius just the size to effect that capacitance to the space medium around it. For an electrically short-circuiting perfect sphere:

$$C=4\pi\varepsilon R \qquad (5.1)$$

In (5.1), C is the capacitance of the sphere to the background in farads, ε is the permittivity of the open space medium around the sphere in farads per meter, and R is the radius of the sphere in meters. Then if one knows the capacitance of a certain blob to space, the *effective radius* can be determined by reversing equation (5.1) to:

$$R_{eff} = C / 4 \pi\varepsilon \qquad (5.2)$$

With the effective radius approach, the *direct* capacitance between two far-spaced objects can also be determined. The word "direct" means that the capacitance includes only that capacitance between the objects without any shunting by the capacitance of each object to background space. First, as a
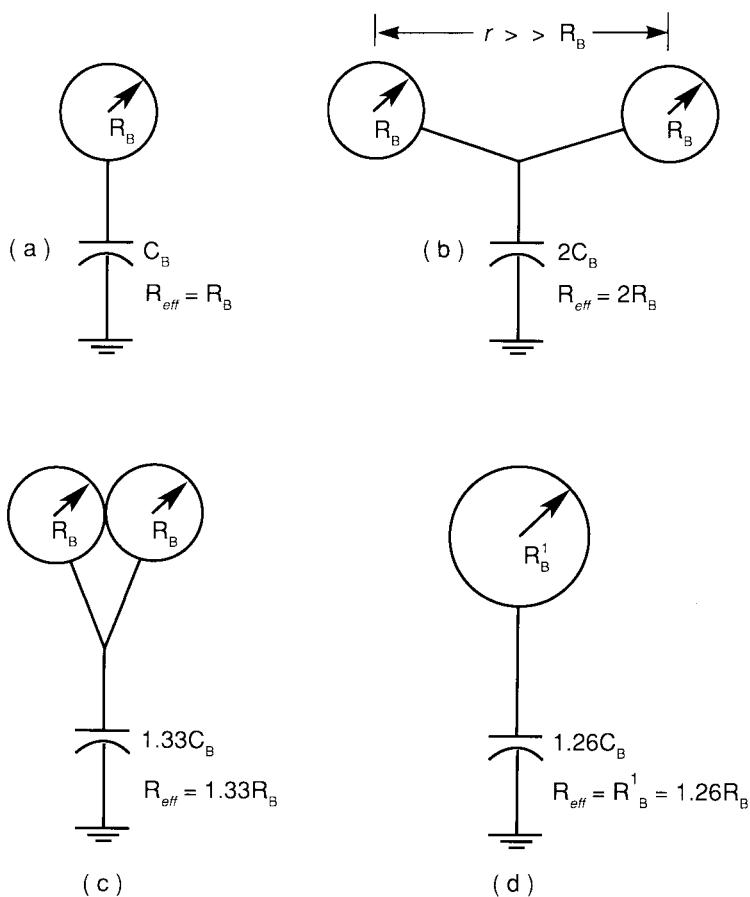
FIGURE 5.1.   SPHERE EFFECTIVE RADII AND CAPACITANCES TO SPACE

simple example, assume there are two metal spheres 1 and 2 with radii R_1 and R_2. The direct capacitance between them (from Reference [1]) is:

$$C_{12} = 4\pi\varepsilon R_1 R_2 / r_{12}, \tag{5.3}$$

where R_1 and R_2 are the effective radii of the spheres, and r_{12} is the distance between their centers, with r_{12} many times greater than either R_1 or R_2.

Then, instead of a metal sphere, it is possible to substitute Tom, an average-size male human being standing on an electrically insulated platform, and measure his capacitance through ε_0 space to ground. When Tom extends his arms, his capacitance is slightly greater, and when he curls in a tight ball, it is slightly less. Assume Tom's capacitance in a relaxed standing position measures about 60 pf to space. From equation (5.2) with $\varepsilon = \varepsilon_0 = 8.85x10^{-12}$ farads/meter, Tom's effective radius is about 0.54 meters.

Using Figure 5.2 as an illustration, imagine Tom with a capacitance to space of 60 pf, having a smaller wife named Anne with a capacitance to space of 40 pf. They have *effective* radii of 0.54 meters and 0.36 meters, respectively. If they are far enough apart, say a few meters or more, and one measures the capacitance between Tom and Anne, it will be found that the measured capacitance is about 24 picofarads, or the value of the two space capacitances in series. This holds true even when Anne is home in Iowa and Tom is traveling in Japan. In other words, this measured capacitance does not vary with the distance between them so long as that distance is much greater than their effective radii. Even when Tom and Anne are far apart, however, there is also the *direct* capacitance between them which varies inversely with distance but is so small in relation to the two capacitances to space that it is unmeasurable. For example, if Tom and Anne are 100 meters apart, their interlinking direct capacitance is only about $2x10^{-13}$ farads, or about 0.2 pf. At a separation of 1000 meters, the direct capacitance drops to about 0.02 pf; at 10,000 meters, 0.002 pf, and so on. These are all small capacitances with respect to the 24 pf series space capacitance separating Tom and Anne. The image that one generally thinks about for a two-plate capacitor has completely shifted around — the "fringe-effect" capacitance, which one is usually told to neglect, is now the large dominate *space* capacitance, and the object-to-object (plate-to-plate) *direct* capacitance, which is usually of greater interest, is small and seemingly insignificant. But both kinds of capacitance are equally important for correctly analyzing gravity circuits which utilize Q-field voltage gradients with real or artificial capacitances to determine gravity forces.
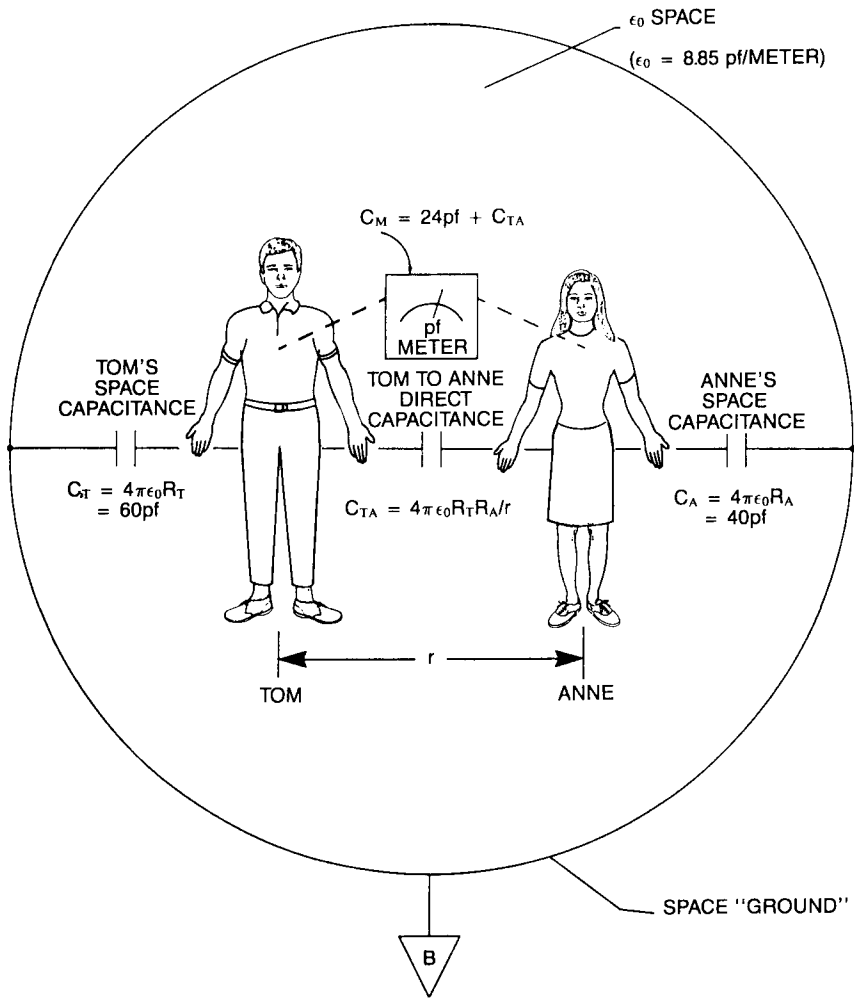
FIGURE 5.2. TOM AND ANNE CAPACITANCE LINKAGE CIRCUIT

Here, the basic difference between electrostatic capacitance and gravity capacitance is apparent. When Tom extends his arms, his electrostatic capacitance to space, or to other objects, increases because his electrostatic effective radius or metal sphere equivalent radius increases, but Tom still weighs the same, arms in close or extended. Why? The difference exists because gravity force is a summation of individual particles' capacitance forces which add up to the total capacitance force, and whether Tom extends his arms or not, he still is comprised of the same particles.

In free space then, the total electrostatic capacitance of an object to the background is $4\pi\varepsilon_o R$; where R is this effective *metallic* radius of the object; while the gravity capacitance of an object, which consists of many far-spaced particles (far-spaced relative to the particles' sizes) is $4\pi\varepsilon_o (R_{p1} + R_{p2} + R_{p3} + \ldots\ldots R_{PN})$ where R_{p1}, R_{p2}, R_{p3}, and so on are the individual effective metallic radii of the individual particles.

When the individual particles in an object are all identical and *quantum* (that is, the smallest possible sub-divided) particles, gravity capacitance is the summation $4\pi\varepsilon_o (\Sigma R_q)$, where R_q is the effective metallic radius of each quantum particle. In the special case, where the electron is considered as the smallest possible quantum particle, its quantum radius in free space is designated R_o in this text.

Chapter 6

Particle Energy, Mass, Capacitance and Effective Radius

Einstein established a well accepted hypothesis that mass is related to energy in his expression $E = mc^2$, where E is the energy, m is the mass, and c is the velocity of light in vacuum free-space. Consider the case of a single electron at rest, and assume that the only energy it has is electrical in nature, related to its charge q_e times its electrical potential v_e relative to a neutral background space. Then:

$$q_e v_e = m_e c^2. \tag{6.1}$$

Given that the charge q_e is $Q_e = -1.60219 \times 10^{-19}$ coulombs, mass m_e is $M_e = 9.10953 \times 10^{-31}$ kilograms, and c is 2.99792×10^8 meters per second (all carefully measured quantities as shown in Reference [1]), then the electron potential relative to space is:

$$V_e = M_e c^2 / Q_e = -5.11001 \times 10^5 \text{ volts, and} \tag{6.2}$$

$$Q_e / C_e = -5.11001 \times 10^5 \text{ volts,} \tag{6.2A}$$

where C_e is the electron capacitance to space.

If a small single body with a charge q has a potential v, its capacitance to infinite background space is q/v, since capacitance is defined as the ratio of charge-to-voltage. The electron capacitance C_e is then:

$$C_e = Q_e/V_c = 3.13539 \times 10^{-25} \text{ farads.} \tag{6.3}$$

But capacitance also has a geometrical relation without utilizing charge or voltage. If one assumes (in a concept that is not necessarily correct) that the electron is a good conductor (having low resistivity) like a small metal ball, then its geometrically derived radius under this assumption is:

$$R_e = C_c/4\pi\varepsilon_o \tag{6.4}$$

$$= 2.81795 \times 10^{-15} \text{ meters.}$$

The value above has traditionally been called the electron "classical" radius. In this text it is called the electron "effective" radius for specific purposes explained later in the text. If one is curious enough to wonder: what is the "real" radius of the electron, then specific relevant qualities of the electron determine the radius for those qualities. For example, much of the energy of the electron is radiated as an electric field which extends to infinity. Should the "real" radius be infinity, or at least, very great? What about a "collision" radius for other small bodies that might smash into it; is this not a better definition? Actually, many ways of visualizing the electron have been offered. The classical radius has been discarded by many physicists in favor of saying that an electron is more like a *point* charge, and thus has zero radius (which then also results in an infinite energy, unacceptable by Einstein's energy-mass relation). Other physicists picture the electron as part of a plasma cloud.

Now, see what happens when the proton is considered as a single body with a measured charge q_p of +1.60219 x 10^{-19} coulombs and a measured mass m_p of 1.67265 x 10^{-27} kilograms. One should be able to use the same Einstein energy-mass approach as was used for the electron to obtain the proton's radius, or at least one might think so. But, this is what happens:

$$q_p v_p = m_p c^2$$
$$V_p = M_p c^2/Q_p = 9.38277 \times 10^8 \text{ volts}$$
$$C_p = Q_p/V_p = 1.70759 \times 10^{-28} \text{ farads}$$
$$R_p = C_p/4\pi\varepsilon_o = 1.53471 \times 10^{-18} \text{ meters}$$

This kind of analysis results in an unacceptable conclusion that a proton has an energy-derived radius about 1836 times shorter than the electron radius. This is wrong from everything that is known, but why is the analysis incorrect and how can it be corrected? Enter at this point with the particle concept.

If one stops somewhere getting smaller and smaller in size and considers some tiny particle as the basic (quantum) sized body, the rest of the bigger bodies can be assumed to be composed of many of these quantum particles. For the moment, charge, and other factors as well, are neglected, and one just assumes the mass ratio of the larger body to the particle determines the number of particles in the larger body. If these quantum particles are separated at great distances from each other with respect to their sizes, and vacuum space is in between, the overall mass and overall capacitance vary together; that is, each is directly proportional to the quantum value for a single particle multiplied by the number of particles. Thus both mass and capacitance vary as a function of particle density times the volume of the larger body. For now, assume that the electron is as small as we can get and is the quantum particle. First, using the values obtained in (6.1), (6.2), (6.3), and (6.4), and treating electrons as tiny little metal balls (a visualization to be modified later), one can see that if there were 1836 far-spaced electrons in a proton sized container of vacuum, the mass, capacitance, and effective radius of the larger body would each increase by a factor of 1836. And, in reality, this is *something like* what happens in a real proton, but there are a number of other considerations and side effects.

1. In a proton there are both plus and minus charges, but the total plus charges cancel and override the total negative charges resulting in a net plus charge for the proton.

2. In a laboratory analogy, when N metal balls are brought near each other, the total capacitance of the balls to space is less than N times the capacitance of a single ball. This "proximity effect" can be denoted by K_p as a multiplying factor, always having a value of one or less. The actual magnitude for K_p ranges from 1 to $N^{-2/3}$ when proceeding from infinite particle spacing down to coincidal centers of volume position. Figure 6.1. (upper graph) is the measured total capacitance versus center to center spacing for two equal sized aluminum spheres.

   When the spacing is zero, the total volume of the resulting sphere is assumed to increase by a factor of 2, increasing the radius and capacitance by a factor of $2^{1/3}$, or about 1.26. K_p is then about 0.63;

Two Spheres Combined to Space
Two Spheres in Parallel to Space
Each Single Sphere to Space

CENTER TO CENTER DISTANCE (in radius units)

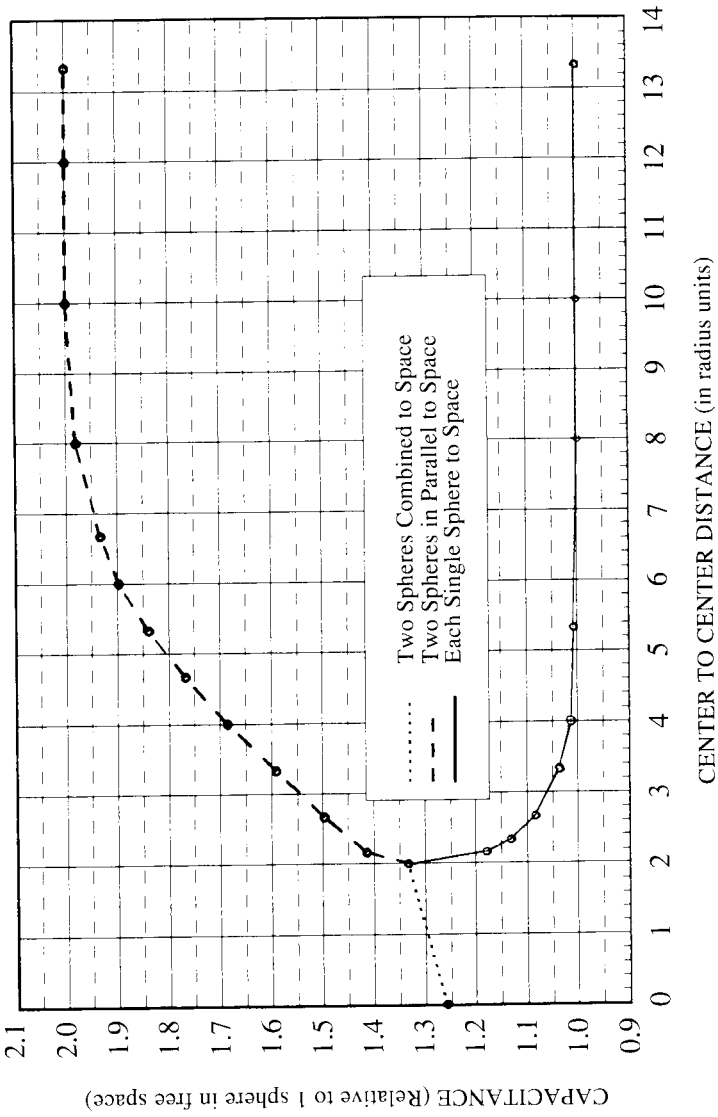CAPACITANCE (Relative to 1 sphere in free space)

FIGURE 6.1. MEASURED PROXIMITY CAPACITANCES OF TWO IDENTICAL CONDUCTIVE SPHERES

that is, $C_t = 0.63\ NC_p$ where C_t is the total capacitance to space and C_p is the free space capacitance of a single sphere. Notice, however, that from the point of view of each individual sphere, its capacitance is increased with closer proximity, as shown in the lower graph. Spheres or balls are rough analogy tools to show what happens with particles.

3. When particles in close proximity are charged, so that the total net charge is kept constant, the energy as seen from outside can be increased with closer spacing, even though the total net capacitance (energy)(mass) is less than that of the smaller sized particles added individually; that is, $K_p(q_1 + q_2)^2/C_t$ is greater than $K_p[(q_1{}^2/C_{p1})+(q_2{}^2/C_{p2})]$ when the two charges are of the same polarity in a two-particle close-spaced situation. The total energy increases (and consequently total mass) with closer spacing even more so when there are more than two closely-spaced charged particles.

These kinds of offsetting effects show up in the atomic periodic table of elements which consist of particles of electrons, protons, and neutrons.

1.) The energy (mass)(capacitance) for any element is always lower than the sum of the individual electron, proton, and neutron energies (masses)(capacitances) due to particle proximity.

2.) For the element table, the overall energy (mass)(capacitance) is reduced by proximity to less than the sum of individual particle energies (masses)(capacitances) as the atomic Mass Number A increases from 1 (hydrogen) to 56 (iron), but energies and masses relative to the sum of those of the individual particles turn around and increase with increasing Mass Numbers for elements 57 through 238 (and beyond). (See Figure 6.2.) The increasing relative energies for greater Mass Numbers can be compared to keeping the total charges constant while decreasing total capacitance to less than the sum of the individual particle capacitances as exemplified in the two ball spacing experiment, so that $q_t{}^2/C_t$ energy increases with more closely spaced particles.

In an element, the protons, which are the equal-plus charged particles with most of the capacitance, provide the greatest portion of the increasing $q_t{}^2/C_t$ close-spacing effect. The equally numbered minus-charged electrons, because of their relatively much smaller capacitances (energies) (masses), are not significant. The neutrons, without *net* charge of their own, nevertheless provide q-loading proximity capacitances in addition to their internal charges and energies making up their masses. Now, to believe that such
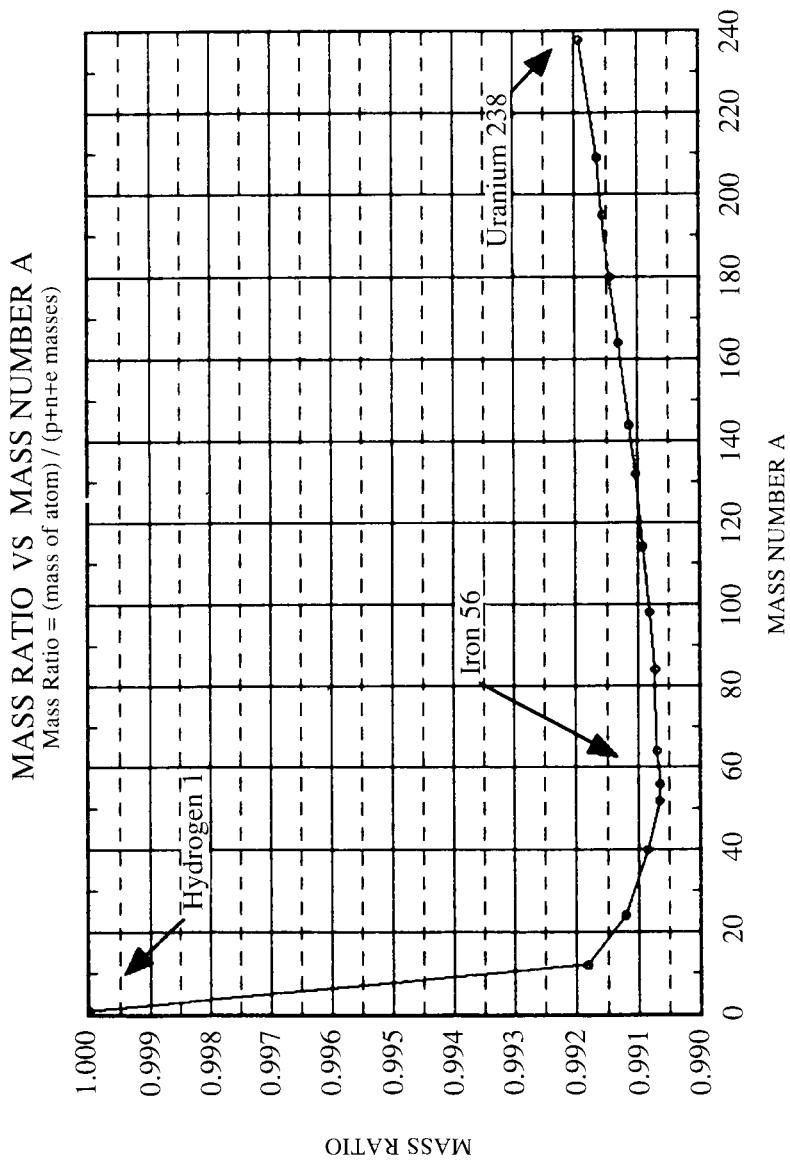
FIGURE 6.2. RATIO OF TOTAL MASS TO SUMMED PARTICLE MASSES (PROXIMITY FACTOR K_p) FOR ELEMENTS WITH MASS NUMBER FROM 1 TO 238.

nuclear actions truly have anything to do with capacitances, one can turn to other close analogies provided by electrostatics. First though, some review is in order.

Earlier it was demonstrated that tiny field-short-circuiting particles in a vacuum, or in air, pull to each plate of a capacitor, even when external to the volume between the plates and distanced remotely from the strongest field. When such particles are far-spaced from each other relative to their sizes, yet closely-spaced enough to look from a distance like a single blob, the total attraction force between this blob and each plate is proportional to the numbers and sizes of the particles. However, the attractive force is also proportional to the "size" of the plate to which the blob is attracted, and should the plates themselves consist of vacuum pieces filled with particles, the attractive forces are dependent upon the product of the numbers and sizes of particles at each end of the reaction - like gravity! In electrostatics, it would be difficult to energize a number of separated insulated pieces forming the plates of a capacitor to try this experiment.   In nuclear configurations, particle capacitance reactions happen naturally.

In electrostatics, if the particles in a capacitance reaction are not field-short-circuiting but field-open-circuiting, the forces are all repulsive rather than attractive. If the particles have the same field impedivity as the background space, the forces are neither attractive or repulsive, but zero. These kinds of force reactions can readily be demonstrated in oil or distilled water (Reference [1]).

For CTG gravity, which has exactly the same qualitative type of force actions, the attractive reactions are all based on field-short-circuiting particles; that is, a greater permittivity ε_p for the particles than the ε_b permittivity of the background. For reactions of single particles in vacuum free-space, for example:

$$\varepsilon_p > \varepsilon_b = \varepsilon_o = 8.85419 \times 10^{-12} \text{ farads/meter} \qquad (6.5)$$

Exactly what are the capacitances of objects and between objects in space, and how do these capacitances relate to the objects? There is more to the concept of capacitance than one might think when having only a casual familiarity with capacitances or capacitors.

First, consider that all objects are made up of much smaller randomly-spaced particles, each with its own capacitance to space. Then in the absence of strong (short circuiting) electric fields, the larger object is like a piece of vacuum filled with these smaller particles, and has its total

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capacitance to space dependant on the numbers and sizes of the smaller particles.

This total capacitance is then proportioned to the larger objects volume. If the object is a perfect sphere, the objects' capacitance is proportional to the radius cubed; that is:

$$C \propto R^3$$

But every physicist knows, that for a sphere of metal, for example, the capacitance is $4\pi\varepsilon_0 R$, which is proportional to the radius; that is;

$$C \propto R$$

What is wrong?

The following is extracted from a letter written by Leigh Tesfatsion, Professor of Economics and Mathematics at Iowa State University, after noting that someone objected to a capacitance dimensional ambiguity brought about by the CTG concept.

> I take strong issue with [your] review of *CTG Capacitance Theory of Gravity*, by Morton F. Spears. [You cite Spears for using equations with unbalanced dimensions.]
> The dimensionality problem noted is only apparent, not real. As it turns out, a careful reading of Mr. Spears' theory reveals that his view represents a fundamental generalization of the standard physics interpretation of capacitance which contains the standard interpretation as a special case.
> More precisely, whereas standard physics thinks of capacitance as measured for a single entity, say a single particle ball of radius R, Spears measures capacitance for a vacuum region, say a vacuum ball B of radius R, which in turn contains particles, say N identical particles each of radius r. The expression Spears obtains for the capacitance of B is then proportional to R^3/r^2, a term which is measured in units of distance. The reviewer criticizes Spears for speaking of capacitance as proportional to R^3 (distance cubed) on the grounds that capacitance as standardly defined is proportional to R (distance). But what the reviewer overlooks is that *Spears' statement is conditional on a given value for r*. Consequently, given r, it is correct to speak of C varying in proportion to R^3 in response to a change in R. This does not contradict the fact that C itself is

proportional to distance, namely, to R^3/r^2.

In mathematical terms, the relation between Spears view of capacitance and the standard physics view can be illustrated as follows.

Consider a ball B in vacuum space with volume V and radius R which is loaded with N homogeneously dispersed identical short-circuiting particles P of radius r and volume v. In this case each of the particles has essentially infinite permittivity.

Let ε_o denote the permittivity of the background space and let k denote the "stacking factor" measuring the extent to which the particles P fill the ball B. Then the capacitance C of the ball B to the background space is given in Spears' CTG theory as follows:

$$C = N \cdot 4 \cdot \pi \cdot \varepsilon_o \cdot r, \qquad (1)$$

where

$$N = \text{number of particles in the ball B} \qquad (2)$$
$$= k \cdot V/v.$$

The volume V of the ball B satisfies

$$V = 4/3 \cdot \pi \cdot R^3 \qquad (3)$$

and the volume v of the particles P satisfies

$$v = 4/3 \cdot \pi \cdot r^3 \qquad (4)$$

Combining equations (1), (2), (3) and (4), Spears' expression for C reduces to

$$C = k \cdot [R^3/r^3] \cdot [4 \cdot \pi \cdot \varepsilon_o \cdot r]$$
$$= [k/r^2] \cdot [4 \cdot \pi \cdot \varepsilon_o \cdot R^3]. \qquad (5)$$

In contrast, the standard physics expression for capacitance of the ball B is

$$C = 4 \cdot \pi \cdot \varepsilon_o \cdot R. \qquad (6)$$

The difference between Spears' representation for C in (5) and the standard representation (6) is that the latter representation assumes that the ball B is itself a single particle ball of radius R, and not a

vacuum ball containing N particles of radius r. The Spears' representation for C reduces to the standard representation in the special case in which N = 1, R = r, and k = 1, i.e., the case in which the vacuum ball B contains only one particle which coincides with B itself.

In short, I believe that [the reviewer] would do well to take a more careful look at the simple yet thought-provoking theory of gravity proposed in *CTG Capacitance Theory of Gravity.*

Professor Tesfatsion has given an elegant readily understood mathematical analysis of capacitance for smaller particles making up a larger object, but there is still more that has to be considered for a more complete understanding of the particle capacitance concept.

When far-spaced particles are pushed closer together, the total capacitance of the object is *less* than the summed capacitances of the individual particles, even though each individual particles' capacitance to outside space is *greater* than when the particles were truly far-spaced. These spacing effects are exemplified in Figure 6.1. measurements for two metal balls coming closer together. With this *proximity effect*, the total capacitance of an object is:

$$C_t = K_p N 4\pi\varepsilon_o R_p, \qquad (6.6)$$

where K_p is the proximity factor affecting the total capacitance of an object with N identical particles, each with an effective radius R_p.

When there are several kinds of smaller particles involved (say three, for example),

$$C_t = K_p 4\pi\varepsilon_o (N_1 R_{p1} + N_2 R_{p2} + N_3 R_{p3}) \qquad (6.7)$$

If, in concept, one keeps thinking smaller and smaller, it can be assumed finally that everything consists of a multiplicity of only one *"size"* quantum particle. Electrons, protons and neutrons (and all other entities) simply consist of numbers of these specks. It turns out for CTG, the electron-sized particle is small enough to be considered as having the basic quantum "size", with some particles having negative quantum charges (electrons); some particles having positive quantum charges (positrons); and some particles having no charges (neutrinos). Then, the simpler Equation (6.6) applies as preferable to requiring Equation (6.7) for total capacitances of objects. The *"effective"* radius of the electron is therefore

an important basic parameter for determining the capacitances, energies and masses of objects.

But there is yet another effect to be considered. It concerns the permittivity or the conductivity of the smallest quantum particle and the results for the total object. How do these properties affect capacitances? The experiments carried out for *CTG Capacitance Theory of Gravity* show that objects with lower impedivity than the background pull towards charges — those with higher impedivity, push away from charges. How is this effect brought into the expressions for capacitance?

Assume first an object consisting of N quantum particles, all electron sized, for example. Consider completely short-circuiting particle material or space as having infinite permittivity rather than infinite conductivity, since there are no electron current flows involved for sub-nuclear particles. Thus all sub-nuclear particle conductivities are zero, and a particle's permittivity, rather than its conductivity, inversely determines its impedivity. Consider completely open-circuiting material or space as having zero permittivity (no such material or space has ever been documented). For infinite, zero, and all particle permittivities in between, an equation for total capacitance of an object has been derived from experimental measurements in the form:

$$C_t = K_p N 4\pi\varepsilon_o R_e (\varepsilon_p - \varepsilon_o) / (\varepsilon_p + \varepsilon_o), \qquad (6.8)$$

where R_e is the *"energy effective"* or *"metallic"* classical radius of the quantum particle electron as found by Einstein's mass-energy relation, and by Equation (6.4). The uncharged (or unenergized) quantum radius for the electron, however, is dependent upon particle and background permittivities and:

$$R_{eq} = R_e (\varepsilon_p - \varepsilon_o) / (\varepsilon_p + \varepsilon_o) \qquad (6.9)$$

In general, for every small particle, its effective radius and capacitance are:

$$R_{pe} = R_{pm} (\varepsilon_p - \varepsilon_b) / (\varepsilon_p + \varepsilon_b) \qquad (6.10)$$

$$C_{pe} = 4\pi\varepsilon_b R_{pm} (\varepsilon_p - \varepsilon_b) / (\varepsilon_p + \varepsilon_b), \qquad (6.11)$$

where R_{pm} is the effective radius of the particle as if all of it were metal short-circuiting an electrical field (like a silver speck, for example), ε_p is the

actual permittivity of the particle, and ε_b is the permittivity of the background, whatever the medium.

Equations (6.8), (6.9), (6.10) and (6.11) are derived from measurements of capacitances and forces between objects submerged in liquid dielectrics. Note from (6.11) that a particle or an object's total capacitance to the background is *zero* if its permittivity is equal to the background permittivity, and its particle or total capacitance is *negative* if its permittivity is less than the background permittivity. This is what really happens in laboratory experiments. When a conductive metal sphere (equivalent to a near infinite permittivity sphere for field short-circuiting purposes) is hung as a pendulum weight to form a positive capacitance to the background, and is established as a capacitance reference, the following capacitance effects happen:

1. Proximity of objects with greater permittivity (and conductivity) than the background increases the capacitance of the reference sphere to its background.
2. Proximity of objects with lesser permittivity (and conductivity) than the background reduces the capacitance of the reference sphere to its background.
3. Proximity of objects with the same permittivity (and conductivity) as the background do not effect the capacitance of the reference sphere to its background space.

When this same reference pendulum weight is charged by applying a high voltage relative to the background, the following force effects happen:

1. Objects with greater permittivity (and conductivity) than the background are attracted to the reference.
2. Objects with lesser permittivity (and conductivity) than the background are repulsed away from the reference.
3. Objects with the same permittivity (and conductivity) as the background are neither attracted or repulsed by the reference.

Figure 6.3 is a plot of how the effective capacitance factor, or more definitively, the effective radius factor, varies for an object which is fixed in size, but has either its own or its background permittivity varied. Three parts of the plot have been measured and are precisely correct: 1.) When $\varepsilon_p/\varepsilon_b$ approaches infinity, the $(\varepsilon_p-\varepsilon_b)/(\varepsilon_p+\varepsilon_b)$ factor is plus 1.0. 2.) When $\varepsilon_p/\varepsilon_b = 1$ (that is, $\varepsilon_p = \varepsilon_b$), the factor is zero; and 3.) when $\varepsilon_p/\varepsilon_b$ approaches zero, the factor is minus 1.0. This factor is designated K_R for CTG purposes. To verify the accuracy of the factor plot in Figure 6.3 for other permittivity ratios, careful measurements (not done to date) are required. Fortunately,

such measurements are not necessary for any gravity analysis that follows in this presentation.

To make this concept clear, however, consider finding the capacitance to background space of a 10 cm. diameter plastic ball P made of a material with a dielectric constant of 3.0 (and near zero conductivity). First one finds the capacitance as if it were a metal ball M; that is:

$$C_M = 4\pi\varepsilon_o R_M = 4\pi \times 8.85419 \times 10^{-12} \times 0.050 = 5.56 \text{ picofarads}$$

Then, to find C_P, C_M is multiplied by the permittivity factor K_R; which is $(\varepsilon_P - \varepsilon_o) / (\varepsilon_P + \varepsilon_o)$. Thus:

$$C_P = C_M (\varepsilon_P - \varepsilon_o) / (\varepsilon_P + \varepsilon_o)$$
$$= C_M (3\varepsilon_o - \varepsilon_o) / (3\varepsilon_o + \varepsilon_o)$$
$$= 5.56 (2\varepsilon_o / 4\varepsilon_o)$$
$$= 2.78 \text{ picofarads},$$

or one half the capacitance of a metal ball of the same size. *The "effective radius" of the ball for capacitance* is $R_{Pc} = C_P / 4\pi\varepsilon_o = 0.025$ meters or just half the "real" radius of the plastic ball.

But suppose the 10 cm. diameter ball is made of a plastic with a dielectric constant of only 1.001. Then:

$$C_P = 5.56(0.001 \varepsilon_o / 2.001 \varepsilon_o)$$
$$= 2.78 \times 10^{-3} \text{ picofarads},$$

or about 1/2000 times the capacitance of a metal ball of the same size. The *"effective radius" of the ball for capacitance* is $R_{pe} = C_P / 4\pi\varepsilon_o \approx 2.50 \times 10^{-5}$ meters, or 1/2000 times the "real" radius of the plastic ball.

It is postulated that this same type of effect takes place with minute particles, reducing the *"effective radius for capacitance"* of the charge-less electron to a very tiny value as will be illustrated in the text that follows. The graph values of K_R as depicted in Figure 6.3 may not be precise, but the concept is still valid.

What does this all mean in terms of gravity, or electrostatics for that matter? It means that both gravity and electrostatic forces can use the same form of the common capacitance force expression:

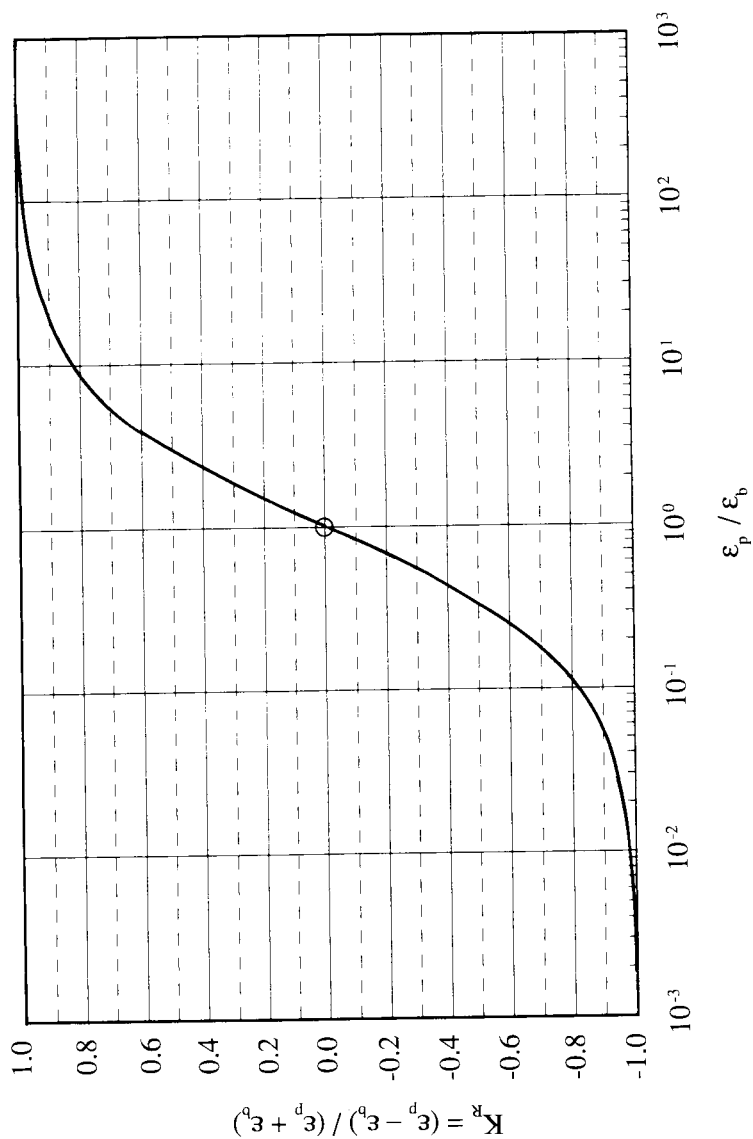$$F_{12} = - C_{12} V^2_{12} / 2r_{12}, \qquad (6.12)$$

FIGURE 6.3. CAPACITANCE FACTOR VS PARTICLE TO BACKGROUND PERMITTIVITY RATIO

where F_{12} is the force between two objects 1 and 2, C_{12} is the capacitance between the objects, V_{12} is the potential between the objects, r_{12} is the distance between the "centers" of the objects, and the minus sign denotes attraction. When C_{12} is positive, attraction occurs; when C_{12} is zero, no force occurs; when C_{12} is negative, repulsion occurs. What differs in electrostatics and gravity is the nature of the capacitance. For basic two-metal-ball electrostatics, the capacitance in free space between two far-spaced balls is simply $C_{12} = 4\pi\varepsilon_o R_1 R_2/r_{12}$. In other media such as liquids with a permittivity of ε_b, for example, the capacitance between *any* two balls is $C_{12} = 4\pi\varepsilon_b R_1 R_2/r_{12}$ with a possibility of either effective radius R_1 or R_2 being negative, because K_R can effect a negative effective radius, causing negative capacitance and a repulsive force between objects 1 and 2.

For gravity in (6.12), C_{12} is derived from the total capacitances C_1 and C_2 of two interacting objects, which sum the individual capacitances of their respective particles, and includes the proximity effects and the permittivities of the individual particles with respect to background space. The basic capacitance expression, however, is the same:

$$C_{12} = 4\pi\varepsilon_{12}R_1 R_2/r_{12}, \tag{6.13}$$

where R_1 and R_2 are the effective radii of two objects, 1 and 2, and ε_{12} is the average effective permittivity over the path between centers of gravity for objects 1 and 2. The gravity expressions for the effective radii R_1 and R_2 for objects 1 and 2 are:

$$R_1 = N_1 K_{p1} K_{R1} R_e \tag{6.14}$$

$$R_2 = N_2 K_{p2} K_{R2} R_e, \tag{6.15}$$

where R_e is the classical charge-energized radius of the electron; and for object 1 and object 2, N_1 and N_2 are numbers of particles, K_{p1} and K_{p2} are the proximity factors, and K_{R1} and K_{R2} are the particle vs background permittivity factors. From (6.12), (6.13), (6.14), and (6.15), the force of gravity in free space between two objects 1 and 2 is:

$$\begin{aligned} F_{g12} &= [4\pi\varepsilon_{12}(N_1 K_{p1} K_{R1} R_e)(N_2 K_{p2} K_{R2} R_e)/r_{12}][Q_e/C_e]^2/2r_{12} \\ &= 2\pi\varepsilon_{12}(Q_e/C_e)^2 R_1^1 R_2^1/(r_{12})^2, \end{aligned} \tag{6.16}$$

Where R^1_1 and R^1_2 are the overall effective radii for objects consisting of particles which include proximity and particle permittivity effects.

Further on it is shown how Equation (6.16) works for gravity, and how electrostatic forces disappear because of the geometry of configurations of particles that make up objects in space.

Capacitance and Gravity Forces

To get an appreciation of what CTG is all about, this section is the most important one in this text. It deals with the fundamental gravity force between objects which depends upon the capacitances between the individual particles in those objects. The CTG theory does not embrace the quantum physics postulation that nearly all laws of classical physics do not apply when distances are reduced below 10^{-10} meters or so. Quantum physics has no appreciation for capacitance or capacitance effects, and has therefore "missed the boat" by neglecting capacitance as a tool for understanding particle reactions. Instead, a purely empirical proliferation of relations has been invented which can predict a few things, but goes wildly astray on many more. The beauty of quantum physics, however, is that any number of all kinds of particles can be conjured up at will to make a theory fit with experimental results. Furthermore, if a proliferation of particles doesn't do the job, simply add new constants, spins, and more dimensions for space-time.

In the much simpler CTG approach, there is only one basic category for forces; that is, electromagnetic. For electromagnetics, there are two sub-categories of electric (static charge) forces and magnetic (motional charge)

forces. Gravity is a type of electric (static charge) force which is *not* a coulomb force. For all objects at rest (or at slow enough velocities to be considered at rest) static gravity, rather than motional or wave gravity, applies. For rotating objects or moving objects (relative to other objects) relativity modifies static gravity by an increase of energy or mass in the usual way, but could also be analyzed for CTG in terms of an increase in an object's permittivity or capacitance (lowering of electric field impedance) when the object consists of particles. Static gravity only is covered in detail herein. Appendix D provides a cursory look at the motional aspects of gravity.

Electrostatic analogies helping to explain gravity are provided by the sketches of Figure 7.1. Sketches (a), (b), and (c) show three arrangements for an ordinary air-spaced metal plate capacitor energized by a voltage V_{12}, and separated by a distance r_{12}. C_{12} is the plate-to-plate capacitance, neglecting the capacitance of each plate to space. For each case the force between plates P_1 and P_2 is the same; $F_{12} = -C_{12}V_{12}^2/2r_{12}$ as shown in equation (6.12) of the last section. The force is attractive in all three cases (minus sign convention) and stays attractive even if the polarity of V_{12} were to be reversed to $-V_{12}$, since the voltage difference is squared in the equation. Is there any way then to make the plates repel each other, say with the configuration of Figure 7.1.b? Yes, there is, under certain specified conditions. If plate 2, instead of metal for example, is made of some material with a permittivity and/or conductivity less than that of the surrounding background space (higher field impedivity than background space), plate P_1 will repel P_2. If (6.12) is correct, C_{12} in the equation is negative when it produces repulsion forces. Repulsion is easy to demonstrate with capacitors immersed in pure distilled water when P_2 plate of Figure 7.1.b is made of Teflon, or some other low-dielectric-constant good insulation material. If the background surrounding medium is vacuum-space, however, no repulsion is possible with any known materials, since all have either greater permittivity, greater conductivity, or both than vacuum space. In Figure 7.1 (d), (e), and (f), metal particles P_1, and P_2 replace plates P_1 and P_2 in (a), (b), and (c). The same expression for the force between P_1 and P_2 survives. If the particles are separated at a great distance r_{12} relative to the effective radii R_1 and R_2 of P_1 and P_2, the capacitance in any background permitivity of ε_b is $C_{12} = 4\pi\varepsilon_b R_1 R_2 / r_{12}$. The voltage of either particle relative to its background is determined by the q value, Q_1 or Q_2, divided by its respective capacitance C_1 or C_2. When grounded, (by direct contact), a particle's short-circuited capacitance to the background can be considered as infinite and its charge and voltage as zero.
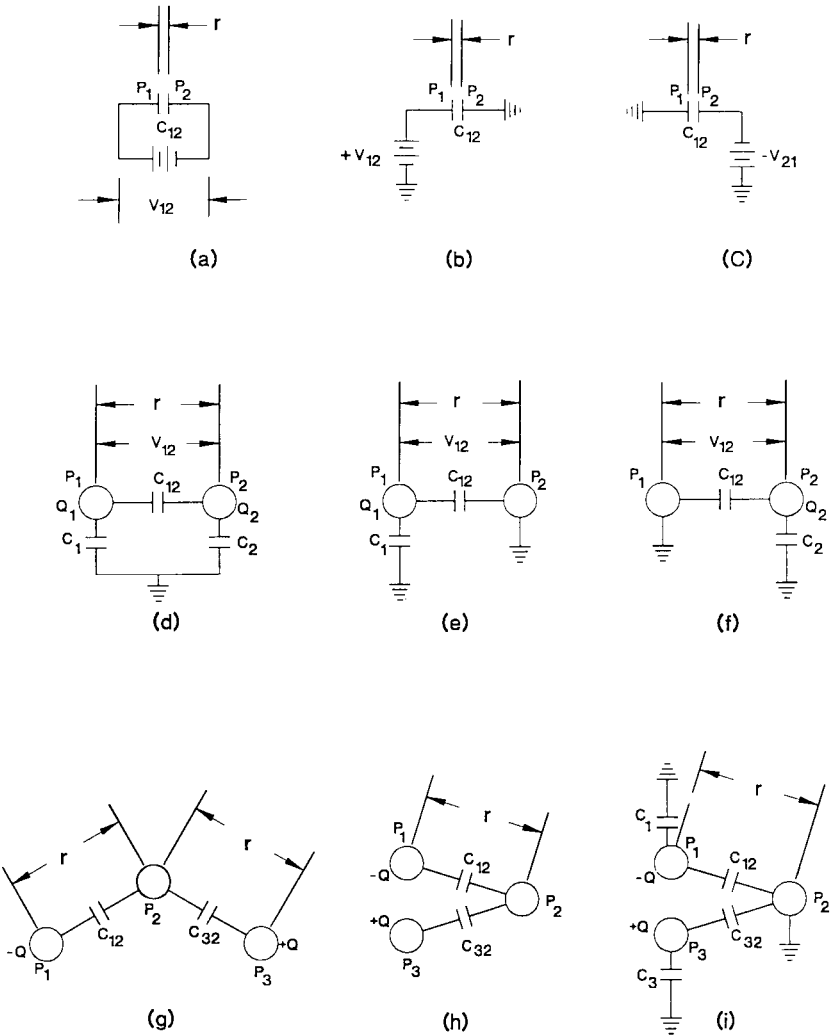
FIGURE 7.1.   TWO PLATE, TWO PARTICLE, AND THREE PARTICLE
CAPACITANCE LINKAGES

In (a), (b), and (c) the attractive capacitance forces are assumed in everyday classical physics to be derived from Coulomb's Law; that is, the plus plate pulls electrons nearer to the surface of the minus metal plate, and vice-versa, the minus plate pushes electrons back into the plus metal plate farther away from the minus charges in the minus plate. Since opposite polarity charges which attract are then closer together than the like polarity charges which repel, the overall result is attraction. This means of visualizing a force goes away when very tiny particles (say the size of electrons) face each other. There is no room in such a small entity to push or pull charges about to establish a difference in distance from other charges. Also, by Coulomb's Law:

$$F_{12} = Q_1 Q_2 / 4\pi\varepsilon_b r^2_{12}, \tag{7.1}$$

and, strictly speaking, when either Q_1 or Q_2 is zero, no forces can occur between a charged and an uncharged particle. But, they do. So engineering handbooks and other basic texts use an explanation based upon assuming half the total charge of the interlinking capacitance is positive and positioned at one plate (or particle), while the other half of the total charge is negative positioned a the other plate (or particle). The assumption is made without regard to which, if either, plate is grounded which makes this attraction force equal to the product of the half-charge and the electric field, E.

This assumption of half q's for plates or particles supplies the correct answer:

$$F_{12} = -\tfrac{1}{2}qE \ = -\tfrac{1}{2}qV_{12}/r_{12} = -C_{12}V^2_{12} / 2r_{12} \tag{7.2}$$

And for particles after substituting for C_{12}, $4\pi\varepsilon_b R_1 R_2 / r_{12}$:

$$F_{12} = -(2\pi\varepsilon_b R_1 R_2)(V^2_{12}) / r^2_{12} \tag{7.3}$$

The sketches (g), (h), and (i) illustrate how any floating uncharged particle at position 2 is effectively grounded whenever it is equidistant from equal positive and negative charges at positions 1 and 3. For its potential relative to a background:

$$V_2 = Q_1/4\pi\varepsilon_b r_{12} + Q_3 / 4\pi\varepsilon_b r_{32}. \text{ Then when } r_{12} = r_{32}, \text{ and } Q_1 = -Q_3, V_2 = 0.$$

Sketch (h) depicts closely spaced charges Q_1 and Q_3 (as in a hydrogen atom, for example) acting on a far away particle to clamp it to ground potential. Sketch (i) depicts the equivalent electrical capacitance circuit of (h). All the properties are now assembled to solve for both electrostatic forces and gravity forces from Equation (6.12). There is no problem in demonstrating that forces occur with Figure 7.1 configurations; the "meat of the conception" is to establish, that for a multiplicity of equal numbers of plus and minus charges facing another multiplicity of equal numbers of plus and minus charges, the electrical coulomb forces net to zero, but the electrical gravity forces do not, and that gravity forces net instead to an approximate magnitude equivalent to the Newton expression:

$$F_{12} = -GM_1M_2 / r^2_{12}. \tag{7.4}$$

The next few paragraphs are devoted to showing that there is virtually no possibility of a net Coulomb electric field force existing between equally disposed plus-and-minus charges in two separated substances or objects. Then it is explained how the gravity electric charge forces operate in these same circumstances.

The basic electric force expression is $F = QE$, where Q is the charge at a point in space, and E is the voltage-gradient electric field that intercepts the charge. In free-space, the vector electric field E at a distance from a point charge Q_1 is $Q_1 / 4\pi\varepsilon_o r^2$, and when this field intercepts Q_2, the force between charges is:

$$F = Q_2Q_1 / 4\pi\varepsilon_o r^2_{12} \tag{7.5}$$

Similarly, the vector electric field at a distance from Q_2 is $Q_2/4\pi\varepsilon_o r^2$ and when this field intercepts Q_1, the force is:

$$F = Q_1Q_2 / 4\pi\varepsilon_o r^2_{21}. \tag{7.6}$$

Equations (7.5) and (7.6) are expressions of Coulomb's Law. Notice that by Coulombs' Law, particles without charges do not have any forces exerted on them by other charges; and can therefore be eliminated from force considerations.

Forces between charges are reciprocal and equal, as shown by (7.5) and (7.6). If the two charges are of the same polarity, the force is positive (mutual repulsion) and if the charges are of opposite polarity, the force is

negative (mutual attraction).

Next, consider what happens by Coulomb's Law when the electric fields from a closely spaced oppositely charged pair of tiny particles (say a plus proton and a minus electron in hydrogen) intercept, first, a plus particle, and then, a minus particle, as shown in Figure 7.2. For this representation of Coulombs' Law the particles are small enough to be categorized as point charges; the unfilled rings signify plus charges; and the black-filled rings signify minus charges. In Figure 7.2 (a) and (b), the hydrogen atom is represented at an instant in time when the alignment of its dipole is at a right angle to the line between its center and a distant plus charge. In (c) and (d), the distant plus charge is in line with the hydrogen dipole. In (e), (f), (g) and (h) the same hydrogen atom fields encounter a distant minus charge. Notice that the vector summation force at the intercepted charged particle for (a), (b), (e) and (f) is not directionally oriented between the particle and the miniscule hydrogen dipole, but instead is at a virtual right angle to the two electric fields. Repulsive forces occur in (d) and (g), as well as the attractive forces of (c) and (h). Whenever the hydrogen dipole is rotated 180° from any orientation, the vector summation force rotates 180° also, resulting in an equal magnitude force on the charge pointing in the opposite direction.

Now assume that there are myriads of randomly orientated hydrogen dipoles intercepting, by means of electric fields, myriads of plus, minus and zero charged particles. For every force on a single charge, there is always an equal and opposite force on the same charge, since with a multiplicity of field suppliers, there is no orientation favored, and a summation of their force fields at any point in space is statistically zero. Furthermore, since the intercepted polarized charges are usually hooked to charges of opposite polarity, each opposite polarity charge has a real-time applied opposite polarity cancellation force. Also, by Coulomb's Law, there are no forces on any of the uncharged particles. Therefore, there are *no net coulomb forces on any of the particles, or on the whole conglomeration of particles.*

When larger atoms, molecules, and combinations of molecules occur in homogenized mixtures, there are also no coulomb forces. Only when charges are moved about, removed from or added to a material to effect an imbalance, can there be a net coulomb force, and then only if the other material (particle or object) which provides the fields is also charge-unbalanced.

Capacitance forces do not work by Coulomb's Law as just illustrated. Instead either plus or minus charged particles act upon portions of vacuum space filled with particles. If an individual particle has lower field impedivity
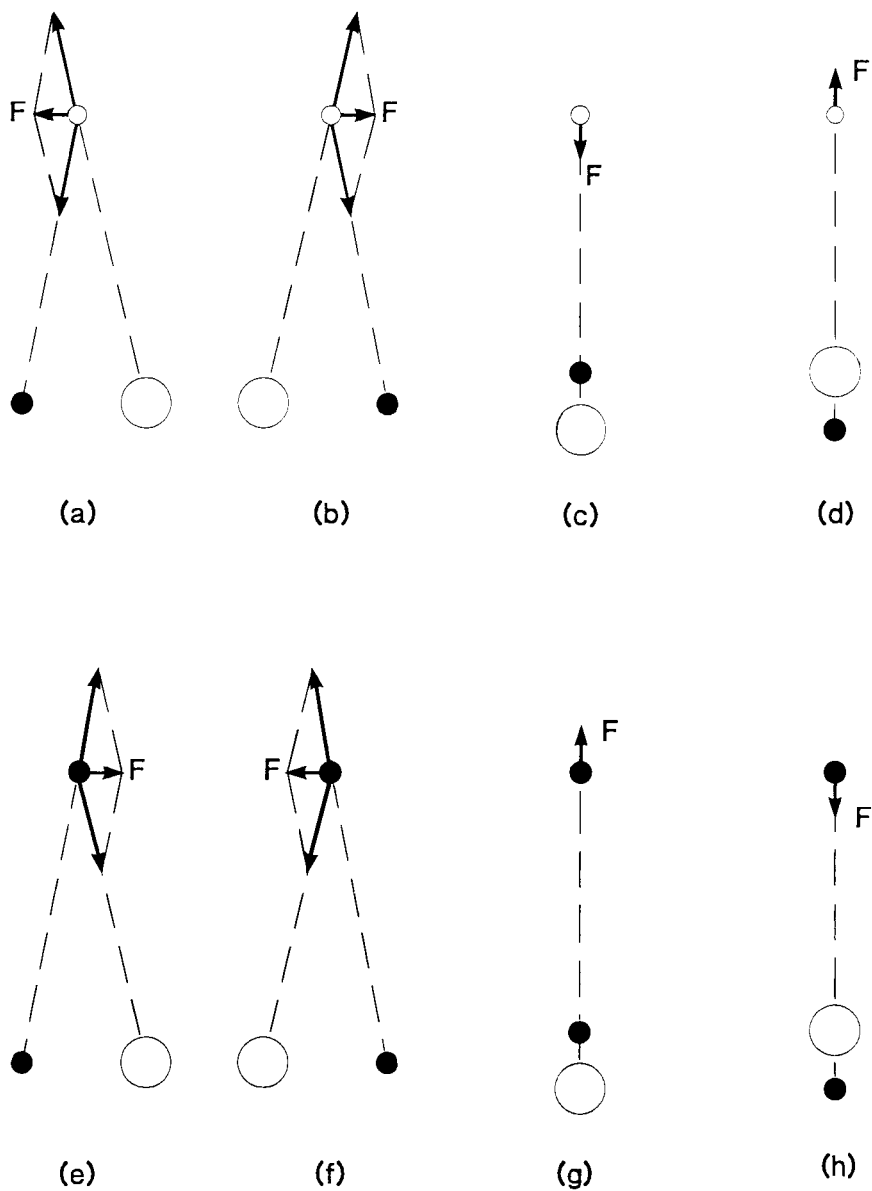
FIGURE 7.2.   DIPOLE COULOMB LAW FORCES ON A PARTICLE

than the background, attractive forces result between that particle and the charges of either polarity. If an individual particle has higher field impedivity than the background, repulsive forces result between that particle and the charges of either polarity. Only when an individual particle has the same field impedivity as the background, no forces result between that particle and the charges. Field impedivity in the realm of particles relates inversely to permittivity; that is, relative to the background, higher permittivity particles are attracted to charges, lower permittivity particles are repulsed by charges, and equal permittivity particles are neither attracted or repulsed by charges.

Figure 7.3 illustrates what happens for capacitance forces when the fields from a hydrogen atom encounter a distant particle. For this representation, a charge of either polarity (in hydrogen) is signified by a filled-in black circle, a distant particle of higher permittivity than the background is signified by an open circle while a distant particle of lower permittivity than the background is signified by a filled-in black circle.

First, the most important thing to notice is that there is always an attractive force between hydrogen (in any orientation) and the distant higher permittivity particle, as in (a), (b), (c) and (d). If in vacuum free-space, one could find particles (or materials) with lower permittivity (and also lower conductivity), than space, then the hydrogen in any orientation would always repel it, as in (e), (f), (g) and (h).

Compare Figure 7.2 and Figure 7.3.

For Figure 7.2 type Coulomb confrontations, if there are myriads of hydrogen atoms in all orientations confronting myriads of particles, the forces cancel to zero.

For Figure 7.3 type capacitance confrontations, if there are myriads of hydrogen atoms in all orientations confronting myriads of particles, the small "amplitude wobble" and small "directional wobble" forces cancel, but the much greater resultant vector forces are summed in accordance with the number of hydrogen atoms at one end of the force reaction, and the numbers of particles at the other end. The reversible mutual reaction can conceptually be understood by simply reversing the charge bi-poles (hydrogen atoms) to the other end of the reaction while the proton and electron particles in the hydrogen atoms then become higher (than the background) permittivity particles.

Consider for a moment the postulation in Reference [1] that the charge Q, voltage Q/C, and energy Q^2/C for tiny (almost point) particles at rest remain unchanged in changing permittivity backgrounds. For this to happen, a
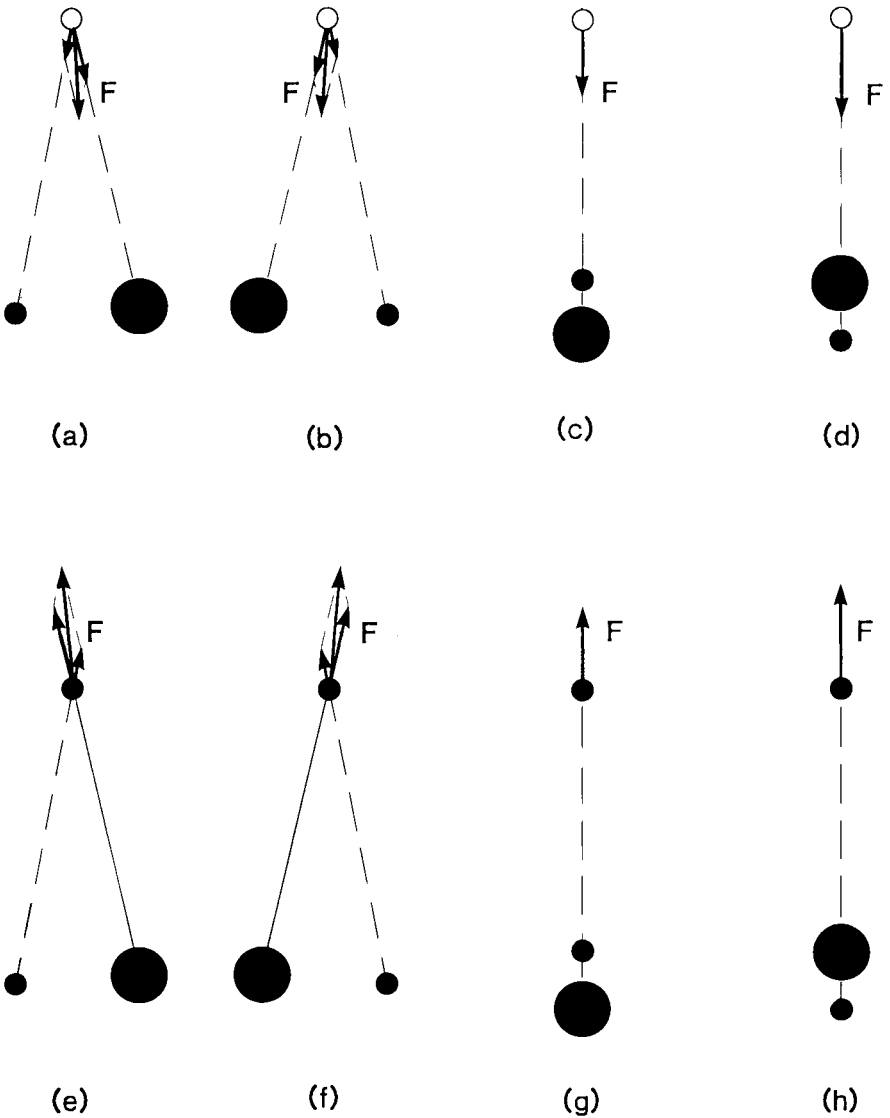
FIGURE 7.3.   BI-POLE CAPACITANCE (AND GRAVITY) FORCES
ON A PARTICLE

particle's capacitance C must also remain unchanged. Thus $C = 4\pi\varepsilon_b R_p =$ Constant, and the product $\varepsilon_b R_p$ stays unchanged. Whenever the background permittivity ε_b increases, the particle's effective radius R_p correspondingly decreases, and when ε_b reduces, R_p correspondingly increases. With this reasoning, the gravity attractive force between two particles 1 and 2 in free space takes the simple form of $-C_{12}(V_{12})^2 / 2r_{12}$ and reduces to:

$$F_{12} = -(4\pi\varepsilon_b R_{p1} R_{p2} / r_{12})(Q / C)^2 / 2r_{12}, \text{ or}$$

$$F_{12} = -(Q / C)^2 2\pi\varepsilon_o R_{p1} R_{p2} / (r_{12})^2 \tag{7.7}$$

V_{12} is Q/C because the far-away particle for gravity is always "grounded" at zero potential relative to the background as illustrated in Figure 7.1. Any charge or voltage on the far-away particle results in Coulomb forces which cancel to virtually zero when multiple balanced charges face each other as described a few pages back. Because voltage on the local particle is Q/C, and on the far away particle is zero, the difference potential V_{12} is a constant Q/C. For the positron, Q/C is equal to $+5.11001$ x 10^5 volts and for the electron, Q/C is equal to -5.11001 x 10^5 volts, as examples. The method for obtaining these values is shown in Section 2.

What remains to be determined for gravity quantitative force calculations is the "quantum" radius of the designated quantum particle electron; that is, the effective radius of the electron without charge in an ε_o background. When that is accomplished, gravity calculations can proceed quite easily.

Using expressions (6.14) and (6.15), the quantum radius of the single particle electron is:

$$R_q = K_p K_R R_e, \tag{7.8}$$

If one considers the electron by itself in free space, the K_p proximity factor is 1, and the reduction of the radius when situated in larger nucleus particles, elements, and compounds does not have to be taken into account. The *variation* of K_R as plotted in Figure 6.3 can be neglected because the electron is in a constant ε_o background, and $K_R R_e$ then has a constant fixed value. The free-space quantum radius of the electron $K_R R_e$ is next designated R_o.

To solve for R_o, the force (7.7) between two electrons in *free space* is equated to the CTG *free-space gravity* force expression which, by Reference [1], is:

$$F_g = K \, Q_p Q_e R_e R_e / 2(P+1) \, r^2_{12} \text{ newtons},\qquad\qquad (7.9)$$

where:

(1)   K is the constant unit conversion factor equal to 1 daraf/meter; converting the force in MKS "gravits" to MKS "newtons".

(2) Q_p and Q_e are the charges on a proton (or positron) and on an electron respectively.

(3) R_e is the Einstein energy-derived effective metallic radius of the electron (classical radius of the electron).

(4)   P is the proton-to-electron mass (or capacitance) ratio of 1836.15.

(5) r_{12} is the distance between the centers of two particles; 1 and 2.

Then, the force identity equation including (7.7) and (7.9) is solved below, using (6.2A) electron potential for Q/C, and values for the terms below taken from Appendix A:

$$(Q_e / C_e)^2 \, 2\pi\varepsilon_0 \, R_0^2 / r^2_{12} = K \, Q_p Q_e \, R^2_e / 2 \, (P+1) r^2_{12}$$

$$R_O = [K \, Q_p \, Q_e \, R_e^2 / 2 \, (P+1)(2\pi\varepsilon_0) \, (Q_e/C_e)^2]^{1/2}$$

$$= 1.95422 \times 10^{-36} \text{ meters} \qquad\qquad (7.10)$$

One may solve for the quantum particle radius R_0 just as well in another way by equating the force expression (7.7) to the Newton free-space gravity force expression as shown in Reference [1]:

$$F_g = -K_{aE} \, G \, M_e \, M_e / r^2_{12}, \qquad\qquad (7.11)$$

where $K_{aE} = 1.00192$, the artificial dielectric constant modifier for the earth.

Then:

$$(Q_e / C_e)^2 \, 2\pi\varepsilon_o R_o^{\,2} / r^2_{12} = K_{aE} \, G \, M_e^{\,2} / r^2_{12}$$

$$R_o = [K_{aE} \, G \, M_e^{\,2} / 2\pi\varepsilon_o (Q_e / C_e)^2]^{1/2}$$

$$= 1.95422 \times 10^{-36} \text{ meters} \qquad (7.12)$$

Notice that (7.10) and (7.12) are identical.

Make-Up of Electrons, Protons and Neutrons for CTG

For classical newtonian gravity to work, the proton-to-electron mass ratio has to be 1836.15 and the neutron-to-electron mass ratio has to be 1838.68 (Reference [2] values). Similarly, for CTG gravity to work, the proton-to-electron capacitance ratio has to be 1836.15 and the neutron-to-electron capacitance ratio has to be 1838.68 (Reference [1] values).

Using the quantum particle concept, let $N_e = 1$ quantum particle for the electron, let N_p quantum particles make up the proton and N_n quantum particles make up the neutron. How many N_p and N_n particles are there anyway? Even the electron may actually consist of many smaller more basic particles, but the electron is small enough in relation to everything else to just be considered by itself as the basic or smallest unit quantum particle. Then, positrons of equal size but opposite charge sign are also quantum particles. That is how we proceed here.

The proton appears to consist of $K_p N_p$ electron and positron quantum particles, where K_p is the proximity factor that reduces capacitance (and also mass) as shown in Figures 6.1 and 6.2. Since the proton is very close in capacitance and mass to the neutron, K_p is approximately the same for both entities and one can assume equality. Three is the minimum number of

quantum particles that can be added to a proton to go from a ratio of 1836.15 to 1838.68, or $3K_p = 2.53$. Then $K_p = 2.53/3.00 = 0.8434$. Next:

$K_p N_p = 1836.15$, and $K_p N_n = 1838.68$. Then:

$N_p = 1836.15/0.8434 = 2177$ quantum particles;
$N_n = 1838.68/0.8434 = 2180$ quantum particles.

Further, N_p consists of 1089 positive quantum particles, and 1088 negative quantum particles to effect an overall plus one (+1.60219 x 10^{-19} coulombs) positive charge for the proton; while N_n consists of 1090 positive quantum particles and 1090 negative quantum particles to effect an overall neutral charge of zero for the neutron. This sort of make-up is illustrated in Figure 8.1.

None of the above may be the actual way the electrons, protons, and neutrons are put together, but it is *one* way to explain the actual mass and capacitance ratios. It's a simple concept, and right or wrong, accomplishes what happens in reality for mass and capacitance. Say, though, that the electron actually consists of 1000 smaller quantum particles, each with a radius one thousandth of the electron or quantum radius used previously. Then, N_e, N_p, and N_n values would simply be multiplied by 1000; the charge values would have to be distributed in another way, perhaps using quark combination values, but the overall mass, capacitance and charge values would be unchanged.

electron (–)

R_e

$R_p = 1836.15\ R_e$
proton (+)

$R_n = 1838.68\ R_e$
neutron (0)
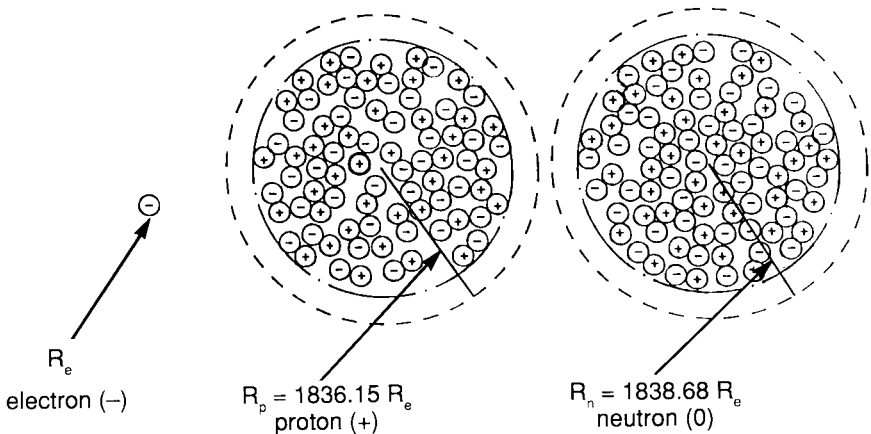
FIGURE 8.1. BUILDING BLOCK PARTICLE MODELS WITH EFFECTIVE RADII AND NET CHARGES

Pinning Down Gravity More Precisely

If one is satisfied to work within tolerances of ± 1%, either the newtonian empirical $GM_1M_2/(r_{12})^2$ expression or the theoretical capacitance $C_{12}(V_{12})^2/2r_{12}$ expression with fixed *"effective"* quantum radii for the electron ($R_o = 1.95$ x 10^{-36} meters), proton ($R_p = 1836.15$ $R_o = 3.59$ x 10^{-33} meters) and neutron ($R_n = 1838.68$ $R_o = 3.59$ x 10^{-33} meters) is close enough. In the capacitance approach, the gravity force expression for the force between two particle constructed objects in free space with total effective radii R_1 and R_2 becomes:

$$F_g = - 2\pi\varepsilon_o \, (V_{12})^2 \, R_1 R_2 / (r_{12})^2,$$

and since R_1 and R_2 are actually the sum of particle radii, and V_{12} for a charged particle is Q_e/C_e:

$$F_g = - 2\pi\varepsilon_o(Q_e/C_e)^2 \, (\Sigma R_o + \Sigma R_p + \Sigma R_n)_1 (\Sigma R_o + \Sigma R_p + \Sigma R_n)_2/(r_{12})^2 \quad (9.1)$$

For newtonian gravity, listing element masses in physics book tables (from Reference [3], for example) is one way that the reduction in mass by

proximity can be taken into account, see Figure 6.2. The newtonian force expression itself does not explain how the sum of individual masses is more than the total mass when smaller individual masses are combined. Also, there is no way to reason from the newtonian expression how gravity varies through free space, through the earth, or through any other medium. The empirical factor G takes into account that gravity has acted through the earth and is based solely upon that assumption.

Neither general relativity or quantum physics can explain the many idiosyncrasies that CTG does explain. So here goes a few. This is the only part of this text to which one has to pay close attention for understanding. It's just a bit more complicated.

First, as explained earlier, the *effective* radius of something or other is the radius for that characteristic in which one is interested. The actual material effective radius of a plastic ball in free space, for example, is greater than the capacitance effective radius of the ball. When the ball is made of metal, the material and capacitance radii in a background of air are identical. The plastic ball can be increased in effective radius for capacitance by impregnating it with small metal particles. In our universe, all material objects that we know about consist of portions of vacuum space impreg- nated with field-short-circuiting particles. These particles increase the capacitance to the background of the impregnated volume which becomes an object acted on by gravity (or by the electrostatic charges throughout the universe). The balance of plus and minus charges cancels coulomb forces, but capacitive (9.1) forces do not cancel. Nevertheless, the effective radii of closely spaced particles reduce when the density of their surroundings is increased (although there are some increased energy counter-effects as explained in Section 6 and by Figures 6.1 and 6.2). Thus for every element, molecule, or molecular compound the effective quantum radius R_o is different, although the effect of molecular spacing is much less than for atomic spacing as shown for the elements in the periodic table of Figure 6.2. A multiplying factor varying between 1.000 and 0.990 can be used to modify R_o for any particular element or element mixtures acted upon by gravity. However there is another important modifier that must be faced.

For earth gravity, for example, there are two counteracting effects.
1. Normal proximity reductions of R_o and R_o products occur within the earth, and within the object being attracted, and
2. Gravity (capacitance) paths are through ε_E earth, not through uniform ε_o vacuum space. The increased ε of the capacitance path

increases earth capacitance forces between individual particles either totally within, or between those within to those outside of the earth.
In the gravity force expression $C_{12}(V_{12})^2/2r$, when particles in the earth are acting on particles in Object x just outside the earth:

$$C_{12} = 4\pi\varepsilon_{EA}(\Sigma R_{oE}+\Sigma R_{pE}+\Sigma R_{nE})_1(\Sigma R_{ox}+\Sigma R_{px}+\Sigma R_{nx})_2/r_{12}, \qquad (9.2)$$

where subscript 1 means summation of all particles within the earth and subscript 2 means summation of all particles in the object being acted on which is situated outside the earth in air (or in the equivalent of free space). ε_{EA} is the "effective average" permittivity of the earth for the path between gravity actions. The gravity force expression of (9.1) modifies to:

$$F_g = -2\pi\varepsilon_{EA}(Q_e/C_e)^2(\Sigma R_{oE}+\Sigma R_{pE}+\Sigma R_{nE})_1(\Sigma R_{ox}+\Sigma R_{px}+\Sigma R_{nx})_2/(r_{12})^2$$
$$(9.3)$$

The force (9.3) can be expressed in terms of just the total equivalent number of R_o's at each end of the reaction since R_p is 1836.15 R_o's, and R_n is 1838.68 R_o's. The force expression then modifies to:

$$F_g = -2\pi\varepsilon_{EA}(Q_e/C_e)^2(\Sigma R_{oE})_1(\Sigma R_{ox})_2/(r_{12})^2, \qquad (9.4)$$

where ΣR_{oE} indicates the summation of all R_o's within the earth and ΣR_{ox} indicates the summation of all R_o's in the object in free space being acted on, whether R_o's are alone or in protons and neutrons.
To illustrate the point being made here, refer to Figure 9.1. The gravity force between the two balls in Sketch (a) is predicted to be slightly less than the earth-derived GM_WM_L/r^2 expression indicates, even though M_W and M_L masses are established from tables which all ready account for the particle-proximity-effect reductions of their two respective masses. The lesser gravity force occurs because the gravity fields pass through a nearly all-wax path with a lower particle-permittivity value ε_W than that of the earth ε_E.
The gravity force between the two balls in Sketch (b), however, is predicted to be slightly greater than the GM_WM_L/r^2 expression indicates because the gravity fields pass through a nearly all-lead path with a higher particle-permittivity value ε_L than that of the earth ε_E.

$$F_g = -G\, M_w M_L / r^2 \qquad\qquad \text{NEWTON}$$

$$F_g = -2\pi\varepsilon_{12}\, (Q_e / C_e)^2 R_w R_L / r^2 \qquad \text{CTG}$$
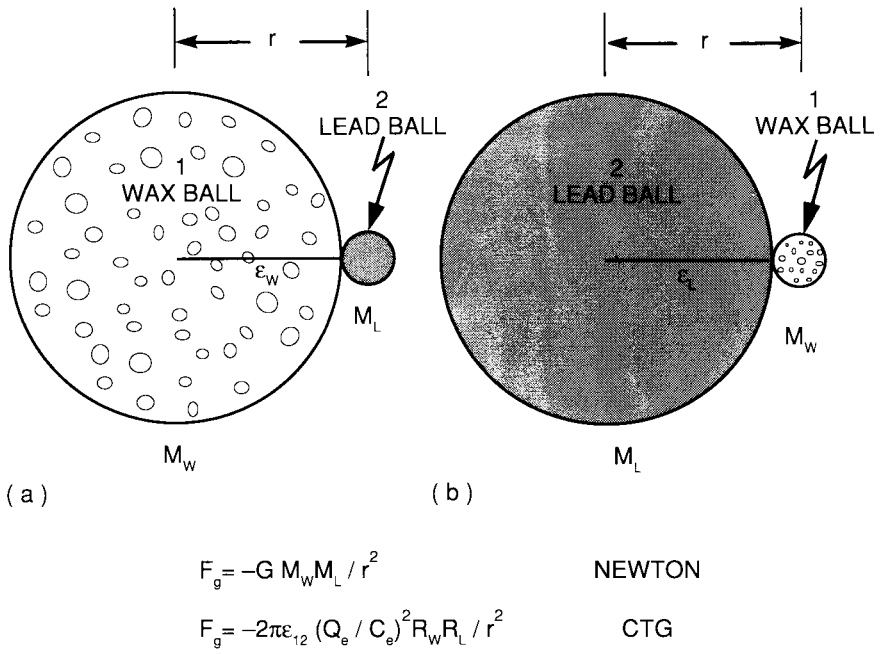
FIGURE 9.1. GRAVITY FORCES BETWEEN BALLS OF WAX AND LEAD

If the foregoing is understood, next understand that for the capacitance gravity force expression in Figure 9.1:

$R_W = (\Sigma R_{oW}) = (N_W K_{pW} K_{rW} R_e)_W$ from (6.14).

$R_L = (\Sigma R_{oL}) = (N_L K_{pL} K_{rL} R_e)_L$ from (6.15).

$(Q_e/C_e) = \pm (Q_e/C_e)$ voltages for plus or minus charged quantum particles.

ε_{12} is the average effective permittivity of the medium between the centers of Balls 1 and 2. In (a), $\varepsilon_{12} \cong \varepsilon_W$; in (b), $\varepsilon_{12} \cong \varepsilon_L$. Then, the capacitance force expression for wax and lead balls in Figure 9.1 is a specific form of the generalized expression (6.16), which is applicable to all media.

If one measures gravity at the bottom of a deep hole into the earth, and carefully accounts for the location of *all* different density masses (including the external sun and moon), centrifugal force effects, earth eccentricity, measuring equipment sensitivity, changes with temperature, pressure, magnetic fields and the like, does gravity measure greater or less than the best calculated values using neutonian gravity concepts? By Newton, there is actually no way of predicting reliably what the outcome will be, not even a good way of guessing. The easiest course is to predict *no change* and, depending where the hole is located, there's a chance of being (almost) right. The gravity force is affected by where one digs the hole because the ε permittivity path between interacting bodies determines strength increases, offsetting particle-proximity-effect (Figure 6.2 type) mass decreases. At a particular measuring location, the make-up of all the earth-varying composition masses and their relative locations determines the extent of decreasing tendencies, while the average ε of *every* separate capacitance particle-to-particle path determines the increasing tendencies.

Figure 9.2 is a two-dimensional sketch representing a simplified three-dimensional world having only two gradations of density. X represents an object buried in a hole in this world. Then, only two grades of particle-proximity mass reductions take place, but the location and distance of separate particles within the world from the object they attract have a great bearing on the total summation gravity force. In Figure 9.2, Points a through f are shown as representative particles working capacitively in conjunction with Object X. The shortest-distance capacitance paths are designated aX, bX and so on. To show the complication that results, notice that any field from point a over the path aX originates in a low density (low permittiv-
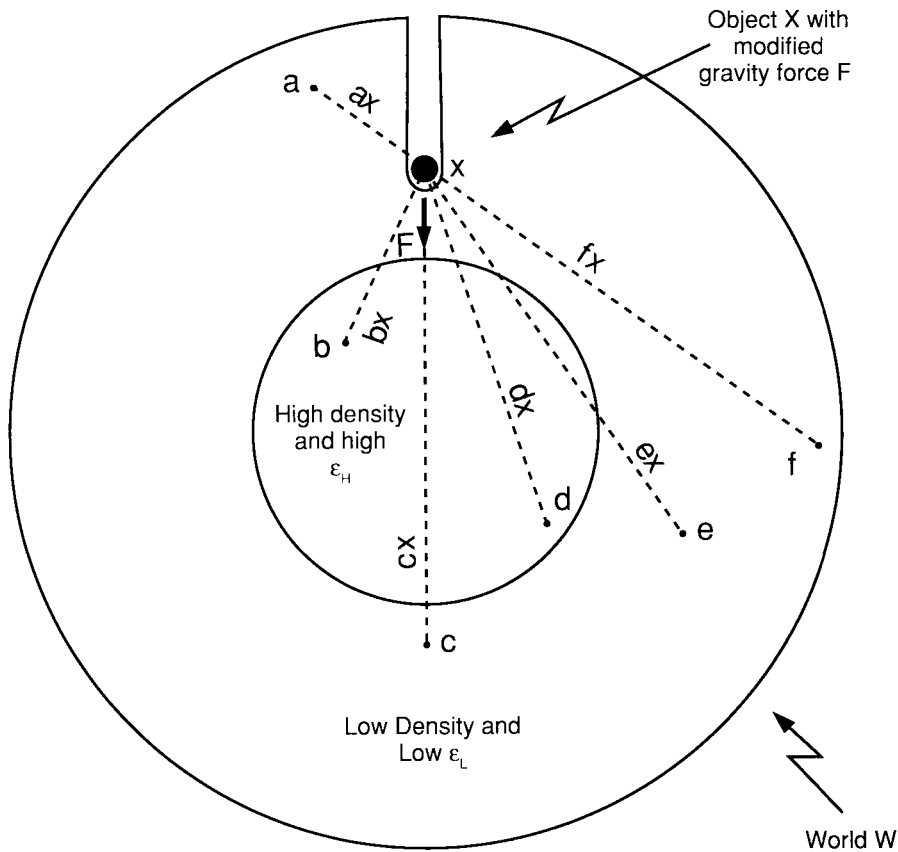
FIGURE 9.2.   PARTICLE GRAVITY FORCES ON AN OBJECT X
AT THE BOTTOM OF A HOLE IN A SIMPLIFIED TWO-DENSITY WORLD

ity ε_L) medium; then travels a relatively short distance entirely through this same medium to interact with Object X. But Point b is situated in ε_W to react with X over a path with a combination of ε_L and ε_W media. Point c is situated in ε_L, but is capacitively linked mostly through ε_W medium to react with X. Point d, although situated in ε_W, is interlinked capacitively with X over nearly the same kind of path as Point c. Point e has a relatively long capacitive path through ε_L, then ε_W, and then through ε_L again. Point f is located in ε_L and has a relatively long linkage entirely through ε_L. By now, one should get the idea that in *our* world Earth, which consists of all kinds of varying density masses situated haphazardly throughout its volume, that it is almost impossible to predict accurately what the value of G should really be in the earth gravity force formula. Not only is any prediction plagued with density variations coupled with square-of-the-distance problems, but the average ε_{EA} permittivity path between objects complicates the picture even more. At best, G is an educated guess. Therefore, variations in gravity results reported after measurements taken by anyone probing deep into the earth should not be surprising to anyone.

The general rule for CTG is that atomically denser objects produce a lower gravity attraction per particle, but gravity interactions transmit better through denser objects.

What about reactions of the earth with far-spaced objects? If the objects are really far-away with respect to the radius of the earth, most of the capacitance linkage is through ε_o space, or at least through space with permittivity close to ε_o. Since ε_o is less than ε_E, gravity has to fall-off with distance a little faster than it did through the earth while transitioning from an all ε_E linkage to a virtual all ε_o linkage far away from the earth. Reference [4] contains actual measurements resulting in greater than the square-of-the-distance fall-off of gravity just outside the earth, as one moves away from it, normal to the earth's surface. CTG is a creditable theory which explains this measured phenomenon so logically and so accurately as shown in Reference [1].

Perhaps simple mathematical relationships can show the foregoing more clearly.

Let F_{go} represent the gravity force (6.16) in free vacuum space between two tiny entities, say quantum particles 1 and 2, for example. If a medium with ε_{12} permittivity different from ε_o free space is effectively situated between Particles 1 and 2:

$$F_g = (\varepsilon_{12}/\varepsilon_o)F_{go} \qquad\qquad (9.5)$$

If, in addition, Particle 1 is in a medium background permittivity ε_1 different from ε_o, say in a piece of iron, for example:

$$F_g = (\varepsilon_{12}/\varepsilon_o)(\varepsilon_o/\varepsilon_1)F_{go} \qquad (9.6)$$

Then, in addition, if Particle 2 is also in a medium permittivity ε_2, different from ε_o, say in carbon, for example, then:

$$F_g = (\varepsilon_{12}/\varepsilon_o)(\varepsilon_o/\varepsilon_1)(\varepsilon_o/\varepsilon_2)F_{go}$$

$$= (\varepsilon_{12}\varepsilon_o)/(\varepsilon_1\varepsilon_2)F_{go} \qquad (9.7)$$

Let $(\varepsilon_{12}\varepsilon_o)/(\varepsilon_1\varepsilon_2)$ be called the total two-object modifier factor K_m.

For illustration, lets use the earth with effective radius R_E acting on a piece of Carbon 12 of effective radius R_C. Then:

$$F_g = K_m F_{go}$$

$$= [(\varepsilon_{EA}\varepsilon_o)/(\varepsilon_E\varepsilon_C)][-2\pi\varepsilon_o(Q_e/C_e)^2(R_{oE}R_{oC}/r^2], \qquad (9.8)$$

where R_{oE} and R_{oC} are the summation of particle effective radii in the earth and in the carbon object respectively. The K_m modifier factor, $(\varepsilon_{EA}\varepsilon_o)/(\varepsilon_E\varepsilon_C)$, can be expressed as $(\varepsilon_{EA}/\varepsilon_E)(\varepsilon_o/\varepsilon_C)$. If the earth were made of uniform substance throughout, $\varepsilon_{EA}/\varepsilon_E$ would virtually be unity (1.0), since virtually all of the path between Objects 1 and 2 would be through constant ε_E permittivity. The only gravity variation from free space gravity, in that example, would result only from the total particle-constructed permittivity varying in the attracted object. A piece of Carbon 12 has an $\varepsilon_o/\varepsilon_C$ ratio of 0.9918 that can be determined from Figure 6.2. Gravity for Carbon 12 is consequently 0.9918 times that which acts on the sum of its individual particles.

However the earth is not uniform and $\varepsilon_{EA}/\varepsilon_E$ could be either slightly less or slightly more than unity (1.0), depending upon the location of the object being attracted by the earth. Reference [1] shows that $\varepsilon_{EA}/\varepsilon_E$ is about 0.9981 using the value of G in most reference works; that is, free space gravity, not involving the earth paths, nor the proximity reduced masses, is 1/0.9981 times earth gravity which is based upon:

$$G = 6.6726 \times 10^{-11} \, m^3/(s^2 \times k_g) \tag{9.9}$$

Then for a free space constant G_o:

$$G_o = 1.0019G \tag{9.10}$$

The general Newton gravity force expression then becomes:

$$F_g = (\varepsilon_{12}\varepsilon_o/\varepsilon_1\varepsilon_2)G_oM_{o1}M_{o2}, \tag{9.11}$$

where M_{o1} and M_{o2} are the summation free-space masses of all the quantum particles in Mass 1 and Mass 2.

All of the foregoing has been based upon having a constant ε_o of about 8.85×10^{-12} farads/meter. What if this varies (even slightly) some places in the universe?

First, the velocity of light changes inversely as the square-root of the background permittivity, but a very small change would not be noticable. However a background ε_b different from ε_o would have many profound effects altering today's concepts of the universe. For CTG, the change in the relative permittivity ε_p of the quantum particle compared to the background ε_b would add an enormously important modifying factor K_R/K_{RO} to gravity expressions. K_R is the factor plotted in Figure 6.3; ε_p is the permittivity of the quantum particle itself which is just barely greater than ε_o because it effectively reduces the "energy" or "metallic" radius of the electron R_c down to the tiny quantum radius R_o. K_R/K_{RO} is the ratio of K_R in any background to K_{RO} occurring only when $\varepsilon_b = \varepsilon_o$. Then each single quantum particle (and therefore each total mass) varies in accordance with the ratio, K_R/K_{RO}. Since gravity is expressed as the product of two effective radii (or two masses), the force F_g varies as the square of K_R/K_{RO}, and:

$$F_g = K_m \, x(K_R/K_{RO})^2 \times F_{go}$$

$$= (\varepsilon_{12}/\varepsilon_1)/(\varepsilon_b/\varepsilon_2) \times [(\varepsilon_p - \varepsilon_b)/(\varepsilon_p - \varepsilon_o)]^2 \times F_{go} \tag{9.12}$$

The actual expression for K_R/K_{RO}, if the graph of Figure 6.3 correctly represents the change in a particle's effective radius with background permittivity, is $[(\varepsilon_p - \varepsilon_b)/(\varepsilon_p + \varepsilon_b)] \div [(\varepsilon_p - \varepsilon_o)/(\varepsilon_p + \varepsilon_o)]$; but the ratio, $(\varepsilon_p + \varepsilon_o)/(\varepsilon_p + \varepsilon_b)$, closely approaches unity for very small background changes, and is dropped in Expression (9.12), establishing $(\varepsilon_p - \varepsilon_b)/(\varepsilon_p - \varepsilon_o)$ as K_R/K_{RO}.

Looking at this effect combined with Newton's law for a gravity force between single electrons in any medium:

$$F_g = K_M G_O M_{e1} M_{e2} [(\epsilon_p - \epsilon_b)/(\epsilon_p - \epsilon_o)]^2/r^2, \qquad (9.13)$$

or generally, for the force between any two masses:

$$F_g = G_O M_1 M_2 [(\epsilon_p - \epsilon_b)/(\epsilon_p - \epsilon_o)]^2/r^2, \qquad (9.14)$$

since K_M has customarily been included in the two mass values M_1 and M_2. Near earth, the background permittivity is ϵ_o (that is, $\epsilon_b = \epsilon_o$), then:

$$F_g = G_O M_1 M_2/r^2, \qquad (9.15)$$

but if M_1 is the earth itself;

$$F_g = G M_E M_2/r^2. \qquad (9.16)$$

What would happen under the CTG theory of permittivity effects just presented, if space permittivity ϵ_b reduced a bit with increasing distance from the center of the "Big Bang"? Gravity would increase manyfold way out in space since the modification term, K_R/K_{Ro}, or $(\epsilon_p - \epsilon_b)/(\epsilon_p - \epsilon_o)$, would get much bigger, effectively increasing masses.

Let's suppose, for example, that a quantum particle permittivity ϵ_p is only 1 part in a million greater than our local ϵ_o. Then:

$$(\epsilon_p - \epsilon_o) = \epsilon_p \times 10^{-6}$$

Now reduce ϵ_o to a new background permittivity of $\epsilon_b = 0.99\epsilon_o$. Then:

$$(\epsilon_p - \epsilon_b) \simeq \epsilon_p \times 10^{-2}, \text{ and}$$

$$K_R/K_{RO} = (\epsilon_p - \epsilon_b) / (\epsilon_p - \epsilon_o) = 10^4.$$

In other words, a 1% reduction in ϵ_o, would increase masses 10,000 times. No wonder that a mere 100 to 1 ratio of dark mass to known mass can appear to exist for far-away galaxies. In the assumption above, ϵ_o would only have to change in value about 100 parts in 10^6 to make the gravity forces

to all of the real masses increase 100 to 1, which would account for the supposedly missing mass.

Actually, in this CTG capacitance concept of quantum radii, the ratio R_o/R_c is only 6.935 x 10^{-22} instead of 10^{-6}. As a consequence, only an infinitesimal undetectable change in ε_o is required to effect a 100 to 1 apparent mass increase in the universe; that is, to make $(K_R/K_{Ro}) = 100$. See Appendix E for more explanation of this phenomenon.

If anyone takes the time to speculate about other things that might happen with the CTG concept, many more seemingly mysterious phenomena fall into place. For example, if some neutrinos have a permittivity of less than ε_o, they are expelled rapidly from the sun. Because they are also repelled by the earth, only a fraction (like one third) of them are shot through the earth; the others, diverted by the repulsion gravity forces, miss the earth.

Chapter 10

Conclusion

Gravity as an electrostatic capacitance force is a reasonable representation of this wondrous, but elusive, phenomenon of nature. The forces due to gravity are consistent with capacitance forces that can be set up in simple repeatable laboratory experiments. When a multitude of exactly balanced plus and minus closely spaced charges (bi-poles) in a random orientation confronts a second multitude of plus and minus closely spaced charges in random orientation, the result is always mutual attraction as long as the substance of the bi-poles has greater permittivity and/or conductivity than the background substance in which the reaction works. With enough bi-poles, the cube-of-the-distance "push and pull" dipole pattern coulomb forces all cancel out, but the smaller square-of-the-distance omnidirectional attractive capacitance forces, like gravity forces, do not.

In this text it is shown how the capacitance force expression $C_{12} (V_{12})^2 / 2r_{12}$ can be used to define quantitatively the total gravity force between two objects just as well as the Newton empirical $GM_1M_2 / (r_{12})^2$ expression; with the bonus of understanding variations that occur with the make-up and packing density of the objects' particles, and with variations of the properties of the medium or media between two interacting objects.

It is easy for a critic simply to say, "I don't believe it.", if he (or she) doesn't understand or want to believe something. What is often not easy, is to *prove* with either sensible logic or mathematical certainty that a new idea is wrong. That is why a multitude of religions and cults exist in physics just as they do in theology. For CTG, until someone shows that there is no force caused by one or more proton-electron capacitor pole pairs acting on other objects (as there is when one makes a large-scale model), then a negative critique without this backing is not complete and has not produced a fatal flaw in the theory. Furthermore, there are too many identical observed actions of capacitance and gravity to assume arbitrarily mere coincidences.

Constants, Symbols and Units

(As in Reference [1] with additions for this text)

A glossary of constants follows:

Parameter Constant	Symbol	Value
Elementary Electron Charge	Q_e	-1.60219×10^{-19} coulombs
Balanced Proton Charge	Q_p	1.60219×10^{-19} coulombs
Mass of Electron	M_e	9.10953×10^{-31} kilograms
Proton/Electron Mass Ratio	P	1836.15
Neutron/Electron Mass Ratio	N	1838.68
Permittivity of Vacuum Space	ε_o	8.85419×10^{-12} farads/meter
Speed of Light in a Vacuum	c	2.99792×10^{8} meters
Gravitational Constant	G	6.6726×10^{-11} m^3 / (s^{2}kg)
Mass of Earth	M_E	5.98×10^{24} kilograms
Radius of Sphere (same volume as Earth)	R_E	6.37122×10^{6} meters

Other symbols and units are:

C = capacitance, farads

S = elastance (1/C), darafs

M = mass, kilograms

E = Mc^2 energy, joules

Q = charge, coulombs

Q_f = charge field, volts/daraf

I = current, amperes

I_f = current field, volts/ohm

V = potential, volts

E_f or E = electric field, volts/meter

F_c = charge force, coulomb-volts/meter

F_g = gravity force, coulomb-volts/daraf

R = effective radius of a particle, meters
     (with appropriate subscript e, p, or n for electron, proton or
     neutron, for example)

K = a dimensionless constant (or ratio)

Δ = change increment of symbol that follows

ε = permittivity, farads/meter

μ = permeability, henrys/meter

σ = conductivity, mhos/meter

R = resistance, ohms

p = resistivity, ohms-meters

Z = impedance, ohms

z_v = impedivity, ohms-meters

r = distance, meters

N = number of entities; for example, N_p is a number of particles

Additions:

ε_1 is CTG permittivity of Object 1, farads/meter.

ε_2 is CTG permittivity of Object 2, farads/meter.

ε_{12} is effective CTG permittivity of space between Objects 1 and 2, farads/meter.

ε_E is average effective CTG permittivity of the earth, farads/meter.

ε_{EA} is the average ε_{12} permittivity of earth space between the earth and an attracted object, farads/meter.

ε_p is permittivity of an individual particle as part of a larger object, farads/meter.

ε_b is permittivity of the background in which an action takes place, farads/meter.

K_p is proximity of particles capacitance (or mass) modifier for objects; that is, K_{p1} is $\varepsilon_o / \varepsilon_1$ for Object 1, and K_{p2} is $\varepsilon_o / \varepsilon_2$ for Object 2.

K_R is capacitance, or effective radius, modifier $(\varepsilon_p - \varepsilon_b) / (\varepsilon_p + \varepsilon_b)$.

K_m is the total modifier factor for non-free-space gravity relative to free-space gravity; that is
$$K_m = (\varepsilon_{12} / \varepsilon_o)\,(\varepsilon_o / \varepsilon_1)\,(\varepsilon_o / \varepsilon_2) = \varepsilon_{12}\varepsilon_o / \varepsilon_1\varepsilon_2.$$

V_e is Q_e / C_e potential of electron relative to free-space, -5.11001×10^5 volts.

R_e is the energy (or metallic) classical radius of the electron, 2.81795×10^{-15} meters.

R_o is the quantum radius of the electron (or positron) in free space, $K_R R_e = 1.95422 \times 10^{-36}$ meters.

R_q is the quantum radius of the smallest possible particle, meters.

Amplification Responses to Critics of CTG Capacitance Theory of Gravity

1. CTG Circuit Concept

In my view, the Universe can be treated as one grand electrical circuit network with separate-particles-make-up for everything; that is, everything we know of composed of volumes of "vacuum" filled with "particles". The circuits are either capacitive, inductive, or conductive. For steady diminutive electric fields through space, the space itself is capacitance-dominated, having zero conductivity and zero inductive effects (zero inductive "field-impedance" for electric fields after steady-state has been established).

I wrote a book called *CTG Capacitance Theory of Gravity* which shows that all you have to do qualitatively and quantitatively to understand gravity is use the circuit of a positive electrostatic pole near a negative electrostatic pole attracting anything that has higher "artificial" (particle filled) permittivity than its surrounding background. A pair of poles, called a bi-pole, also pushes away *anything* that has a lower artificial permittivity than its surrounding background. These two effects can be electrostatically demonstrated quite easily in gases and liquids, and also occur with gravity. For example, copper is attracted to the earth (consisting of multiple bi-poles) through water; paraffin is pushed away from the earth through water. A

balloon filled with air colder than the background will be pulled towards the earth; an equal-volume balloon filled with air sufficiently warmer than the background will be pushed away from the earth. These effects usually attributed to Archimides Principle can be understood electrically just as well in terms of artificial permittivity, because artificial permittivity varies directly with density, or with the number and size of particles in a given volume.

The basic circuit of an electron and a proton (hydrogen) pulling on a single electron-sized particle is:

LET $R_1 = R_2 = R_e$

LET $R_3 = PR_e$
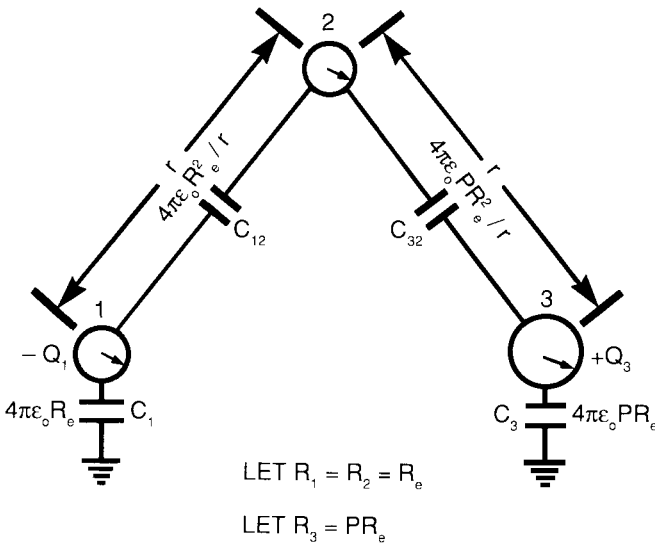
The fields through the capacitors C_{12} and C_{32} are voltage-gradient fields in terms of volts per daraf instead of volts per meter, since all electric volts-per-meter vector fields are effectively cancelled by having the electron and proton very close together, and by having trillions upon trillions of other

randomly oriented bi-poles close-by, statistically contributing to zero E-field strength in the space between the particle and the bi-poles, and at the particle itself. Therefore, without E-fields there cannot exist any usual Coulomb Law type forces — yet, almost radar-like, there are effects back at the two bi-pole energy sources (electron and proton) due to a distant particle's presence.

The general distant particle force magnitude by Coulomb's Law calculations, is determined by a charge times the voltage-gradient E-field. In contrast to Coulomb's Law, when the uncancelled voltage-gradient is a Q-field in units of volts per daraf, the charge times the field determines a force which calculates to a much, much smaller magnitude. When solving for capacitance bi-pole forces of hydrogen attracted to an electron-sized particle, it turns out that they are identical to the magnitude of gravity forces between a single atom of hydrogen and an electron. Some think this is just an ordinary coincidence. If so, it is a precise one, good to better than two parts per million. Actually, there are many, many more "coincidences" confirmed by experiments and everyday experience, which are only understood when using the CTG approach. In MKS dimensions the formula for gravity force works into the general formula:

F_g = QV/S coulomb-volts per daraf

$= QQ_f$ (coulombs)$^2 = KQQ_f$ coulomb-volts per meter, or newtons, where K is one daraf per meter. The coulomb-volts per daraf force unit is called a "gravit" in the book.

Ultimately, the force between either particle of the bi-pole and a distant electron sized particle takes the form $KQ_eQ_pR_1R_2 / 2 (P + 1) (r_{12})^2$ newtons. When the gravity force is found between the single (hydrogen) bi-pole and the electron-size-smallest-particle by CTG, it agrees quite closely with Newton's GM_1M_2/r^2 result. Since the basic radius of the particle at Position 2 does not change, but more particles are added to form larger objects, the force of gravity increases proportional to the number of these basic particles; and since a basic bi-pole always has the same charge strengths, the force of gravity for larger objects increases proportional to the number of bi-poles. For reciprocity, the Position 1 and 3 bi-poles and Postion 2 particles can be reversed in position with identical results, since there are many bi-poles consisting of particles at each end of a normal gravity interaction between objects. The bi-pole in the illustration consists of two particles, the electron and the proton, with the proton equivalent to 1836.15 electrons (and/or positrons).

2. Coulombs Squared Force and Dimensional Balance

The Coulombs Squared QQ_f expression probably jumps out of the page and conjures up a picture to most physicists of two point charges side by side, or otherwise positioned. Actually Q_f is a voltage gradient field of volts per elastance through permittivity-dominated, three-dimensional space. One cannot put a charge Q into such a field without a force on the charge. If one were to make the effort for any particular geometric configuration, the volts per elastance field could be converted to a volts per distance field with both fields varying in a fixed relation to each other at a floating charge Q when it moves through space. This holds true when the units of distance are meters, centimeters, inches, feet, or any other unit of length. The same goes for elastance in units of darafs, statdarafs, abdarafs, megadarafs, or whatever. Please read appendix D of Reference [1], *CTG Capacitance Theory of Gravity*.

Just as the name "newton" was established for a coulomb-volt/meter force, Reference [1] established the name "gravit" for a coulomb-volt/daraf force as shown on Page 36. The dimensionally balanced expressions for force are then:

$F = QQ_f$ gravits $= KQQ_f$ newtons, where K = 1 newton/gravit = 1 daraf/meter.

For MKS one may change

$F = KQQ_f$ newtons to $F = KQQ_f$ coulomb-volts/meter, and

$F = QQ_f$ gravits, to $F = QQ_f$ coulomb-volts/daraf or (coulombs)^2.

In the *CTG* book sixteen pages out of eighty-six (pages 23 through 36 and Appendix D) are devoted to explaining how a voltage-gradient is formed through capacitance in space in MKS units of volts/daraf. The Q_f field was determined by the author to be the easiest approach to explain the minute gravity effects.

The unit of gravity force is a "gravit" for *MKS* and *Practical Unit* dimensions. It is a "statgravit" for *esu* or *Gaussian unit* dimensions, and an "abgravit" for *emu* dimensions. By using a conversion table for coulombs squared and from $F_g = QQ_f$:

$|1$ gravit $| = | 9 \times 10^{18}$ statgravits $| = | 10^{-2}$ abgravits $|$

At the end of Chapter 3 in the book (Page 36) it is shown that 1 gravit is equivalent in magnitude to 1 newton (or 10^5 dynes) for the example shown, but obviously gravits and newtons have different dimensions. However,

$$|1 \text{ gravit}| = |1 \text{ newton}| = |10^5 \text{ dynes}|.$$

If equations using gravits, statgravits or abgravits (instead of newtons or dynes) are used for gravitational forces, dimensional balance is always maintained.

The basic gravitational force formula for free-space, derived in gravitational units from QQ_f in this basic circuit, is:

$$F_g = Q_e Q_p R_1 R_2 / 2 (P+1) r^2, \text{ where}$$

Q_e = electron charge

Q_p = proton charge

R1 and R2 are effective radii of particles

$P = M_p/M_e = C_p/C_e = R_p/R_e = 1836.15$ (a dimensionless ratio)

r is the distance between particle centers

Assume two electrons in free space separated by 1000 meters. The effective radius R_e of each electron determined from its energy is 2.81795 x 10^{-15} meters, as shown in Reference [1]. F_g is the gravitational force between them. The minus sign obtained by multiplying $Q_e Q_p$ denotes attraction.

MKS Units

$$F_g = -(1.60219 \times 10^{-19})^2 (2.81795 \times 10^{-15})^2 / (2 \times 1837.15 \times 10^6) \text{ gravits}$$

$$= -5.54779 \times 10^{-77} \text{ gravits}$$

$$|F_g| = |-5.54779 \times 10^{-77} \text{ newtons}|$$

Practical Units

$$F_g = -(1.60219 \times 10^{-19})^2 (2.81795 \times 10^{-13})^2/(2 \times 1837.15 \times 10^{10}) \text{ gravits}$$

$$= -5.54779 \times 10^{-77} \text{ gravits}$$

$$|F_g| = |-5.54779 \times 10^{-77} \text{ newtons}| = |-5.54779 \times 10^{-72} \text{ dynes}|$$

ESU or Gaussian Units

$$F_g = -(4.80657 \times 10^{-10})^2 (2.81795 \times 10^{-13})^2/(2 \times 1837.15 \times 10^{10}) \text{ statgravits}$$

$$= -4.99301 \times 10^{-58} \text{ statgravits}$$

$$|F_g| = |-5.54779 \times 10^{-77} \text{ gravits}|$$

$$= |-5.54779 \times 10^{-77} \text{ newtons}| = |-5.54779 \times 10^{-72} \text{ dynes}|$$

EMU Units

$$F_g = -(1.60219 \times 10^{-20})^2 (2.81795 \times 10^{-13})^2/(2 \times 1837.15 \times 10^{10}) \text{ abgravits}$$

$$= -5.54779 \times 10^{-79} \text{ abgravits}$$

$$|F_g| = |-5.54779 \times 10^{-77} \text{ gravits}|$$

$$= |-5.54779 \times 10^{-77} \text{ newtons}| = |-5.54779 \times 10^{-72} \text{ dynes}|$$

The dimensionless $\varepsilon_o/\varepsilon_E$ multiplier (0.998084) as derived in Appendix C of Reference [1] is used for gravity through the earth (This CTG write-up, however, has determined that the correct multiplier is actually $\varepsilon_{EA} / \varepsilon_E = 0.998084$):

$$F_{gE} = 0.998084 \, F_g = -5.53716 \times 10^{-77} \text{ gravits}$$

MKS:

$$|F_{gE}| = |-5.53716 \times 10^{-77} \text{ newtons}|$$

PU, ESU, EMU:

$|F_{gE}| = |-5.53716 \times 10^{-72} \text{ dynes}|$

By Newton:

MKS:

$F_{gE} = -GM_1M_2 / r^2$
$= -(6.6726 \times 10^{-11})(9.10953 \times 10^{-31})^2 / (1000)^2$
$= -5.53716 \times 10^{-77} \text{ newtons}$

PU, ESU, EMU:

$|F_{gE}| = |-5.53716 \times 10^{-72} \text{ dynes}|$

3. Magazine Review

The following is in response to Professor Aspden's review of my CTG Capacitance Theory of Gravity book, presented on page 90 in the November 1991, issue of "Electronics World and Wireless World".

It is apparent that the reviewer failed to grasp the concept of a voltage gradient field in dimensions of volts per daraf though capacitance-dominated space, which is much like a volts per ohm field through resistance-dominated space. These fields were explained in pages 23-36 and in Appendix D. Volts per daraf equates in MKS(R) dimensions to coulombs, just as volts/ohm equates in MKS(R) dimensions to amperes. The dimensions remain balanced and true when converted and equated with MKS(NR), CGS, ESU, and EMU. The force, Q-times-the-volts-per-daraf, which is not in "newtons" (as explained on page 36 but misinterpreted by the reviewer), was therefore designated with new amplitude-equivalent-for-MKS units called "gravits". Then, for the examples in the book:

K gravits = newtons, where K is equal to one newton/gravit, or one daraf/meter. When the F_g gravity force and K dimensions are both converted to other dimensional systems, no errors occur in either amplitude or dimensional balance. In the CTG book, instead of K, amplitude-equivalence vertical brackets were used throughout the book to designate "gravit" force equivalance to "newton" force, as MKS units were used exclusively.

As far as demonstrating that electric field Coulomb Law forces disappear in the CTG theory, this was explained on pages 27 through 29. Electric fields from myriads of closely spaced plus and minus poles of dipoles with random orientation cancel at any point in space, hence no Coulomb Law forces.

4. Square of the Distance Discussion

If I were writing the CTG book again, I would add a section devoted exclusively to the bi-pole (force) square-of-the-distance fall-off, contrasting it to the charge force fall-off from a dipole. While the QE_f charge forces used in the demonstrations described in the book are in many ways like QQ_f gravity forces, they are not actual Q-field (gravity) forces and were meant to show some similar qualities, but the square-of-the-distance fall-off was not one of them. The book diagrams, in Figure 3.2 (dipole) and Figure 3.5 (bi-pole) were meant to highlight these force differences, but were insufficient to explain the differences to everybody. I should have *clearly* stated that the demonstrated dipole charge force magnitudes were not determined by the square-of-the-distances used. For this oversight, I apologize.

It is certainly true that the vector summed electrostatic field E in space from a single pair of closely spaced positive and negative charges +q and –q is proportional to the distance 2a between the charges and reduces as the cube of the distance r from the center point between the charges. When r is much greater than a:

$$E = 2aq \,/\, 4\pi\varepsilon r^3 = aq \,/\, 2\pi\varepsilon r^3 \qquad \text{Reference [2]}$$

With vector addition of each E-field from the plus and minus charges of the dipole, the direction of the field (and, for example, the force on a positive point charge Q) is determined. Let small open rings represent plus charges, and small solid circles represent minus charges; the forces at isolated positive point charges due to far away dipoles are shown in Figure B.1.

If the point charges were made negative instead of positive in the sketch, the forces would simply reverse direction 180°.

Notice that the force fields acting on a single point charge of either polarity are directionally-reversed but symmetrically oriented around dipoles. When there are a great many dipoles all close together and all acting on a single point charge, and these dipoles are assumed to have random orientations, it is easy to see without complicated statistical analysis that the combination of all the E-field forces on either a positive or negative point charge vectorially sum to approach zero. The more random oriented dipoles
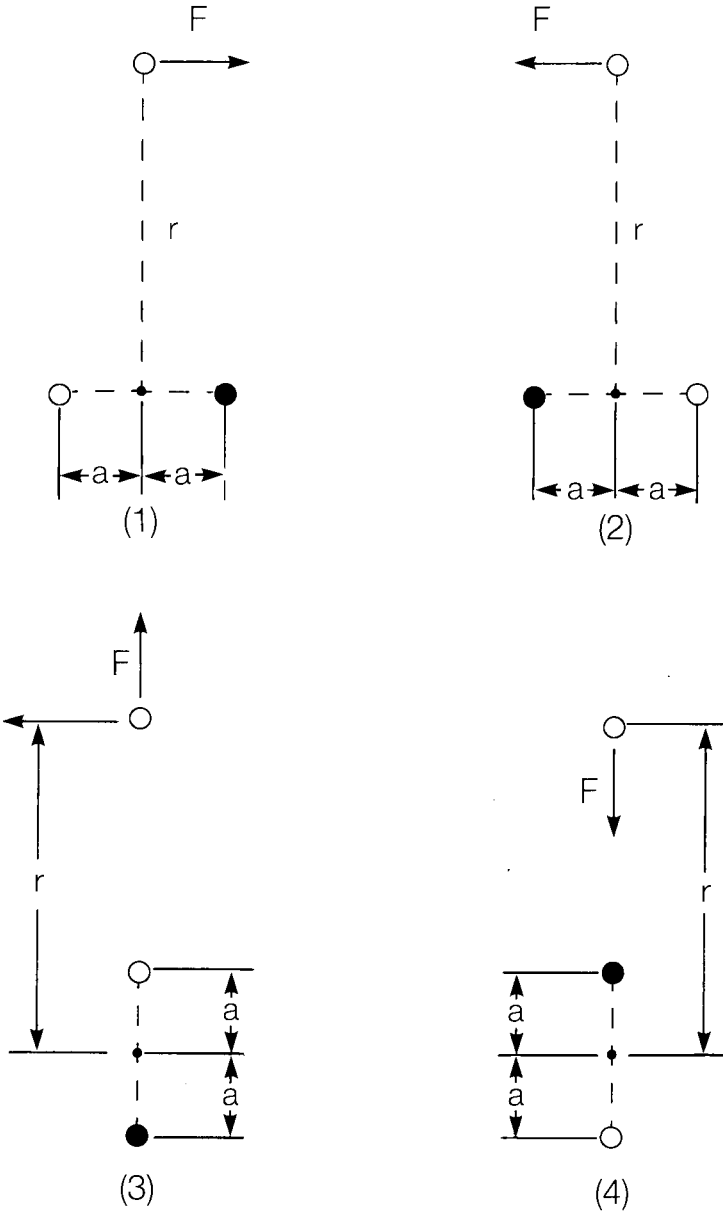
FIGURE B.1.   DIPOLE FIELDS AND FORCES AT A SINGLE POSITIVE
POINT-CHARGE IN SPACE

that there are, the nearer the force to absolute zero. Furthermore, when vast numbers of dipoles and point charges are involved in mass to mass confrontations, almost every positive charge in nature is attached to a nearby negative charge which further reduces any resultant combination E-field force by vector sum cancellation.

When performing the electrostatic experiments for the CTG demonstrations, the force fall-off with distance is like that of a single stationary dipole source acting on an *induced* dipole in the material being acted on, since electrons are moved about in that material. This charge force does not, and was never intentionally represented to, fall-off with the square of the distance. In any event, the charge forces disappear between masses of objects containing multiple charge-balanced, randomly-oriented dipoles, and only the tiny Q-field forces which do not cancel remain.

The contention of CTG is that the voltage gradient (volts/daraf) Q-field, in many ways, does not act like the voltage gradient (volts/meter) E-field, especially when the source is from two closely spaced poles.

First, Q-field magnitude Q_f originating from a distant plus and minus two-pole source is not proportional to the spacing between the plus and minus charges of the two-pole source. (To emphasize differences, the dipole for CTG is designated a bi-pole.)

Second, the field is omnidirectional from each point charge of the bi-pole and acts in summation to attract any substance having "field impedivity" lower than its surrounding background. The many plus and minus charges in the substance acted on are not important since their affects are cancelled out (as described in the preceding paragraphs).

Third, the Q-fields along daraf paths do not have to follow straight lines, as a daraf path may be curved even to the extent of almost doubling back on itself; for example, from the plus charge to the minus charge of a bi-pole via a distant particle.

Fourth, and most important, the Q-field is so weak that it does not influence charge force placements or orientations within a substance.

Fifth, since charge is not displaced to counteract the weak Q-field, as it would be for an E-field in a given substance, the Q-field acts on all the individual particles throughout a substance's volume; and the total capacitance of any portion of the substance is proportional to the mass, or to the number and size of the particles within the volume containing those particles. For E-fields, on the other hand, the total capacitance of a volume of substance depends solely upon the *effective radius* of that volume of particles, not upon the volume or mass.

If one accepts the concept of a QQ_f force, then by simple circuitry (provided in the CTG book), the force from a bi-pole does fall-off as the square-of-the-distance. No complicated statistical analysis is required to understand what happens. Even more convincing, the QQ_f force magnitude precisely matches that of Newton gravity.

For comparison, if one accepts the concept of a QE_f force, then by simple circuitry (provided in the CTG book) the force (on another charge) from a single charge also falls off as the square-of-the-distance. Coulomb's Law results and no complicated statistical mathematics is required to understand what happens.

Unfortunately, we are a long way from having instrumentation sensitive enough to measure Q-field forces from a single bi-pole.

Appendix $\textbf{C}$

How to Use CTG Gravity

To get an overview of how to use the gravity force expressions derived in Reference [1] and in this presentation, electromagnetic and gravity force expressions are compared in the following chart. The derivations and environment modifiers are explained in the main texts.

Forces Comparison Chart
for
Electromagnetics and Gravity

ELECTROMAGNETICS   *GRAVITY*

1) Basic electrostatic force: Basic gravity force:

$F = qE_f = qV/r$ $F = KqQ_f = KqV/S$

2) Coulomb Law electrostatic force: CTG Law gravity force:
(Between Particle 1 & Particle 2)   (Between Particle 1 & Particle 2)

$F_{12} = Q_1 Q_2 / 4\pi\varepsilon \, (r_{12})^2$ $F_{12} = KQ_e Q_p R_1 R_2 /2 \, (P+1) \, (r_{12})^2$

3) EM Capacitance force: Gravity Capacitance force:
(Between Object 1 & Object 2)   (Between Object 1 & Object 2)

$F_{12} = -C_{12} \, (V_{12})^2 /2r_{12}$ $F_{12} = -C_{12}(V_{12})^2 / 2r_{12}$

$\quad = -2\pi\varepsilon_{12} R_1 R_2 \, (V_{12})^2 / (r_{12})^2$ $\quad = -2\pi\varepsilon_{12} \, (\Sigma R_o)_1 (\Sigma R_o)_2 V_e^2/(r_{12})^2$

4) Total Electrostatic Force: Total Gravity Force:
(Between Earth and Object 1)   (Between Earth and Object 1)

$F_{E1} = O$ $F_{E1} = -2\pi\varepsilon_{EA}(NK_p R_o)_E (NK_p R_o)_1 V_e^2/(r_{E1})^2$

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In the Forces Comparison Chart the glossary of symbols, units, and constants in MKS (rationalized) dimensions follows:

F   is force, newtons (between particles or objects, minus sign denotes attraction).

q   is quantity of charge, coulombs.

Q_e is net charge on the electron, -1.60219×10^{-19} coulombs.

Q_p is net charge on the proton $+1.60219 \times 10^{-19}$ coulombs.

E_f is the electric field, volts per meter.

Q_f is charge field, volts per daraf.

r   is distance, meters.

S   is elastance, darafs (or 1/farads).

K   is a constant dimensional conversion factor, 1 daraf per meter.

C   is capacitance, farads.

V   is electrical potential difference, volts.

V_e is the electron potential relative to free space, Q_e / C_e, or -5.11001×10^5 volts.

ε   is permittivity, farads per meter.

P   is the mass (or capacitance) ratio of one proton to one electron, 1836.15.

Q_1 or Q_2 is the charge on particles 1 or 2, coulombs.

R_1 or R_2 is the effective "metallic" radius of particles or objects 1 or 2, meters.

R_o is the electron (or positron) quantum radius, 1.95422×10^{-36} meters.

ΣR_o means to sum the total of all R_o's in an object (one R_o times the total number N of quantum particles). For this exercise, each proton consists of 1836.15 quantum particles and each neutron consists of 1838.68 quantum particles. To be more precise, though, the proton may consist of something like 2177 quantum particles with a K_p proximity reduction factor to each R_o of 0.84343, resulting in an overall simulation of 1836.15 quantum particles. Of the 2177 particles, one may assume there is one more positively charged quantum particle than there are negatively charged quantum particles, which results correctly in an overall positron - equivalent plus charge for the proton. If one further assumes, for example, that there is an absence of neutrinos or other non-charged particles in the core of the proton, then there would be 1089 positive quantum charges and 1088 negative quantum

charges in the proton. The neutron may consist of something like 2180 quantum particles with the same K_p proximity factor of 0.84343, resulting in an overall simulation of 1838.68 quantum particles, of which there are the same number of positively charged particles as there are negatively charged particles. This assumption results correctly in an overall zero-net-charge for the neutron.

To obtain more accurate force magnitudes than from the uncorrected Number 3 expressions in the Force Chart, one must note that both EM and gravity capacitance forces are modified by the surroundings in which the force reactions occur. For gravity, for example, each effective single R_o value is reduced by the proximity of surrounding particles, to an extent that depends upon what kind of substance the quantum particles are packed into. The plot in Figure 6.2 of the main text suffices as the K_p proximity reduction factor to correct the R_o values for the elements comprising the substances at each end of a two-body gravity interaction. The total possible required maximum correction including both interacting objects is less than 2%. Also, for earth gravity, when the force reaction between the earth and an object has taken place through the substance of the earth, the intervening permittivity ε_{12} is modified from ε_o to ε_{EA} (average earth permittivity over the paths from the earth's particles to the object's particles). The total earth permittivity correction as determined in Reference [1] is a multiplying factor of about 0.998. In light of ε permittivity corrections discussed in this text, the $0.998\,\varepsilon_o$ factor which replaces ε_o is actually the combination of two corrections from free space conditions. First one corrects for the earth's K_p proximity reduction in capacitance (or in mass), $\varepsilon_o / \varepsilon_E$, and then for the earth's average gravity action path $\varepsilon_{EA} / \varepsilon_o$, which increases the force. Then true gravity force earth reactions include the product of both corrections as $\varepsilon_{EA} / \varepsilon_E$, or about 0.998 times uncorrected versions.. Depending upon the location of the object relative to a non-homogenous earth, this value will vary slightly, estimated safely at considerably less than 1 %. For earth gravity reactions, the capacitance (or mass) K_p proximity reduction of the object being acted on must also be accounted for.

The fully corrected expressions for electrostatics and gravity earth attractions appear as Number 4 expressions in the force chart. The EM force equation is $F_{E1} = O$, because V_{12} (over r_{12}) is zero due to multiple dipole cancellations of the E-fields.

Motional Gravity or Relativity

The main text of this presentation has described the static, rather than dynamic, aspects of gravity which are shown in many examples to have characteristics closely resembling ordinary electrostatic force actions. In this appendix, a cursory look at the dynamics of CTG is undertaken; that is, what happens to electrostatic and gravity forces when a body is in motion at a sufficient velocity to generate an electrostatic or a gravity force change. In general relativity, the force on a moving body is assumed to increase because the mass of a moving body increases with increased velocity using the expression:

$$M = M_o / (1 - v^2 / c^2)^{1/2}$$

In CTG, the force on a moving body increases because the effective permittivity (and consequently the total effective capacitance to space) of a body increases with velocity, or saying it another way, the "field impedivity" of a body in motion is reduced. When this happens, the lower field impedance relative to the background causes increased attractive forces to multiple balanced charges anywhere in the universe (as demonstrated

throughout this presentation). Unfortunately, CTG is such a new concept that elegant mathematical expressions have not yet been developed, but simple analogous electrostatic experiments can easily be conducted which serve to demonstrate the principles.

Gravity forces are increased as the mass increases for bodies in either rotational motion or in linear motion. For rotational motion of a body, even when the revolutions per time are constant, individual particles within the body move and accelerate with respect to each other, and also continuously reverse positions relative to imposed outside fields. When linear motion of a body is examined, however, the motion is always considered to be relative to some outside entity, but precisely to what entity, that question brings up differences of opinion.

Following through with the CTG concept, first it is demonstrated that an increase in force between a bi-pole and an object occurs when the object is rotated. What one has to show is that the field impedivity for a rotating object is less than when it is still. This is equivalent to increasing either its permittivity or conductivity or both. If this occurs, the rotating object in a background of lower permittivity or conductivity, pulls harder to a bi-pole, as has been demonstrated over and over again by experiments performed for CTG.

Although almost any length and diameter is satisfactory for the next described demonstration, a rod of PZT (lead-zirconium-titanate ceramic dielectric material) about 1.27 centimeters long and 0.64 centimeters in diameter serves the purpose when axially rotated with diametrically opposite fixed metal wire brushes making contact with the perimeter surface of the rotating PZT rod. A fifty volt DC source and sensitive microammeter are attached in series with the PZT commutator as shown in Figure D1(a). Then ohms impedance Z_B of the PZT body versus measured commutator rotation in RPM is plotted. In Figure D1(b), Z_B is obtained by measurement as $Z_B = (V_S - V_M) / I_M$.

There is a resulting reduction of impedance at right angles to the rotating axis in either the horizontal or vertical direction across the PZT piece in the plane of the paper illustration of Figure D1.(a), which with proper orientation relative to a distant bi-pole, produces increased attractive force (or less repulsion force) in a given background medium. If the wire brushes were to contact the *ends* of the rotating PZT rod, however, *no* impedance change between the brushes could be expected from that of a still rod. Thus the orientation of rotation appears to be an important factor to be taken into account.

(a)

$$Z_B = (V_S - V_M) / I_M$$

PZT
Dielectric Constant: 3100
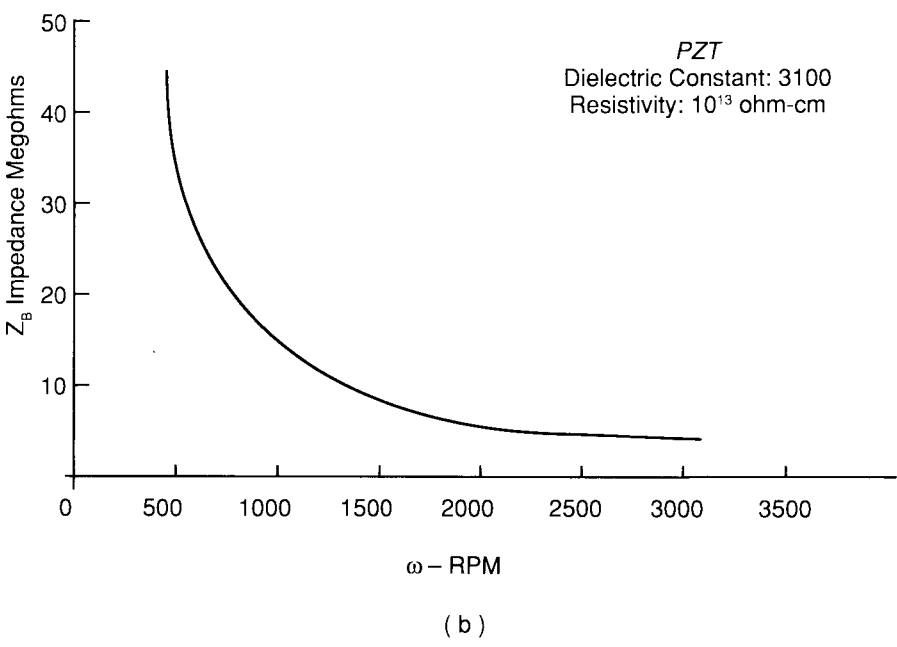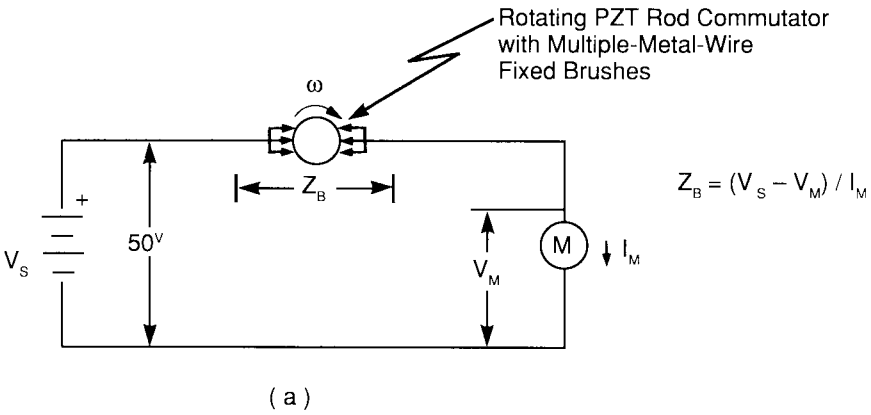Resistivity: 10^{13} ohm-cm

ω – RPM

(b)

FIGURE D.1.   DC IMPEDANCE OF PZT ROD COMMUTATOR VERSUS
ROTATIONAL VELOCITY

For gravity on earth where the body of the earth is so much larger than attracted smaller objects, spinning any such object in any orientation will cause it to have lower gravitational field impedance for all of the earth's bipoles except, perhaps, those relatively few in direct line with the axis of rotation. Realistically, an experimental program is required for a sound understanding of force changes of rotating objects with various axis orientations in relation to attracting objects. Such experiments can be performed electrostatically and translated to gravity. In an electrostatic-to-gravity translation, though, the relatively large displacement-of-charges impedance change, as in the rotating PZT illustration just given, has to be differentiated from the weak gravitational field capacitance change. Otherwise one might expect to measure a sizable weight increase for the rotating PZT piece in Figure D1., which, to no one's surprise, does not occur.

For objects in linear motion, electrostatically speaking, an object has to be moving with respect to the source of the field to effect any change in impedance across itself. That is because when the field amplitude of the object changes either to greater of lesser values, the individual particle-to-particle capacitances within the object must charge or discharge to produce a counter voltage-drop across them, which just cancels the impinging field. The time it takes to charge objects through space is very small (a very short inductance-capacitance time-constant related to the inverse of the speed of light and to the properties of space, $1 / c = (\mu_o \varepsilon_o)^{1/2}$ seconds/meter). If the object is moving fast enough, (say almost at the speed of light relative to the field source) there will be a continuous steady-state charging if the distance is closing, and discharging if the distance is opening, either movement causing a reduction of impedance. If the field source and object are both moving at the same velocity in the same direction (no relative motion), then there is no impedance change, and consequently *no* change in the force between them.

Gravity works the same way; that is, only when objects are moving *relative to each other*, can there be a change in gravitational force between them.

The CTG theory, then, accounts for both electrostatic and gravity relativity changes in forces, but due to the newness of the approach, up to now has no precise means available to express quantitatively either force change.

Dark Matter

After this second CTG book was completed in rough form, several people asked me about "dark matter" and how it relates to my theory. When I explained it to them, most seemed quite impressed. As a consequence, this appendix, explaining the supposedly missing mass phenomenon in our universe, has been added using the same explanation techniques as provided to the questioners.

Suppose one takes an empty glass bottle with an overall capped volume of 1000 cubic centimeters and an empty weight of 500 grams, and fills it with sea water weighing 1.0250 grams per cubic centimeter until the bottle with sea water weighs 1025.1 grams (525.1 grams of sea water added). When the bottle is placed in the same density sea water, it sinks with a force of 0.1 grams towards the earth.

Next, place this same bottle with its contents in a pool of fresh water with a density of 1.000 gram per cubic centimeter. The 1000 cubic centimeter volume bottle weighing 1025.1 grams will sink in the fresh water towards the earth with a force of 25.1 grams. With a mere 2.5% density reduction around the bottle, its net gravity force has increased 25.1/0.1, or 251 times.

The bottle could have conceptually been filled to 1025.001 grams total weight, with a downward force in sea water of only 1 milligram. Then in fresh water at only 2.5% density reduction, this same bottle would sink with a force of 25.001 grams, or step-up of force from a background of sea water to a background of fresh water of 25001 to 1. Furthermore, if this 1025.001 gram bottle is placed not in freshwater, but in sea water which is a little bit warmer than before (or has slightly less salinity) so that its surrounding density is 1.024 grams per cubic centimeter, the bottle will sink with 1.001 grams force, and the force step-up is 1.001/0.001, or just over 1000 to 1. In this last case, a change in surrounding density of only 1 part in 1025 (less than 0.1%) has stepped up the apparent net weight over 1000 to 1.

This same phenomenon occurs capacitively when a charged object attracts an uncharged dielectric body surrounded by "space" having a permittivity less than that of the attracted body. Think of permittivity in space in the same sense as density around the bottle in the previous examples. When a particle permittivity ε_p is just barely over the background permittivity of ε_o that is encountered at this particular place in space, the attractive force is small. When, or if, even an infinitesimal reduction of the special-case ε_o occurs to effect a new background permittivity of ε_b, the attractive force can increase dramatically. The mathematical relations as postulated and plotted in this book indicate that the effective radius ratio (or mass ratio) of a particle way-out "there" (R_b) to a particle "here" (R_o) is:

$$R_b / R_o = [\, (\varepsilon_p - \varepsilon_b) / (\varepsilon_p + \varepsilon_b) \,] / [\, (\varepsilon_p - \varepsilon_o) / (\varepsilon_p + \varepsilon_o) \,]$$

Because ε_b and ε_o are so nearly equal, $(\varepsilon_p + \varepsilon_b) \simeq (\varepsilon_p + \varepsilon_o)$. Also, the forces are proportional to the masses (radii) squared, so the ratio of a force "there" to a force "here" simplifies to:

$$F_b / F_o = [\, (\varepsilon_p - \varepsilon_b) / (\varepsilon_p - \varepsilon_o) \,]^2$$

All matter consists of a multiplicity of separated quantum particles occupying a volume in space. If each quantum particle has a permittivity just barely greater than the background, minute forces due to distant charges (of either plus or minus polarity) occur. The total force on an object, which is composed of many of these particles, is the number-of-particles multiplied by the force on each single particle. This behavior describes gravity and, I believe, *is* gravity.

Pulling the foregoing together, one sees that any diminutive reduction

of ε from ε_o to a lesser value ε_b will multiply manyfold the attractive capacitance forces between objects consisting of multi-particle matter. Out in space, extra hidden (dark) masses have been postulated in galaxies to explain the great rotary velocity of rotating stars around a center with extraordinary centripetal gravity required to keep the stars from flying off into space.

The conclusion of this appendix – there is no dark mass; the observable things that are all ready there effect much greater attraction than expected, because "way-out" from us the ε_b of space is undetectably less, perhaps by as little as one part in a billion or less. This change can conceptually produce gravity forces one hundred times larger, and more.

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Epilogue

Aspiring to knowledge of Heaven and Earth, a child of the future asks the Mentor:

"Why is Truth so hard to find?"

And the Mentor replies:

"Remember, the very wisest of their times have said:

Heaven and Earth were made in six days;

The Earth beneath Heaven is flat;

The sun in Heaven revolves around the Earth; and

Curvatures of space-time, which includes Heaven and Earth, is Gravity."