The Final Theory

Rethinking Our Scientific Legacy

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Universal Publishers
USA • 2004

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Universal Publishers/uPUBLISH.com
USA • 2004

ISBN: 1-58112-601-8

www.uPUBLISH.com/books/mccutcheon.htm

To my parents for their support, my father for his considered feedback throughout and many long hours of editing, and friends who offered their time and comments along the way

Introduction

We are all born into this universe and live out our lives within its laws and principles. From the inescapable law of gravity extending across the universe to the fundamental principles behind the tiniest atoms, our lives are immersed in the laws of nature. As intelligent beings it is only natural for us to wonder about the world around us, and as children of this universe it seems reasonable that we should be able to arrive at an understanding of it all – that this understanding is very much our birthright. In fact, to many it may seem as if we have already arrived at this understanding, with only a few loose ends remaining. Isaac Newton gave us an understanding of gravity as an attracting force in nature, and from there many others have contributed to our understanding of light, electricity, magnetism, atomic structure, etc. This process has finally brought us to a point where science today contains theories that cover every known observation, collectively known as *Standard Theory*. This age of understanding has made it possible to invent radio, television, and computers, even allowing us to build spacecraft that have visited distant planets. Although scientists continue to pursue deeper questions, it may seem that Standard Theory provides us with a fairly comprehensive scientific understanding of our universe. But is this really the case?

How much do we *truly* understand about gravity, for example? Do we know the physical reasons why gravity attracts objects together instead of repelling them away from one another? Newton gave us a compelling *description* of this observation as an apparent attracting force, but provided no *explanation* for the existence and nature of this force itself. Does it really make sense that a force holds objects to the surface of planets, and moons in orbit, all with no known power source? Do we know if it is possible to create some type of anti-gravity device, what principles might underlie such a device, or for that matter, even what principles underlie gravity itself? And despite Newton's concept of gravity, Albert Einstein found it necessary to continue searching for answers, arriving at a very different description of gravity, while scientists continue to search for still other explanations. Why is it that we have two explanations for the same effect in our science today, and

continue to search for still others – and do any of them truly answer our most basic questions about gravity?

Do we *truly* understand light? For centuries a debate raged back and forth as to whether light was composed of waves or particles. Today we have settled on a belief that somehow light is *both* a wave *and* a particle (the photon) – sometimes behaving as one and sometimes as the other, depending on the situation or experiment. Even today this remains a very mysterious and poorly understood characteristic of light as part of a theory known as *Quantum Mechanics* – a theory whose very creators and practitioners readily describe as bizarre and mysterious.

Do we *truly* understand magnetism? We know that two magnets will repel each other if both of their north poles or south poles face each other, but can we truly explain this? If we try to hold these two magnets together against this repelling force our muscles will tire as we continuously expend energy, but the repelling force from within the magnet does not. Is it reasonable that an apparently *endless* force from within magnets will continuously battle any external power source in this manner, eventually exhausting all external power sources without an equivalent weakening itself? In fact, there is *no identifiable power source at all* within these magnets to support this endless force from within. Do we even know what magnetic fields are, or have we simply discovered how to create them and learned to model their behavior with equations? That is, are we confusing practical know-how and abstract models with true knowledge and understanding?

A closer look shows that solid answers to these and many other questions about everyday occurrences are not to be found in today's Standard Theory. Science has managed to *model* our observations rather well, but many of these models lack a clear physical explanation. Newton worked out a *model* of gravity as an attracting force but couldn't tell us *why* it should attract and *how* matter does this endlessly simply by existing; in fact, we still lack these answers three hundred years later. We have equations that *model* magnetic fields, and theories that describe their obvious observed behaviors, but we have little clear physical explanation for *why* they behave as they do, leaving mysteries such as the apparently endless energy emanating from within a simple permanent magnet. In fact, many scientists recognize that we still lack a deep

understanding of our universe, which is why there are ongoing efforts to further our knowledge using high-energy particle accelerators and powerful space telescopes. The hope is that these investigations will lead to a key breakthrough in understanding – perhaps through the discovery of a currently unknown fundamental subatomic particle or principle, or possibly via some new type of energy or cosmological phenomenon detected in the heavens. It is expected that if such a key fundamental discovery is made, it will have a ripple effect that runs through the patchwork of often poorly understood theories in our Standard Theory today, ideally transforming them into a single clear theory that simplifies and truly explains everything. This much-hoped-for theory is known by physicists as the Theory of Everything – and is considered the ultimate goal of much fundamental research in physics today.

A key expectation of the Theory of Everything is not only that it will finally explain all of physics – gravity, light, magnetism, etc. – with a clarity and simplicity that is unknown today, but that it will do so via *one single unifying principle* in nature that has so far eluded us. Once found, this theory is expected to provide a clarity and understanding akin to turning on a light to see the contents of a room at a glance, where current theory is like a flashlight in the dark, giving only disconnected glimpses here and there. A less comprehensive form of this theory, known as the Unified Field Theory, would explain and unify everything *except* gravity, since it is thought that gravity may have a very different nature than the other fields and forces once we come to truly understand them all. Both theories are sought after by physicists around the world today, with the ultimate goal being the arrival at an understanding that explains all the forces of nature *including* gravity – i.e. the all-encompassing Theory of Everything.

Although this fairly formal definition of the Theory of Everything has only taken shape within the last century, it has actually been the ultimate goal of science ever since the earliest times; even medieval alchemists were, in their own way, searching for this ultimate understanding of the physical world. Some of Newton's many contributions to science were his descriptions of gravity, light, and the mechanics of moving objects, while Einstein provided quite different descriptions of these phenomena, with additional ideas about energy,

mass, space and time. Both of these scientists were essentially in pursuit of the Theory of Everything, whether or not their efforts were formally presented as such, as are many scientists who pursue basic research in an attempt to discover fundamental truths about our universe.

So far, our efforts have not yielded the Theory of Everything, but rather *a* "theory of everything" known as Standard Theory. Although it isn't typically represented this way, Standard Theory is indeed *a* "theory of everything" since it attempts to explain every known observation and phenomenon. It has evolved from many hypotheses presented over the centuries, with the most successful ones incorporated as sub-theories *within* Standard Theory. Even such radical and mysterious theories as *Quantum Mechanics* and *Special Relativity* are not considered part of some other "theory of everything" but part of Standard Theory today. Therefore, Standard Theory is not only *a* "theory of everything," but it is also the *only* one so far. In order for a new theory to truly form the basis of another "theory of everything" it would have to be based on a principle that lies entirely outside of known physics – *and* provide a sweeping rewrite of everything in Standard Theory based entirely on this new principle. Figure 1-1 shows the patchwork of theories within Standard Theory today that have resulted from our "flashlight-in-the-dark" approach to science over the past few centuries, as well as the single illuminating perspective of the Theory of Everything that is expected once the correct underlying principle is discovered.

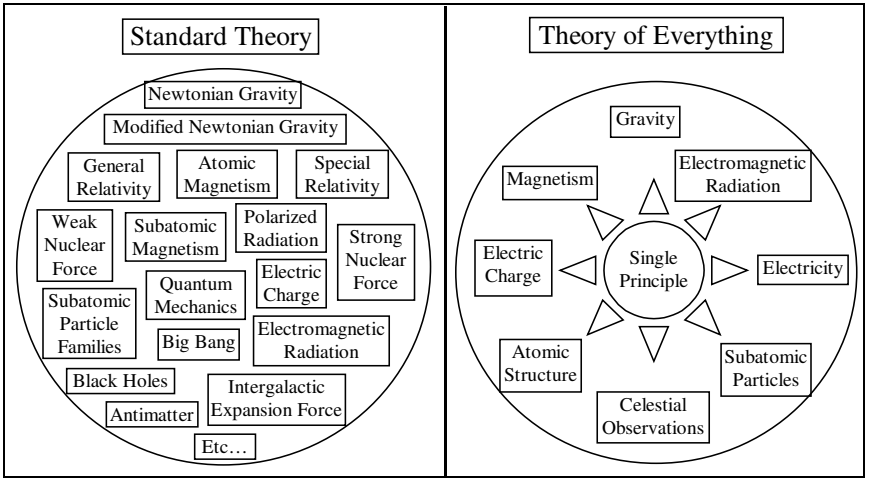


Fig. 1-1 Patchwork of Theories Today vs. Theory of Everything

The chapters to follow present just such a new principle in physics, showing that all matter may well possess this important new property that has so far been overlooked or misunderstood, and developing this principle into a second "theory of everything" for us to consider. This new theory begins with a clear physical explanation for gravity that resolves the many questions and mysteries surrounding it today, such as why it behaves as an attracting force and how it functions without a power source. Planetary orbits, ocean tides, and all other known gravitational observations are entirely explained by this new theory without relying on our current theories of gravity. New insights and possibilities are also suggested by this new theory that are unknown today and would not be predicted by our current gravitational theories.

This same new principle further explains the structure of the atom, as well as the nature of the individual electrons, protons, and neutrons composing atoms, with a physical simplicity and clarity that is unknown today. This new perspective on atomic structure shows how the gravity of objects can be directly related to the electricity and magnetism produced by the flow of electrons in wires, since this new principle underlies both atoms and electrons. The apparently endless energy within magnets mentioned earlier is also explained by this new principle, and a clear physical reason is given for why electricity and magnetism are so

closely related. This principle also suggests an explanation of electron orbits within atoms that resolves this still mysterious aspect of atomic theory in our science today.

This same new principle is further shown to explain the nature of light, suggesting a resolution to the age-old question of whether light is a particle or a wave … or indeed something else entirely. Since the mysterious wave-particle beliefs about light in Standard Theory support a sizable portion of the theory of *Quantum Mechanics*, resolving this issue has serious implications for *Quantum Theory*. In fact, our current quantum mechanical descriptions of atomic structure, light, and energy are shown to be unnecessary once the new unifying principle is considered. This should be expected of any alternate "theory of everything" since, by definition, it would have to be entirely separate and self-sustaining without relying on any of the patchwork of theories that compose Standard Theory today – of which *Quantum Mechanics* is one. As might be further expected then, Einstein's *Special Relativity Theory* is also shown to have serious problems, and is also replaced by this new principle. This means we can now replace the complexities and mysteries of *Quantum Mechanics* and *Special Relativity* with one simple principle that runs throughout our science, dispelling some long-standing mysterious beliefs such as the speed-of-light limit that we accept as true today. All of the well-known thought experiments and real-world experiments that are used to support these mysterious theories and beliefs are re-examined and shown to have serious flaws, misunderstandings, or even clear errors upon closer examination.

Finally, the same simple principle is shown to explain the many mysterious phenomena and particles that have emerged from high-energy particle accelerator experiments in recent decades, such as *virtual particles* and *antimatter*, removing the mystique that surrounds them today. This new explanation of subatomic particle experiments also suggests a new interpretation for the increasing number of new particle types that are being discovered in ever more powerful particle accelerators. It also provides a new perspective on Einstein's idea that matter and energy can be converted back and forth (according to his famous equation, $\boldsymbol{E=mc^2}$). Rather than this mysterious conversion of matter into energy in the explosion of an atomic bomb, or energy into

matter when subatomic particles apparently materialize out of pure energy in particle accelerators, this new unifying principle provides a clear, demystifying explanation for both effects. This principle also speaks to many of our celestial observations, suggesting simple alternate explanations for observations leading to today's more mysterious theories about Black Holes, the "Big Bang" creation event, and the apparently accelerating expansion of our universe.

The alternate explanations presented throughout this book do not constitute a string of proposed new theories *within* Standard Theory, but belong to a new and *entirely alternate theory* – an alternate "theory of everything." This parallel explanation of our universe provides answers to the many questions and mysteries in our science today with a clarity that allows even non-scientists to truly comprehend our universe – and does so via one simple unifying principle that is consistent with all known experiments and observations. It is worth noting that this last point is a claim that cannot be made even of Standard Theory today. That is, as shown in each of the following chapters, within many of our everyday experiences lie unanswered questions, unexplained mysteries, and even clear violations of our most elementary laws of physics when explained with Standard Theory. Therefore, as it stands today, our current body of scientific knowledge is not merely lacking some answers, but is actually a *fatally flawed* "theory of everything." While it is possible that our ongoing search for answers will be able to resolve these flaws and turn Standard Theory into the much-sought-after Theory of Everything, it is equally possible that the answers can only be found in an entirely new "theory of everything." It is suggested that the new theory presented in the following chapters does not merely provide an entirely alternate way of viewing our universe, but that it is the only one to meet the criteria of the Theory of Everything for which science has been searching for centuries. However, this will be up to the scientific community, as well as each individual reader, to decide for themselves. We now begin the journey toward discovery and understanding of this new principle with an exploration of *gravity*.

First … A Note on Format

Although this book is intended for both scientists and non-scientists alike, it does represent a sweeping re-think of our complete body of scientific knowledge today. Therefore, in order to help organize the discussions, as well as to quickly identify key points and their significance, summary boxes or icons will accompany key sections or phrases as follows:

NOTE  Highlights a key point in a discussion.

WATCH FOR... 

- Lists key points in the discussion to follow.
-

 Introduces a new idea for consideration.

LAW  Reminder of a current law of physics in Standard Theory.

VIOLATION  Indicates a physical law violation in a current scientific belief.

 Indicates an unexplained mystery in a current scientific belief.

ERROR  Indicates a logic or math error in a current scientific belief.

EXPERIMENT

Presents a thought experiment or real-world experiment.

OPTIONAL MATH

(x, y) Indicates that math follows, but is optional reading which is explained in either the preceding or following section.

- 1 -

Investigating Gravity

The Theory of Gravity

Gravity as One of Four Basic Forces in Nature

Gravity is one of the most fundamental and familiar forces of nature. As such, before discussing gravity in particular, it is important to clarify what the forces of nature are considered to be and how they relate both to Standard Theory and to our ultimate quest for understanding. Although Standard Theory is a composite of many sub-theories, some of which were listed earlier in Figure 1-1, most scientists believe the search for the Theory of Everything is a quest to understand and unify what are currently considered to be the four separate fundamental forces of nature:

- ***Gravity –*** the familiar attraction between all matter, first described by Isaac Newton.

- ***Electromagnetism –*** the closely related phenomena of electricity and magnetism, as well as electromagnetic radiation such as radio waves and light.

- ***Strong Nuclear Force –*** a powerful, short-range force thought to be holding atomic nuclei together. Atomic nuclei have many positively charged protons in close proximity, which should strongly repel each other and cause the nucleus to fly apart according to the theory of *Electric Charge*. Therefore, the concept of an attracting *Strong Nuclear Force* between protons in the nucleus was introduced to explain how the nucleus is held together in apparent violation of *Electric Charge Theory*.

- ***Weak Nuclear Force –*** another nuclear force, considered to be much weaker than the *Strong Nuclear Force*. Phenomena such as the random decay of populations of subatomic particles (i.e. radioactivity) were difficult to explain until the concept of this additional nuclear force was introduced.

It is currently believed that these are the four fundamental forces in nature, and that, in essence, they are merely different manifestations of

one single underlying force or principle that has so far eluded science. To discover this underlying force or principle would be to arrive at the Theory of Everything since, at a glance, it would show the single underlying cause for every observation, belief, and theory in science today. Such a unified understanding is expected to transform the patchwork of separate abstract theories in Standard Theory into a much simpler, coherent whole that shows a true *physical* explanation for everything, sparking a scientific revolution.

The new theory discussed throughout these chapters suggests that while this vision is the proper intuition, there are several reasons why success has eluded us so far. First, since we obviously lack the deeper understanding that we are seeking, we cannot be certain we have properly identified the fundamental forces of nature. If, for example, our theory of *Electric Charge* is an imperfect model of the true underlying principle behind many of our observations, then our current model of proton behavior as positively charged particles that always repel each other may not be an accurate description of the nucleus of an atom. Instead, it may be perfectly natural for protons to cluster together when in the nucleus of an atom, according to an undiscovered principle in nature that may have been misunderstood and represented as a "positive electric charge" upon protons. That is, in many situations protons may behave *as if* they literally possess our concept of a "positive charge," but this behavior could also arise from a very different principle – one that causes them to naturally cluster together when in an atomic nucleus. In that case, the concept of a "*Strong Nuclear Force*" keeping the nucleus from flying apart would be a completely unnecessary fabrication, and our attempts to find a unifying theory would be based in part on a force that doesn't even exist. Our current goal of unifying these four forces may be based on such flawed assumptions from the start.

Secondly, much of our current and largely mathematical approach to finding a unifying theory may be straying from the original spirit and purpose of the quest. The goal of a new and deep physical understanding of our universe may be in danger of merely becoming an exercise in mathematical manipulation of our current equations. Since arrival at this deep physical understanding is expected to yield a common mathematical framework for all the forces of nature, it is often assumed

that if we simply pursue this mathematical end result directly – using our current models – we will achieve this deeper understanding. However, this approach may be unsound since it assumes we have correctly identified the fundamental forces of nature and simply need to rearrange our mathematical models. Yet, if this turns out to be an incorrect assumption, then such an approach would only achieve a largely meaningless mathematical link between flawed models of the physical world. This approach also risks trivializing our search for deeper *physical* understanding into an attempt to achieve a mere *mathematical* goal, bringing no deeper meaning. We may expect mathematically unified models to emerge once we achieve a deep physical understanding of our universe, but this does not necessarily mean this deep physical understanding will emerge by mathematically unifying our current models. It is possible that this approach may provide some useful insights, but it may also result in little more than contrived mathematical relationships between essentially the same equations modeling the same limited physical understanding we have today.

For the reasons mentioned above, the discussions of this new "theory of everything" in the coming chapters do not strictly follow the format of a mathematical unification of the "four fundamental forces" in nature. In fact, there is very little math and only loose references to these forces amidst a broad and rich discussion of science in clear physical and common-sense terms. The discussions do, however, begin with the first of these forces – *gravity* – showing the numerous problems with our current gravitational beliefs, and leading to an introduction of the new unifying principle behind a new theory of gravity that resolves these problems. Once this new principle is established, it does indeed ripple through the rest of Standard Theory in the chapters that follow, not only redefining our concept of the "four fundamental forces," but redefining the complete patchwork of theories in science today in clear physical terms.

The Trouble with Gravity

Newton's Theory of Gravity is undoubtedly one of the most universally recognized and accepted theories in all of science. It has become so

deeply ingrained in our thinking and our science over the centuries that this theory has largely become synonymous with the very phenomenon of gravity itself. It is almost inconceivable today to separate our everyday experience of gravity from Newton's proposal of an attracting force emanating from all matter; yet, as shown in the following discussions, Newton's theory actually contains many unexplained mysteries and scientifically impossible claims. Such problems should prevent any new theory from becoming widely accepted as fact, leaving it only with the status of a proposal or *hypothesis*; however, the compelling nature of Newton's proposal combined with the lack of a more viable theory has meant that it has largely escaped such scrutiny.

- Newton's theory of gravity does not explain *why* objects attract one another; it simply models this observation.
- There is no known power source supporting the gravitational field that Newton claims to be emanating from our planet and from all objects.
- Despite the ongoing energy expended by Earth's gravity to hold objects down and the moon in orbit, this energy never diminishes in strength or drains a power source – in violation of one of our most fundamental laws of physics: the *Law of Conservation of Energy*.
- These mysteries and violations are overlooked today because of a flawed explanation that arises from the improper use of an equation known as the *Work Equation*.
- Every effect explained by Newton's theory of gravity today is accurately modeled by *non-gravitational* equations that existed even before Newton.
- Newton's gravitational force is actually an entirely redundant and superfluous concept providing no additional usefulness and having no proven existence in nature or scientific support.

Newton's Error – Violations of the Laws of Physics

Gravity is one of the most familiar and important phenomena in nature. Although it has always been known that *something* obviously causes

objects to fall, it wasn't until Isaac Newton (1642-1727) that we had a clear model of this *something* as an attracting force emanating from all matter in a manner that is precisely describable via an equation. Newton also claimed that this very same attracting force was responsible for the orbits observed in the heavens, making our universe as comprehensible and predictable as a clockwork mechanism for the first time in history. This was such a monumental achievement in Newton's day that it set the stage for other models of forces described by equations in similar fashion ever since.

Although today we commonly speak of such forces, it is often overlooked that modern science still has little or no solid physical explanation for many of them. The legacy of theories and equations that compose our body of scientific knowledge today works rather well, making it easy to forget that these are largely *abstract models* – not solid physical explanations. Newton was the first in a long line of scientists to produce explanatory models for various classes of phenomena, which can be very compelling and useful but cannot be fully explained in physically meaningful and scientifically viable ways even today.

In fact, there was a strong undercurrent of resistance to Newton's gravitational force concept when it was introduced, since it seemed to represent an almost magical force at a time when solid rational thought was finally beginning to prevail over the mysticism and superstition of ages past. Today, largely as a result of the scientific acceptance of Newtonian gravity, we have grown accustomed to the idea of unexplained forces reaching across empty space to affect objects at a distance in some equally unexplained manner. We have even grown accustomed to the fact that many of these forces (gravity, magnetism, electric charge, etc.) have no known power source. However, in Newton's time such concepts were only known in stories of myth and magic. To philosophers such as René Descartes (1596-1650), it had been a long journey for society to shake off the mysticism of the past and finally enter a welcome era of solid rational thought and debate.

In fact, Descartes himself had an earlier and widely accepted *physical* theory of orbits that claimed the planets were dragged along by an invisible material, known as the ether, which presumably swirled around the sun. Although this theory had its own problems, in this era of

rationality many considered Newton's idea of a completely unexplained force acting across empty space to be an unwelcome return to the magical thinking of the past. Newton realized this fundamental problem with his theory of a gravitational force, and never claimed to be able to explain it. However, the compelling and rational nature of his accompanying mathematical model soon solidified the force of gravity as a physical reality and a scientific fact that continued to grow in acceptance for centuries, being the predominant theory even today.

It is important to note, however, that although it is generally recognized that Newton's gravitational force lacks a proper physical explanation, the much larger issue – that it *violates the laws of physics* – has gone almost entirely unnoticed. This point will be clearly illustrated, beginning with a reminder of one of the most fundamental and unbreakable laws of physics – *The Law of Conservation Of Energy*.

The Law of Conservation Of Energy

Energy can neither be created nor destroyed, but merely changes from one form to another.

This is one of the most fundamental and unbreakable laws of physics, serving as a test for the scientific validity of any proposed theory or invention. If a proposed theory or device either uses or produces energy it must draw on an existing power source to do so, merely transforming energy from one form to another in the process. For example, the stored chemical energy in gasoline changes to kinetic energy as it is "used up" to accelerate a vehicle. In accordance with the *Law of Conservation Of Energy*, the chemical energy in the gasoline does not actually vanish, but is converted into another form of energy – the kinetic energy of the vehicle's motion. Similarly, the kinetic energy of the vehicle did not simply appear out of nowhere, but was converted from an existing chemical energy source – the gasoline. Although we commonly refer to power sources being *drained*, what we actually mean by this is that the energy from a given power source is converted into another form of energy elsewhere. This is the law that tells us perpetual motion machines

are impossible since they are considered to be devices capable of producing or expending energy continually without draining a power source. There is no such thing as "energy for free" in our science. Free energy devices violate our most elementary laws of physics.

Also noteworthy, once it was realized that energy (denoted by the symbol ***E***) and matter (denoted by ***m*** for mass) can change form back and forth, modeled by Einstein's famous equation $\boldsymbol{E=mc^2}$, the *Law of Conservation Of Energy* included *matter* as one of the energy forms. The explosion of an atomic bomb, for example, does not actually *create* the enormous amount of energy in its explosion, but is considered to *release* it by converting its original core of matter into energy. Therefore, in all things the *Law of Conservation Of Energy* must be upheld.

Newton's Gravitational Force Violates the *Law of Conservation Of Energy*

There is nothing in Newton's gravitational theory stating that the force of gravity weakens as it expends energy. The mass of the moon exceeds one percent of the Earth's mass and would fly past the Earth and off into space if not forcefully constrained by gravity to circle the Earth, according to Newton's theory. Yet this tremendous continual effort expended by Earth's gravitational field is not considered to diminish the strength of this field at all – millennium after millennium.

Returning to the vehicle analogy, when a car increases its speed it is said to accelerate, which is only possible by drawing on a power source, converting its energy into the car's increased speed or kinetic energy. Turning the vehicle in a circle is another form of speed change or acceleration, involving a constant, forced change from its natural straight-line direction of travel. This continuously forced circular direction change is known as *centripetal acceleration*, and also requires energy to maintain this constant diversion from the natural straight-line path of objects. Likewise, the natural forward momentum of the moon would carry it away from our planet and off into space in a straight line if gravity were not forcefully pulling it into a circular orbit moment by moment. Yet this tremendous energy expenditure is not balanced by a

conversion of energy from any known power source. This is a *creation* of energy from nothing – energy for free – rather than a *conversion* of energy from one form (a power source) to another (circular centripetal acceleration). This situation is a clear violation the *Law of Conservation Of Energy*.

Gravity also forcefully holds down all objects on the surface of our planet, which would drift off into space otherwise. In fact, the pull of gravity holds our very planet together, creating tremendous crushing forces within the center of the Earth. This has been going on for well over 4 billion years, yet no known power source is being drawn upon to support this tremendous ongoing energy expenditure.

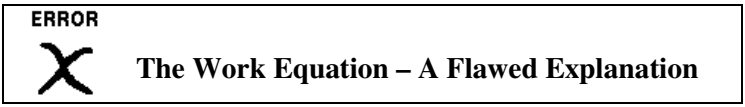
This mystery is further deepened when we consider that not only is there no *drainage* of energy from a power source to support the effort expended by the gravitational force, but in fact there is *no power source at all*. A gravitational force is considered to emanate from within each atom of matter, adding up to the tremendous overall gravity of the Earth, yet we still have no explanation for its endless power source despite having created detailed atomic theories – and even having split the atom. This is a textbook case of an impossible free energy device.

This discussion naturally raises the question of why such a fundamental violation of our laws of physics doesn't generate intense scientific concern, curiosity, and investigation. Why is Newtonian gravitational theory simply accepted and its mysteries left uninvestigated? This question brings a curious mixture of responses. One answer is that science *has* responded to these concerns by accepting a very different explanation of gravity proposed by Albert Einstein (1879-1955) known as *General Relativity Theory*, which will be explored further in later discussions. However, Einstein's theory offers no solutions to these problems either. In fact, these violations are not generally acknowledged as the reasons for accepting Einstein's alternate theory of gravity, nor are these violations even generally acknowledged at all today.

Perhaps more curious is the fact that even though *General Relativity Theory* is generally accepted in academic circles as the proper description of gravity, it is not widely taught or used by engineers and physicists – usually being reserved for optional or advanced study, and

mostly for rare and exotic applications. Most university science and engineering graduates know little or nothing about Einstein's theory of gravity despite the fact that it is presumably the true explanation of this phenomenon, and it is not generally used in our space programs. Newton's concept of gravity is by far the main gravitational theory used in space missions today, despite the fact that there was apparently good reason to accept Einstein's quite different theory of gravity into our science. All of this further deepens the mystery surrounding gravitational theory today, so let's take a closer look at these issues starting with the currently unrecognized law violations in Newtonian theory.

The serious law violations and mysteries found in Newtonian gravitational theory have just been clearly pointed out in reference to one of our most fundamental laws of physics, yet science does not generally recognize these violations. How can this be? Why might those who are the most highly educated in physics be the least likely to acknowledge these mysteries and violations? The answer is that when Newton's theory of gravity is taught, it is usually accompanied by further instruction on how to resolve these mysteries and violations by referring to an equation called the *Work Equation*. Although it will be shown shortly that this is a fatally flawed explanation attempt that gives a false sense of closure on these issues, this fact is overlooked by our educational institutions today since there is no other explanation for Newtonian gravity. Therefore, all properly educated scientists have firmly learned the standard (though erroneous) logical techniques that have been taught for generations to provide ready answers for the mysteries and violations of Newtonian gravity. This leads to the curious fact that, on the one hand, science found it necessary to search for and accept such alternate gravitational theories as Einstein's *General Relativity Theory*, while on the other hand, Newtonian gravity is still widely accepted by scientists. This makes the *Work Equation* an important pivotal element in this whole mystery, and therefore worthy of a closer look.



The Work Equation – A Flawed Explanation

Physical labor typically involves moving heavy objects or material from one place to another. The heavier the object and the further it is moved, the more energy must be expended in the process. The *Work Equation* is merely an attempt to describe this fact using a simple equation – originally designed to help engineer mechanical devices that use energy to do work, such as steam engines that burn fuel to move trains. This equation is written as $\boldsymbol{W = F\,d}$, which is read as *work* (***W***) equals *force* (***F***) times *distance* (***d***). That is, the more force required to move an object, and the further the object is moved by that force, the more work is done in performing this task.

The *Work Equation* can be a very useful tool in analyzing and quantifying the amount of work done by a given process or machine, and has served engineers well for over a century. However, serious problems arise when its use is extended beyond its design intent. Its original purpose was as an engineering tool to compute how much *work* is done when a force moves an object across a distance, which also corresponds to how much *energy* was expended, since an equivalent amount of fuel must be used in the process. This all seems quite reasonable; however, over the years the *Work Equation* has undergone a subtle and surprisingly deceptive transformation into a "work detector," whose result is taken as the final word on how much *energy* was used in any given process. This is such a subtle yet powerfully deceptive transformation that it needs to be clarified with an example:

Consider the situation where an object is simply too heavy to move, despite all efforts to push it. There is no question that one could expend a tremendous amount of effort and energy attempting to move the object, yet never actually manage to move it an inch. However, applying the *Work Equation* as a "work detector," it calculates that zero work was done. A tremendous amount of force was applied to the object, but the object was nevertheless moved *zero* distance, and since *work* equals *force* times *distance*, the *Work Equation* calculates that zero work was done. If this were further taken to mean no *energy* was expended, we would have a worker who is exhausted from attempting to move such a

heavy object, yet who is considered to have expended *no energy*. Of course, this is obviously a serious misapplication of the *Work Equation* that brings nonsensical results, yet this is precisely the logic used to justify the gravitational force, as we will see shortly. The *Work Equation* is only designed to help organize and quantify situations where a force clearly moves an object through a distance, but is not meant to function as a generic "work detector" that further tells us whether any energy was expended by an arbitrary event.

Now, to complete the improper transformation of the original *Work Equation* from a simple engineering tool to a generic "work detector," it has evolved from its original form of $\boldsymbol{W = F\,d}$ to its current form $\boldsymbol{W = F\,d\,\cos(\theta)}$. The additional term here, $\boldsymbol{\cos(\theta)}$, is the cosine function, which transforms any angle from 0 to 360 degrees into a value that lies between -1 and 1. Therefore, the original result from the *Work Equation* calculation is now multiplied by a value between -1 and 1 that corresponds to the angle ($\boldsymbol{\theta}$) between the direction the object is pushed and the direction it actually ends up moving. If the object simply moves in the direction it is pushed, which is the usual case, this zero-degree angle between force and movement results in the work calculation being multiplied by 1, since $\boldsymbol{\cos(0) = 1}$. This means nothing changes from the original *Work Equation* when force and movement are in the same direction. However, if the object somehow managed to move completely sideways despite a forward push being applied to it, this 90-degree angle between force and movement means the resulting work calculation must be multiplied by 0, since $\boldsymbol{\cos(90) = 0}$. Therefore, the work done in this scenario would be calculated as zero. This *modified Work Equation*, $\boldsymbol{W = F\,d\,\cos(\theta)}$, is said to calculate the amount of *useful* work, since only the amount of work done in the direction of the force is considered to be desired and therefore useful work.

This is how the *Work Equation* is taught today, which now sets the stage to explain why the previously mentioned violations of the laws of physics by Newton's gravitational force cause no particular concern for most scientists. First, the issue of objects being held to the planet's surface by a force that has no known power source is easily dismissed by noting that an object held down by the gravitational force does not move. If the object doesn't move, there is no work done according to the *Work*

Equation, and therefore no energy is expended and no energy *source* is required to explain how things are forcefully held down by gravity. The serious law violation that results from gravity forcefully holding objects to the planet's surface with no known power source suddenly vanishes. This is the same flawed logic used earlier, which left our worker exhausted after trying unsuccessfully to move a heavy object despite having apparently expended no energy. Yet, of course, both the worker and gravity must expend energy in these examples.

In similar fashion, the *modified Work Equation* is used to justify the tremendous energy required to hold our moon in orbit, again with no known power source. Since the moon is actually traveling *past* the Earth in a straight line but is continuously constrained in its orbit by the gravitational force pulling it *down* toward the planet, this is considered to be a situation much like an object that slides sideways when a force pushes forward. The angle between the direction of the moon's travel *past* the Earth and the direction of gravity pulling *down* is the same 90-degree angle as in the earlier example of the sideways-sliding object, meaning the *Work Equation* must be multiplied by 0. This gives the result that the gravitational force does zero useful work and thus expends no energy in constantly constraining our moon from flying off into space, removing the need to look for a power source. Once again, a serious violation of the laws of physics suddenly vanishes. Yet, a person who must constantly struggle to constrain a heavy, speeding rock into traveling in a circle on the end of a rope might disagree with this zero-work, zero-energy conclusion for orbits.

Finally, there is the situation where objects fall straight down. Surely the *Work Equation* would have to give a non-zero result here since the direction of movement is in the same direction as the downward pull of gravity. Indeed, the *Work Equation* does calculate a positive amount of work, which should mean energy has been expended by the gravitational force, requiring an energy source be identified within the Earth that is drained by an equivalent amount if this event is to remain within our laws of physics. Since there is no such energy source known to science, we must either admit that Newtonian gravity cannot be scientifically explained, or arrive at some further justification. Indeed, an additional logical abstraction *has* been invented for this type of situation

to avoid the search for a power source, which runs along the following lines:

In order for an object to drop from a given height, work had to be done earlier *against* the pull of gravity to lift it to that height in the first place. Since this upward lifting could be considered *negative* work from the perspective of the downward-pulling gravitational force, the positive work done by gravity when the object falls could be considered to cancel with this earlier negative work. This zero overall work then corresponds to zero net energy expenditure, and thus we are once again saved from looking for the energy source for gravity. Of course, this abstract exercise overlooks the *physical* reality that the falling object must still somehow drain gravity's unknown energy source, and no known theory states how lifting the object earlier would have *charged* this power source in order to compensate for this later energy drain. Further, this explanation implies the *existence* of such a mysterious and currently unknown power source, which is the very issue it was invented to avoid. So the "energy balance" in this logic is a meaningless abstraction that merely diverts attention from the physical law violation that gravity somehow pulls objects to the ground while expending no energy.

Once again, the reason this logical conundrum has arisen in our science is due to the deceptively subtle, yet powerful difference between using the *Work Equation* to describe clear situations where a force moves an object through a distance, and using it as a generic "work detector" in all situations. In fact, in the case of Newtonian gravity, not only has the *Work Equation* been misused as a "work detector" but also as a "force authenticator." That is, not only is it used to alleviate concerns about law violations by calculating that the gravitational force does no work and expends no energy, but it is put to this use in order to help justify or authenticate the very *existence* of the gravitational force. After all, any theory involving a force that violates our most fundamental laws of physics is unacceptable as anything other than a purely abstract model of a still unexplained physical process. It cannot literally be taken as the proper physical explanation since this is precisely why our laws of physics exist – as a litmus test or sanity test for such proposed new ideas. The *Work Equation* is simply intended to describe the work done by

known forces as they move objects, but here it is being used in an attempt to *authenticate the existence* of the previously *unknown* force introduced by Newton – a force that is otherwise *scientifically unexplainable*. This misapplication of the *Work Equation* essentially creates a loophole in the *Law of Conservation Of Energy*, corrupting the original purpose of *both* of these concepts.

This *Work Equation* discussion shows the type of logic that keeps most physicists from acknowledging that Newton's gravitational force violates the *Law of Conservation Of Energy*. However, once the flawed *Work Equation* explanation is exposed and removed, there are simply no excuses remaining for this unexplained force. The rationalists of Descartes' time had good reason to see Newton's gravitational force as a return to the magical thinking of the past. Perhaps in Newton's day it was reasonable to expect that future generations of scientists would find a scientifically viable explanation or even a true power source for the gravitational force. However, three centuries later we have found no answers, instead opting to turn a blind eye to its violations of our laws of physics by installing a flawed logical justification for this force into our science. Regardless of its original purpose, the *Work Equation* has now been incorporated into our science in such a manner that most scientists clearly believe a zero-value result from its calculation always means there has been no expenditure of energy. This has led to the logical oversight that gravity need not expend energy to hold objects to the planet, since there is no motion involved, nor to constrain the moon from speeding away, since the pull of gravity is perpendicular to the moon's orbit.

This state of affairs exists because we very much *want* to believe in this force. For centuries it has been the only reasonable explanation we have had, and in fact, it is still the only compelling and intuitive physical explanation for falling objects and orbiting moons even today. The official position in science today does state that another viable explanation exists in Einstein's *General Relativity Theory* of a "warped space-time continuum," but this does not address our everyday experiences and seems far off the mark compared with Newton's intuitive gravitational force. And indeed, as shown in the following chapter where the new principle is introduced, gravity *can* be explained

in a simple, intuitive, and scientifically viable manner – but without appealing to either an unexplained force or an abstract and largely incomprehensible "warping of space-time."

So far, we have seen a number of questions, mysteries, and even violations of physical laws surrounding the concept of a gravitational force. We have no answer for why it attracts rather than repels objects, we know of no power source within matter that would produce this force, and it expends energy without diminishing in strength or draining a power source – an "energy-for-free" scenario that violates the *Law of Conservation Of Energy*. In addition, there is yet another troublesome issue with Newtonian gravity to consider – the issue of its speed of travel through space. We begin with a reminder of our currently accepted universal speed limit, the speed of light.

LAW

The Speed-of-Light Limit

Neither matter nor energy can travel through space faster than the speed of light.

This is a currently accepted law in our science today, stating that the speed of light in the vacuum of empty space represents an absolute upper speed limit on all objects and also on the speed of propagation of all fields and all forms of energy through space. According to this law, nothing known to man can travel faster than light. This is an idea that Einstein proposed as part of his *Special Theory of Relativity*, and which currently stands as an unbreakable law of nature.

VIOLATION

Newton's Gravitational Force Exceeds the Speed of Light

Newtonian gravitational theory comes with no speed limit. A common example of this is to imagine our sun suddenly vanishing. While it would still appear as if the sun were present for roughly eight minutes as the last

rays of light eventually made their way to Earth at light-speed, the gravitational field of the sun would vanish immediately along with the sun. The Earth would not experience eight additional minutes of the sun's gravity constraining it in orbit, but would *immediately* leave its orbit about the sun and begin to drift off into space. This is because the loss of gravity from the sun would be immediately felt at any distance throughout the solar system, and indeed throughout the universe according to Newtonian theory. This faster-than-light transmission of the gravitational force through space – and indeed even *instantaneous* transmission across *any* distance in our universe – is a great, unexplained mystery in our science today.

This is *one* violation in Newtonian gravitational theory for which a logical justification has *not* been found that allows it to be dismissed or overlooked. That is, unlike the law-violating behaviors mentioned earlier that were justified with a misapplication of the *Work Equation*, this speed-of-light violation remains in plain view. However, although this violation lacks a logical justification, a resolution can be found in Einstein's *General Relativity Theory*, since one of the key differences with this alternate theory of gravity is that the element of *time* is built into its equations. This provides a description of gravity that allows it to take time to travel or propagate through space, proposing a solution to this issue. However, this is only a *proposed* solution since the actual speed of gravity is unknown – no direct tests have been done to determine it.

So, we have the choice of Newton's simple and intuitive theory, which violates the speed-of-light limit, or Einstein's complex and mysterious theory, which offers an unproven solution to this violation. As a result of this type of interplay between these two theories, we are left with an odd combination of *both* theories in our science today. Neither theory truly stands alone today as the singular, correct description of gravity, as both theories tend to complement each other's weaknesses. It is this type of interplay between them that leaves us with two very different explanations for gravity in our science today, even though common sense tells us there can be only one clear physical explanation underlying any observation. Clearly one of these theories must be fatally flawed, or *both* theories are merely useful interim models

that have captured one aspect or another of the true and as-yet-undiscovered physical explanation for gravity. It is precisely this as-yet-undiscovered explanation that is proposed in the next chapter, offering a resolution to this odd state of affairs in our science today.

The Origin of Newton's Gravitational Force

The discussions so far have largely taken for granted that we are all very familiar with the Newtonian explanation of gravity as an attracting force that somehow emanates from matter; as such, the details and origin of this theory have not yet been addressed. If we could examine the progression of ideas that led to Newton's theory of gravity, perhaps we could identify once and for all either where the overlooked power source may be for this force, or alternatively, how this *fictitious* force came to be invented.

The first publication of Newton's *Law of Universal Gravitation* appeared in his famous work, widely known as "*The Principia*" today, published in 1687. In this publication Newton describes his proposed new force, showing how it explains our observations of falling objects and orbiting bodies, and even providing a simple and intuitive mathematical formula for calculating the strength of this gravitational force between any two objects. To arrive at this equation Newton would have had to follow the clues available to him at the time, both from his own experience and education as well as from the available astronomical data of his day. Let's now follow the type of thought processes that would have led to Newton's formal theory of a gravitational force.

At the time, a formal mathematical description of the orbits of moons and planets was already in existence – provided by Johannes Kepler (1571-1630) – based on the astronomical data of the day. In fact, Kepler's three laws of planetary motion are very accurate and useful indeed, still remaining as some of the most important tools used in our space programs. Yet, despite this great achievement by Kepler, these laws only provided a *mathematical* description of planetary motion without explaining *why* and *how* this motion occurs. In essence, Kepler's Laws described only the *geometry* of planetary motion, but not the *physical* reason for this geometry.

Prior to Newton's *Law of Universal Gravitation* there were suspicions that some type of attracting force might be at work, but no one had managed to arrive at a solid theory or justification for such a force. Newton's well-developed theory of a gravitational force finally managed to achieve this convincingly, bridging the gap between Kepler's purely geometric laws of planetary motion and the strong suspicion that some type of attracting force in nature may underlie them. Newton's *Law of Universal Gravitation* is now presented, followed by a consideration of its origins to see what insights can be gained into the source of the familiar, yet still quite mysterious gravitational force that we believe in today.

LAW

Newton's Law of Universal Gravitation

There is an attracting force in nature emanating from all objects, pulling them toward one another with a strength that increases with their masses and decreases with the distance between them squared.

According to this claim made by Newton, now considered a law of nature, the greater an object's mass the greater its gravitational field strength, and this gravitational field diminishes rapidly in strength the further it extends out into space away from the object. Specifically, the strength of this gravitational force between any two objects is calculated by multiplying their masses together then dividing by the square of the distance between their centers. Finally, this result is multiplied by a constant, known as the *gravitational constant*, to present it in standard units of force. The resulting equation of the strength of the gravitational force, $\boldsymbol{F}$, between two objects is written as:

$$F = \frac{G \cdot (m_1 m_2)}{R^2}$$

where $\boldsymbol{m_1}$ and $\boldsymbol{m_2}$ are the masses of the two objects.
$\boldsymbol{R}$ is the distance (radius) between their centers.
$\boldsymbol{G}$ is a constant, called the gravitational constant.

This equation is known as the *Law of Universal Gravitation*. Yet this represented much more than just another equation when Newton introduced it. It ushered a completely new force of nature into our awareness and our science. It was not merely an abstract model of observations, but a statement of an *actual* force in nature emanating from objects – varying in strength with their mass, which we can lift, and their distance, which we can measure. This is a concept that we are now taught as children and have grown accustomed to, but it would have been truly revolutionary when it was first introduced in Newton's day. Some had suspected that something of this nature might exist to explain falling objects and orbiting bodies, but Newton was the first to actually *show* that this force apparently did exist, and to describe it in very definite, concrete terms. Further, it is fairly straightforward to derive today's *Newtonian Orbit Equation* from Newton's *Law of Universal Gravitation*, as will be shown shortly, which very accurately predicts the motions of the planets and plays a central role in our space programs even today. All of this made Newton's theory of gravity a revolutionary discovery, as well as apparently irrefutable proof of the existence of such a force in nature.

But where did this revelation come from? Somehow we went from a vague suspicion that an attracting force might be operating in the world around us, to a definite statement of its existence, its source in all material objects, and its precise behavior captured in an equation. How does something like this happen? The following investigation into this issue will help to clear up this mystery, showing that Newton's gravitational theory is actually a completely superfluous and unnecessary invention that is based on a logically and scientifically flawed assumption. As a result of this invention, a crucially important equation for the orbits of planets was overlooked, then recast in Newtonian gravitational terms and presented as an entirely new equation – the *Newtonian Orbit Equation* that is currently in use today. The story of how this occurred and its enormous implications follows, showing surprising revelations about Newtonian gravitational theory.

An Alternate Origin

Although Newton provided a mathematical derivation for his law of gravity based on Kepler's laws of planetary motion, the somewhat different derivation below provides a clearer picture of the origin of the gravitational force in our science, addressing the issues that still remain a mystery even today.

- Kepler developed three *purely geometric* equations of planetary motion involving no gravitational force, which described the heavens extremely well prior to Newton, and still do even today.
- A fourth *purely geometric* orbit equation of great importance is easily identifiable in the astronomical data available at the time, yet no formal record of this *Geometric Orbit Equation* exists.
- Newton's gravitational force equation can be easily arrived at by equating the *Geometric Orbit Equation* to the equation for a rock swung by a string, thereby *inventing* Newton's force by making the same rock-and-string assumption made by Newton.
- This assumed equality between swinging rocks and orbiting planets is seriously flawed, leading to the unexplainable mysteries and violations still present in Newtonian gravitational theory today.
- The *Newtonian Orbit Equation* widely used today is derived from Newton's gravitational theory; however, this only *appears* to give an entirely new and important orbit equation, but is actually merely a disguised return to the original *Geometric Orbit Equation* that pre-dated Newton.
- In actuality, Newton's whole theory of gravity is a pure invention with no scientific support, based on the pre-existing *Geometric Orbit Equation* combined with a flawed rock-and-string equality to orbits.

The Orbit Equation Actually Existed Prior to Newton

The analysis of the origin of Newton's proposed gravitational force begins with Kepler's three laws of planetary motion. Unlike Newton's *Law of Universal Gravitation* and the Newtonian orbit equation that follows from it, Kepler's laws are *purely geometric* descriptions of planetary motion based on observations of the heavens. They were arrived at prior to Newton's theory of gravity, and make no reference to a gravitational force. These laws are as follows:

LAW

Kepler's Laws of Planetary Motion

- *Kepler's First Law* states that the planets move in oval-shaped ellipses around the sun, with the sun at one end of the ellipse.
- *Kepler's Second Law* states that as a planet proceeds in its elliptical orbit, an imaginary line joining the sun and the planet would always sweep out the same area in a given time period regardless of where the planet is along its elliptical path.
- *Kepler's Third Law* provides an equation that calculates the average distance of a planet from the sun simply by measuring the time it takes to make a complete orbit.

These three laws are very accurate, reliable, and central to our space programs today. However, an additional and very important geometric relationship regarding orbits can be readily seen in the astronomical data that would have been available to Kepler and Newton, yet it is missing from both *Kepler's Laws* and Newton's gravitational theory. In fact, there is no formal record of it at all in our scientific history. This purely geometric relationship is so "Kepler-ian" in nature that it is tempting to call it *Kepler's Fourth Law*, but since this would obviously be inappropriate, we'll call it the *Geometric Orbit Equation*:

The Geometric Orbit Equation

The *Geometric Orbit Equation* is a previously unrecognized, purely geometric equation embodying a relationship in the standard astronomical data showing that the orbital radius of any planet in our solar system (i.e. its distance from the sun) multiplied by the square of its velocity always gives the same constant value. This would be written as:

$v^2R = K$, where K is a constant with the unchanging value of 1.325×10^{20} [m^3/s^2]
R is the orbital radius of the planet (distance from the sun)
v is the velocity of the planet

This relationship can be readily deduced from any standard table of planetary data that can be found in most introductory physics textbooks. The constant, K, is the same for all planets orbiting the sun, but differs for other orbital systems. For instance, the value of K for objects orbiting the *Earth* rather than the sun can be readily calculated as 3.7×10^{14} by referring to these same tables of planetary data. This value of K for our Earth-based orbital system would apply to the orbit of the moon, for instance, as well as the orbits of the various satellites and spacecraft about our planet.

This geometric orbit equation allows the distance of orbiting objects to be calculated if their speed is known. Perhaps more importantly, it allows for the planning or alteration of satellite and spacecraft orbits by indicating the speed required to achieve a given orbit, and the required speed change to transfer from one orbital trajectory to another. This type of calculation would underlie everything from fuel requirement planning for space shuttle missions to orbital insertion of satellites around Mars. Notably, the *Geometric Orbit Equation* pre-dates Newton and achieves these results in a purely geometric fashion, as its name implies, *without any reference to masses or gravitational forces*.

The *Geometric Orbit Equation* is the type of important astronomical observation that we might expect to be noticed and

identified in the time of Kepler and Newton. Although there is no clear record of this occurring, the existence of this earlier geometric relationship provides an intriguing alternate derivation for Newton's gravitational force and the final form of his *Law of Universal Gravitation*. To see this, we turn to the common analogy for planetary orbits taught in all elementary physics courses – the presumably equivalent scenario of a rock swung in a circle at the end of a string, as assumed by Newton.

The Rock-And-String Assumption

The idea of the moon being forcefully constrained by gravity to circle the Earth seems very reasonable at first, since we are all familiar with the seemingly similar concept of swinging a rock on the end of a string, causing it to "orbit" about us. Of course, this is not truly an orbit since it involves a physical length of string with clear physical tension throughout it as our muscles strain to keep the rock from flying off. This leads to the mysterious concept that the orbit of our moon involves a mysterious attracting force acting across space in a manner that is still unexplained by science, apparently forcefully keeping the moon from flying off without drawing on any power source. However, since this is the equivalence made by Newton and widely accepted today, we will follow this same assumed rock-and-string equivalence in this alternate derivation of Newton's gravitational force.

Once this assumption is made, it may then seem reasonable to equate the force required to constrain the rock in a circular path about us with the gravitational force said to constrain the moon in its orbit about the Earth. The *Centripetal Force Equation* for calculating the force, $\boldsymbol{F}$, required to constrain a rock swung by a string is well known, as it was in Newton's day:

Centripetal Force Equation ("rock-and-string")

$$\boldsymbol{F = mv^2/R}$$ where $\boldsymbol{m}$ is the mass of the rock
$\boldsymbol{v}$ is the velocity of the rock
$\boldsymbol{R}$ is the radius of swing (string length)

Equating this with the scenario of gravitational orbits gives the picture of equivalence between all elements involved, as shown in Figure 1-2.

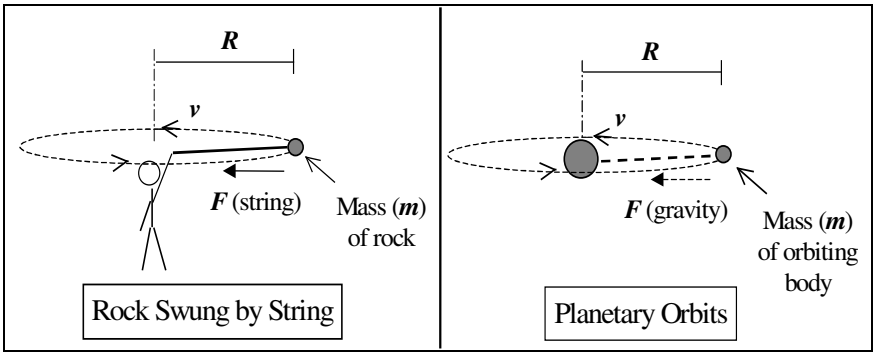


Fig. 1-2 Assumed Equivalence between Rock-and-String and Orbits

At this point, we have an equation for orbits (the *Geometric Orbit Equation*), an equation for a rock swung by a string (the *Centripetal Force Equation*), and an assumed equivalence between them. So then, it should be valid to combine these two separate equations to create one single equation that embodies this equivalence. This can be done by first rearranging the *Geometric Orbit Equation* in terms of its velocity parameter ($v = \sqrt{K / R}$), then substituting this velocity expression into the *Centripetal Force Equation*, resulting in the equation:

Hypothetical Gravitational Force Equation

$F = mK/R^2$ where ***m*** is the mass of the orbiting body
K is the constant from the *Geometric Orbit Equation*
R is the orbital radius, also from the *Geometric Orbit Equation*

This new equation is a hybrid of the *Geometric Orbit Equation* and the *Centripetal Force Equation*, obtained by making the *completely arbitrary assumption* that swinging rocks are *physically* equivalent to orbiting objects – and not simply similar in *appearance*. This would mean that there must somehow be an actual physical force pulling on objects to constrain them in orbit, just as there is a physical tension force in the rock-and-string equivalent as shown in Figure 1-2. As we will see soon, this new equation forms the foundation of Newton's *Law of*

Universal Gravitation, and the force, ***F***, is the first-ever occurrence of a *hypothetical* "gravitational force."

NOTE

This new hybrid equation marks the first appearance of an attracting gravitational force in our science.

As noted above, this new hybrid equation is no mere mathematical exercise, but the literal *creation point* for the supposed "gravitational force," and the first point where a force of any kind appears in relation to orbits. Prior to this a description of orbits was already available, provided by the *Geometric Orbit Equation*, but in completely geometric fashion involving only velocity and distance, with no mention of an attracting force emanating from the mass of the orbiting body. Now we have an equation that implies a gravitational force may be at work, which is somehow directly related to the mass of the orbiting body, ***m***, and diminishes with the square of its orbital radius, ***R***.

While this would be an exciting result for a scientist in Newton's day when this issue was a deep mystery and a very hot topic in science, we must keep in mind that this is still an unsupported hypothesis in the derivation so far. We went from a fully functional, purely geometric orbit equation to an equation implying that forces and masses are involved in orbits merely by making a few simple assumptions and mathematical manipulations. This hypothetical force is still just as mysterious as it always was in scientific circles, with no scientific explanation for why it should spring forth from matter and pull on other objects. However, this new equation does give *form* to this proposed force. Instead of being just a vague suspicion, now it has an equation describing it, an identifiable material source (presumably the mass, ***m***, of the orbiting object), and the characteristic that it diminishes in strength with the square of the distance between the object and the orbited body. Whether or not this is based on pure assumption, it is certainly a very compelling result.

To review, at this point we have a hybrid equation involving mass and a force, resulting from the assumption that a rock swung forcefully by a string is equivalent to the otherwise purely geometric

orbits in the heavens. This hypothetical gravitational force equation has the form:

$$F = mK/R^2$$ – Hypothetical Gravitational Force Equation (shown earlier)

This equation claims that there is an attracting force holding objects in orbit, whose strength varies directly with the mass of the orbiting object, diminishes with distance squared, and is also dependent on a mysterious constant, ***K***, that differs from one orbital system to another. But what could this constant refer to?

Since this new, hypothesized gravitational force presumably emanates from the orbiting object, ***m***, it stands to reason that it should also emanate from the object that is being orbited; therefore, we would expect the mass of the *orbited* body to appear in this equation as well. So then, if we assume that the constant, ***K***, is actually the mass of the orbited body, we have a viable explanation. We know that the mass of the sun is a constant factor in all planetary orbits, but not in the orbit of our moon; the mass of the *Earth* is the constant factor in the orbit of our moon (and all man-made satellites) in our separate Earth-based orbital system. Therefore, it seems quite reasonable that this constant that differs between orbital systems may well be the mass of the orbited body, which is also a constant that differs between orbital systems. So then, replacing ***K*** by this second mass, m_2, now gives our hypothetical gravitational force equation the form:

$$F = m_1 m_2/R^2$$ – Hypothetical Gravitational Force Equation with ***K*** replaced by m_2

The only remaining step is to make sure the results from this calculation are expressed in the units of force, and are reasonable values. Currently this equation multiplies two masses and divides by a distance squared, giving the units of [kg^2/m^2] – that is, kilograms squared per meter squared. These are not the proper units for a force, and the values that result when using reasonable estimates for the mass of the Earth or the sun as the larger mass, m_2, are also millions of times too large to be sensible. However, this problem is easily solved by multiplying our

equation by a value that reduces the results to within a reasonable range and alters the units into those of a force. This simply involves the arbitrary introduction of a *constant of proportionality* that has these qualities. However, if we now assume that our hypothetical gravitational force equation truly describes an actual attracting force in nature, then this arbitrarily invented constant of proportionality would have to be a true *natural constant*. Although all of this is still only an assumption, if true, this constant would become what is known as the *gravitational constant*, ***G***, today, giving the final form:

$$F = G(m_1 m_2)/R^2$$ – Newton's *Law of Universal Gravitation*

NOTE

This is precisely the form of Newton's *Law of Universal Gravitation* shown earlier and presented in his *Principia*.

As noted above, this final result is precisely the equation for the gravitational force that Newton presented in his *Principia* in 1687. Although this alternate derivation differs somewhat from that provided by Newton, it shows that the origin for his gravitational force can be clearly found in the *Geometric Orbit Equation*. Given this, we can now evaluate where our current belief in this force comes from, and the firmness of the foundation for this belief. We now know, for example, that there was no advanced knowledge or understanding of a hidden power source that led Newton to this belief. Instead, it is simply based on the assumption that the scenario of a rock swung by a string is the literal physical equivalent to that of objects in orbit. Yet the rock-and-string scenario *does* have an identifiable power source – our muscles, while the gravitational force maintaining orbits does not. Also, the rock-and-string scenario *does* have a physical explanation for the attracting force constraining the rock – the tension in the string, while Newton's proposed gravitational force has no clear physical explanation. In short, the assumption that these two scenarios are equivalent is based more on

their similarities in *appearance* as systems involving circling objects than on any verified *physical* equivalence.

Further, there are other physical systems that may have even more similarities to orbiting objects than a rock swung by a string; consider a rock swung by a *spring*, for example. One of the problems with the rock-and-string equivalence assumption is that the rock can be swung faster and faster while remaining the same distance away at the end of the string – the tension in the string simply increases. If this were a true physical equivalence to orbits then gravity would have to increase its attracting force to constrain a faster moving object at the same orbital distance. However, this does not happen, either in theory or in practice. Instead, orbiting objects that are given more forward thrust move further out into space, much the way the rock would if it were swung faster at the end of a stretchable *spring* instead of a rigid string.

So, as long as we're making arbitrary intuitive guesses at familiar mechanisms that might possibly be a literal *physical* equivalent to orbiting objects, we would have to seriously consider abandoning the rock-and-string idea for that of a rock-and-*spring*. This is not to say that orbits are the physical equivalent of a rock-and-spring either – this model also has its limitations and problems, and is just as arbitrarily chosen since we are merely going on superficial similarities in appearance. Still, as an educated guess it is perhaps more functionally similar to orbits than the rock-and-string scenario upon which today's gravitational theory is built, exposing the weak and arbitrary foundation of Newtonian gravitational theory.

Interestingly, if we used the rock-and-spring model, we would end up with an entirely different version of Newton's *Law of Universal Gravitation* since the centripetal force equation for the rock-and-spring is different than for the rock-and-string. That is, this difference in the centripetal force equation for circling rocks using springs means that when we substitute the velocity from the *Geometric Orbit Equation* into the *Centripetal Force Equation* as we did before, the resulting expression for the gravitational force must also differ. Yet this resulting spring-based gravitational force equation would still give us a numeric value for the gravitational force, just as Newton's current equation does. And although this numeric value is not directly measurable – even from

Newton's current equation – it gives the *appearance* of an actual force in nature; one whose strength we can even *calculate*, using the concrete attributes of mass and distance.

NOTE

Therefore, the familiar form of Newton's *Law of Universal Gravitation* is not a true law of nature, but merely a *flawed invention* based on superficial similarities in appearance between orbits and the very different scenario of a rock-and-string.

The preceding alternate origin for Newton's gravitational force shows that the introduction of an attracting gravitational force in orbits was *completely arbitrary and unnecessary*, considering the contributions by the already existing body of purely geometric equations, i.e. Kepler's three laws plus the *Geometric Orbit Equation*. But this is a fact that could not have been realized without this alternate derivation since *the Geometric Orbit Equation is unknown to science*, at least in the formal manner presented in this discussion. Instead, we have the *Newtonian Orbit Equation* today, derived from Newton's *Law of Universal Gravitation*. Since this *Newtonian* orbit equation is central to our science of astronomy and our space programs, Newton's theory of gravity is considered to be of immense importance as the origin of this equation. However, it is now possible to show that the *Newtonian Orbit Equation* is simply the pre-existing *Geometric Orbit Equation* in disguise. To see this, let's take a closer look at the origin of the *Newtonian Orbit Equation* in use today.

The Invention of the Newtonian Orbit Equation

Throughout the following discussion it is important to keep in mind that the progression from the *Geometric Orbit Equation* to Newton's *Law of Universal Gravitation* that was just shown is unknown to science, just as the formal *Geometric Orbit Equation* itself is unknown. Therefore, the following derivation of today's *Newtonian* orbit equation from Newton's *Law of Universal Gravitation* is currently believed to be the sole origin

and form of the orbit equation in our science. The fully equivalent, pre-existing, and in fact, more proper *Geometric Orbit Equation* is unknown today, as is the flawed foundation of Newton's *Law of Universal Gravitation* itself. This gives the appearance that the existence of today's *Newtonian* orbit equation, as well as its tremendous contributions to astronomy and our space programs, is owed entirely to Newtonian gravitational theory. In actuality, however, this homage that is commonly paid to Newtonian theory is quite unfounded, as will now be shown.

The standard derivation of the *Newtonian Orbit Equation* in use today begins with the assumption that the rock-and-string scenario is equivalent to orbiting bodies in the heavens – a centuries-old assumption that is simply accepted unquestioningly today. Therefore, since Newton's gravitational force and the rock-and-string centripetal force shown earlier are considered equivalent physical concepts today, the derivation of the *Newtonian Orbit Equation* starts by simply equating these two forces:

Newton's Equation $\rightarrow$ $\boldsymbol{GmM/R^2 = mv^2/R}$ $\leftarrow$ Rock-and-String Equation

Here, the two masses, $\boldsymbol{m_1}$ and $\boldsymbol{m_2}$, in Newton's equation are named $\boldsymbol{m}$ and $\boldsymbol{M}$ to signify the smaller mass, $\boldsymbol{m}$, of the orbiting object and the typically much larger mass, $\boldsymbol{M}$, of the orbited body. The above equality immediately simplifies to the familiar form of the *Newtonian Orbit Equation* that exists in our science today:

$$\boldsymbol{v^2R = GM} \qquad \textit{– Newtonian Orbit Equation}$$

Note that, although this *appears* to be a completely new and important equation derived from Newton's law of gravity, in actuality it is merely a reversal of the steps performed earlier in the derivation of Newton's *Law of Universal Gravitation* from the original *Geometric Orbit Equation*. That is, where we started with the *Geometric Orbit Equation* and arrived at Newton's *Law of Universal Gravitation* by making the (flawed) rock-and-string assumption, we now have simply used this same flawed assumption to work backwards from Newton's equation to the original *Geometric Orbit Equation* again. The *Newtonian Orbit Equation* above looks a bit different from the *Geometric Orbit Equation*, but as we'll soon see, this is only a cosmetic difference in appearance.

Today this fact is not recognized since Newton's derivation for his *Law of Universal Gravitation* does not show its origin in the *Geometric Orbit Equation*. Therefore, it *appears* as if the orbit equation we use today is a perfectly valid Newtonian result derived solely from "solid gravitational theory." Today, this mere reversal from Newton's gravitational force equation to a disguised version of the *Geometric Orbit Equation* is unknown, lending unwarranted credibility both to Newton's gravitational theory and to the assumed physical equivalence of the rock-and-string analogy. In actuality, the flawed rock-and-string analogy was used to *invent* Newton's equally flawed equation of a gravitational force in the first place, then used again to undo this logic, merely arriving at a slightly disguised version of the only correct equation in this whole process – the original *Geometric Orbit Equation*.

This discussion literally means that although the *Newtonian* orbit equation above *appears* to differ from the *geometric* orbit equation, this is only a superficial appearance. A review of the earlier derivation for Newton's gravitational equation shows that the constant, $\boldsymbol{K}$, was essentially arbitrarily replaced with the two multiplied constants, $\boldsymbol{GM}$. Recall that this occurred after assuming that $\boldsymbol{K}$ must refer to the mass of the orbited body, then realizing that the "natural constant," $\boldsymbol{G}$, had to be introduced to alter the size and units of the final result. But this switch from $\boldsymbol{K}$ to $\boldsymbol{GM}$ earlier was merely based on an arbitrary and unsupported assumption; as such, it is not only valid but also more correct to return to the original constant, $\boldsymbol{K}$. Therefore, if we simply continue with the step-reversals that were started above and that led from Newton's gravitational equation to the *Newtonian Orbit Equation*:

$$\boldsymbol{v^2R = GM} \qquad \textit{– Newtonian Orbit Equation}$$

the next step in the reversal is to replace $\boldsymbol{GM}$ with $\boldsymbol{K}$, giving the original *Geometric Orbit Equation*:

$$\boldsymbol{v^2R = K} \qquad \textit{– Geometric Orbit Equation}$$

This means the *Newtonian Orbit Equation* used today, based on the Newtonian theory of gravity, provides exactly the same function as the *Geometric Orbit Equation*, which can be derived purely from astronomical observations without appealing to a gravitational force at

all. Indeed, they *are* the same equation. In fact, this explains why the *geometric* orbit equation is unknown today – we already believe we have the proper *gravitational* version, including its reference to mass, ***M***, and the "gravitational constant of nature," ***G***. Given this, there is no need to even take notice of the obvious, simple, and entirely equivalent geometric form that pre-dates our familiar orbit equation today. Yet, it is this very fact – that a simple and *fully functional* geometric form already exists – which is of such great significance, especially since we also widely use Kepler's three laws in our science and space programs, which also have nothing to do with a gravitational force. This means that even when we use our *Newtonian* orbit equation, we are actually unknowingly using the *geometric* orbit equation, and so, all of astronomy as well as our space programs are actually based *solely on geometry* – and *not on Newton's gravitational force at all*. The apparently insignificant fact that a simple *geometric* orbit equation can be easily identified which parallels our gravitational version is actually not so insignificant at all, but of *great significance indeed.*

NOTE

Though not recognized today, Newton's gravitational force is a completely superfluous and redundant abstraction, both in theory and in practice.

The above statement may seem premature since the *Newtonian* orbit equation involves the mass of the orbited body, ***M***, while the *geometric* orbit equation has only an arbitrary constant, ***K***. It might seem that, if nothing else, Newton's gravitational theory shows that this constant actually refers to the mass of the orbited body, which could prove to be a very useful realization. In fact, one very important result from today's *Newtonian Orbit Equation* is that it apparently allows us to calculate the mass of distant bodies, such as the planets in our solar system. That is, if we know the speed, ***v***, with which an object is orbiting and the radius of its orbit, ***R***, we can use the *Newtonian Orbit Equation* to calculate the mass, ***M***, of the larger body it is orbiting. This would tell us the mass of a distant planet simply by observing the motion of its moons, for example,

which is precisely how we have arrived at the values we believe to be the masses of the planets today.

Yet, if we used the *Geometric Orbit Equation*, knowing the speed and orbital radius of orbiting objects would only allow us to calculate the constant, $\boldsymbol{K}$, for that orbital system rather than the mass of the body they are orbiting. Knowing the value of this constant for a particular orbital system is still very useful for calculating the speed or orbital radius of other orbiting objects in that system, but it would not tell us the mass of the orbited body. Therefore, it would appear that if we had never known of Newton's gravitational theory we would not have been able to determine the masses of the moons, planets, and sun of our solar system – at least not by using Kepler's three laws and a purely geometric orbit equation. And so, it might *appear* that Newton's gravitational theory somehow provides a deeper physical meaning and insight into nature. However, the following discussion shows that this is not the case at all, and that it is merely an illusion that Newton's gravitational theory provides any additional insight or utility beyond what was already possible prior to its introduction.

Newtonian Theory Does Not Give Mass-At-A-Distance

Newton's theory of gravity claims that a gravitational force emanates from planets (and all objects) to act across space and out to remote distances, allowing a planet's mass to be determined remotely since its mass is claimed to be directly related to the strength of this force. In particular, referring to the *Newtonian Orbit Equation*, $\boldsymbol{v^2R = GM}$, it would *appear* that we only need to note the velocity and orbital radius of an object in order to determine the mass of the body it is orbiting. However, the following discussion shows that it is only an illusion that mass can be directly determined at a distance in this manner.

- The orbit equation expresses a relationship between the speed and the orbital distance of an orbiting object; in this respect, both the geometric and Newtonian versions function equally.

- The known masses of moons and planets are merely approximations based on an unsupported assumption that is built into Newtonian theory – they are not the literal, accurate masses we believe them to be.
- The above-mentioned assumption is that mass is directly related to orbits – an assumption that is neither scientifically proven nor entirely correct as it turns out, giving arbitrary, inaccurate mass values.
- We are still able to use these inaccurate mass values in other calculations of orbital velocity and distance since these mass values are typically not used alone, but as part of the expression ***GM***, which is entirely equivalent to using the original constant, ***K***, in the original *Geometric Orbit Equation*.

We first begin by noting that whether we use the geometric or the Newtonian form of the orbit equation, the function of the orbit equation is to describe the relationship between the velocity and the orbital radius of an orbiting object. This role is equally fulfilled by *either* orbit equation since the *Newtonian* "gravitational" version is merely the original *geometric* equation with an arbitrary cosmetic change in the appearance of its constant, ***K***. That is, we can arbitrarily change the *symbol* of the constant ***K*** in the *geometric* orbit equation into the two multiplied constants ***GM*** if we wish, creating the *appearance* of a new "gravitational" orbital equation but not actually altering the *function* of the original equation at all. The orbit equation still provides the same relationship between velocity and orbital radius as always, regardless of this cosmetic change.

However, since the value of ***K*** is easily determined by remote observation of orbiting objects, then arbitrarily changing ***K*** to ***GM*** would allow us to calculate ***M*** (since ***G*** is a known constant value), creating the *illusion* that we can remotely determine the mass of the orbited body. The *possibility* that ***K*** may actually be a direct reference to the mass of the orbited body is merely an interesting *conjecture* of Newtonian theory, but one that is both scientifically unproven and also *irrelevant to our orbital calculations*. This is an important point to note, since today we are under the illusion that we use the masses of moons and planets in the

orbital calculations of our space missions. In actuality, we typically do not use these supposed masses alone, but as part of the expression ***GM***. And as we now know, this expression is nothing other than the original constant, ***K***, in the original *Geometric Orbit Equation*. The Newtonian exercise of redefining ***K*** as ***GM***, solving for ***M***, then using ***M*** in the expression ***GM*** is merely a winding path of logic disguising the fact that we are still simply using the original constant, ***K***. The implied existence of a "gravitational force" in this circular Newtonian logic, as well as the supposed remotely-determined mass, are only conjectures at best – and at worst, *pure fictions*.

It is a powerful illusion that our current Newtonian orbit equation, $\boldsymbol{v^2R = GM}$, is the true original orbit equation, and that it contains an actual physical mass. This illusion arises because its purely geometric origins are well hidden under a compelling gravitational overlay. All of the previous discussions comparing Newtonian theory with the original *Geometric Orbit Equation* are impossible today, since this equation is not formally known in our science; its existence and significance have been buried for centuries beneath our unwavering and largely unquestioned Newtonian beliefs. We simply accept the mass of the sun listed in our textbooks, overlooking the fact that it was arrived at by plugging the known velocities and orbital radii of the planets into our current *Newtonian* orbit equation, which actually calculates ***K*** but disguises it as ***GM***. We unknowingly accept that this hidden redefinition from ***K*** to ***GM*** is correct, arbitrarily turning a *purely geometric* constant calculated from *purely geometric* observations of our planets, into the solid mass of the sun. Without benefit of the analysis given in the previous discussions, we could not even know that we are making such an unsupported and arbitrary assumption. We *believe* in Newtonian gravity … we *believe* today's orbit equation is solely a product of Newtonian theory … we *believe* the mass in today's orbit equation describes a real mass … and we are fundamentally unable to contemplate the geometric origins of it all since they are firmly buried beneath these beliefs and illusions.

But then, it is natural to wonder if there remains any significance to the values listed as masses in our textbooks. Even though we may have arrived at these values by making the unsupported assumption that

K is actually ***GM***, it still seems reasonable that ***K*** must correspond to *some* material aspect of the orbited body. And further, the value of ***K*** does vary between different orbital systems in a manner that seems to reasonably reflect the expected mass differences between the central orbited bodies in these separate orbital systems. So, what are we to make of this situation?

This issue of mass will be more fully understood once the new principle in nature is introduced in the next chapter; however, for now it can be said that today's mass values represent *approximate* masses – essentially reasonable educated guesses. This is because the observed gravitational *effect* that we call orbits (which does not involve a confirmed gravitational *force* unless proven scientifically viable) does indeed turn out to be related to the mass of the orbited body – though not *directly* related as assumed today. Therefore, our assumption that it is valid to arbitrarily replace the constant, ***K***, in the orbit equation with the expression ***GM***, involving the mass of the orbited body, is somewhat justified but inaccurate. That is, despite the fact that Newton's model of a gravitational force emanating from matter cannot describe the true physical reality – for all the reasons mentioned so far – it still is undeniable that our massive planets and sun *somehow* cause our observations of falling objects and orbiting bodies. So then, since we know that one of the main defining qualities of our sun and planets is their mass, it would be expected that mass would be involved in our observations of the heavens – if not directly then at least indirectly. And as we will see in the next chapter, mass is only *indirectly* involved.

As an example of how mass might be *indirectly* involved in observations, just for illustration purposes lets consider a hypothetical scenario where all bodies in the heavens have an attracting magnetic field, but where we also have not discovered magnetism yet. In this case, we might tend to think that the mass of an object somehow *directly* causes the attraction that we observe in orbits, which would mean that an object with double the observed attraction must have double the mass. However, unknown to us, the doubled attraction would actually be due to double the *magnetic field*, which may or may not correspond to double the mass depending on whether magnetic field strength is correlated with mass in a direct one-to-one relationship. If two objects with the same

mass but different material composition could have different magnetic field strengths, then this direct relationship would not hold. An observation of double the orbital attraction may be caused by a planet with only 30% more mass than another (though mass of a different material), yet our assumption of a direct relationship between orbital observations and mass would cause us to incorrectly list that planet as having *double* the mass.

This is similar to today's belief that mass is directly related to orbital observations. This direct mass relationship supposedly occurs via Newton's mysterious "gravitational force" – a force that has never been felt or detected remotely, but whose strength is said to directly mirror any changes in mass. So, if our Newtonian calculations tell us that an orbital observation corresponds to double the gravitational pull, we note the orbited body to have double the mass. However, the new principle in the next chapter shows that orbits are not caused by a "gravitational force," and that, although the actual cause *is* related to mass, the relationship is not strictly a direct one-to-one correspondence. It is a reasonable assumption that a larger planet with a greater *effective* gravitational influence on orbiting objects would also have a correspondingly greater mass, but this assumption cannot be verified with certainty from a distance. It would be necessary to physically analyze the material composition of the planet to know for sure. This is analogous to the hypothetical magnetic field scenario, where a stronger influence on orbits (a greater magnetic field in this case) would seem to imply a correspondingly greater planetary mass, but could simply be due to a different magnetic material regardless of mass.

It is for this reason that the accepted masses today of the sun, planets, and moons of our solar system were stated earlier to be only approximations – not true mass measurements. Some of these values may be very close to the actual mass of the body, while others may be far off the mark. This has not been a problem for most standard orbital calculations since, as mentioned earlier, we typically use these mass values in the expression $\boldsymbol{GM}$, which simply returns us to the constant $\boldsymbol{K}$ in the original *Geometric Orbit Equation*, and makes the actual individual mass value irrelevant. However, it is important to understand this mass issue for other reasons. For example, planetary geologists

cannot gather a proper understanding of planetary formation, composition, and geology if the assumed mass is far from the actual mass of the planet. Also, theoretical fusion reaction calculations for our sun include mass in their calculations, and it may well be crucial to have the correct mass value for our sun in order to properly understand the physics of fusion itself.

Despite all of the preceding discussions suggesting that orbits are not ruled by Newton's mass-based gravitational force, there can still be some compelling illusions that appear to support Newton's theory. One such example from our space programs is the need to include the mass of our spacecraft in all trajectory calculations – even down to the diminishing weight of the fuel as it is expended or the additional weight of any rock samples that may be carried back to Earth from a distant moon or planet. If the mass of our spacecraft is an important consideration in the accuracy of our current trajectory calculations, doesn't the success of most missions validate our Newtonian calculations and beliefs?

The answer is that the mass of the spacecraft is only important to the *inertial* calculations of the mission – not the *orbital* calculations. Inertial calculations involve any attempt to forcefully alter the trajectory of the spacecraft using a fuel burn. Just as the mass of a football player is of crucial importance to any player attempting a tackle, the precise mass of the spacecraft is of crucial importance to know how much fuel to burn for a given maneuver. A more massive spacecraft requires a longer or more powerful fuel burn, just as a heavier football player is harder to tackle. This is merely a classical Newtonian *inertial* calculation (not a *gravitational* one), given by Newton's equation $\boldsymbol{F = ma}$ (*force* equals *mass* times *acceleration*). The fact that such mass-based *inertial* calculations are crucial to any space mission lends unwarranted credibility to the illusion that mass is further useful and necessary in our current *Newtonian* "gravitational" orbit calculations. Orbits (which form the basis of all spacecraft trajectories) are still completely described by the *purely geometric* equations of Kepler and the *Geometric Orbit Equation*, which do not involve mass or force.

Does the Evidence Support a Gravitational Force?

Despite the fact that Newton's concept of a gravitational force violates our laws of physics and is unnecessary to describe orbits and spacecraft trajectories, it is still credited with explaining many other facets of life on Earth. For example, the reason objects have weight here on Earth is supposedly because a gravitational force emanates from our planet and pulls them down, forcefully and continuously holding them in place in proportion to their mass and giving them their mass-dependent weight. Even though we have no scientifically viable explanation for this constant pulling force, it would certainly *appear* as if such a force existed, nonetheless.

Yet, we have always known that *something* creates this effect, even before Newton arrived on the scene, but it wasn't necessarily considered to be an attracting gravitational force from within the planet. It could have been due to the Earth's magnetic field, or some type of downward repelling force from the stars in the heavens above, or any manner of other ideas. The weight of objects was simply an experience that was undeniable and common sense – no one expected objects to fall *up* when they were dropped – but the underlying cause could have been almost anything; it was simply unknown. We design spring-loaded measuring scales that we deliberately calibrate to properly weigh objects, but this is merely a device that takes advantage of this obvious *weight effect* all around us. Our mechanical scales are not actually based on a *gravitational force* principle, but rather, on a *spring* principle that takes advantage of whatever is causing the *weight effect* around us.

Even the science of calculating how a projectile, such as a cannonball, flies through the air is not actually based on Newton's gravitational force, though this is commonly thought to be the case today. The work of Galileo Galilei (1564-1642) provided a very useful constant-acceleration equation for falling bodies or flying cannonballs, but a quick look at this equation shows no particular reference to a gravitational force:

$$d = \tfrac{1}{2}at^2 \qquad \text{– Constant-Acceleration Equation}$$

This equation essentially states that the vertical distance, ***d***, that an object falls as it is either dropped or shot through the air is determined by a

constant downward acceleration upon it, ***a***, multiplied by the square of the time, ***t***, that it takes to hit the ground. It is worth noting that this equation is a *purely geometric equation* involving *no physical masses or forces*, merely embodying the obvious fact that objects in free-fall experience a constant downward *acceleration effect*. It does not state the *cause* of this effect any more than the cause for the weight of objects was universally settled upon prior to Newton. This observable and measurable downward *acceleration effect* on Earth is the same for all objects *no matter how massive they are*, and can easily be measured to be 9.8 m/s^2 and substituted directly into the above equation to give:

$$d = \tfrac{1}{2}(9.8)t^2$$

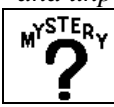
We typically use the symbol, ***g***, for this measured *constant-acceleration effect* upon earthbound objects, giving us:

$$d = \tfrac{1}{2}gt^2$$

The symbol, ***g***, is taken to mean the acceleration due to gravity (9.8 m/s^2), in reference to Newton's proposed gravitational force; but that interpretation, of course, is only an assumption.

Equal Acceleration Regardless of Mass

As mentioned above, whatever the cause may be for the *acceleration effect* of falling objects, it manages to accelerate all objects with equal ease at the same rate and with no noticeable stresses upon them. This is true whether they are as light as a golf ball or as massive as an ocean-liner. If a force were at work here, it would have to be quite a *mysterious and unprecedented force indeed* to achieve such a feat.



The "Gravity Shield" Mystery

Another ongoing mystery surrounding gravity is the idea of a "gravity shield." After all, by using various materials we are able to insulate against electricity, electric fields, magnetic fields, light, radio waves, and

radioactivity, so why not the gravitational field as well? Since science has never had a clear understanding of gravity, it has been impossible to either conceive of or rule out the possibility of developing some material or device to shield us from gravity. Such an invention would allow an object to levitate in mid-air simply by inserting this gravity shield between the object and the ground. If the attracting force of gravity cannot reach up past the gravity shield, then any objects above the shield should float and not be pulled downward. Such ideas have surfaced repeatedly over the years (and continue still), being shrouded in secrecy and mystery, and drawing short-lived interest and funding until ultimately fizzling out.

The preceding discussions have shown that, while Newton's proposed gravitational force is a very compelling and intuitive idea, it is *rife* with problems. As a *model* of the true, and as-yet-unknown, underlying cause for many observations it has proven very useful – which is the purpose of any model or equation – but things become very problematic and mysterious when the model is taken as the literal reality. And in fact, as was also shown, Newton's model is not even strictly necessary, as everything from falling apples to orbiting moons can be dealt with equally well with purely geometric equations. This model is part of our scientific legacy from centuries past, and as such, it sits largely unquestioned in our science today despite the fact that it clearly is not a scientifically viable theory.

We have tried applying logical patches, such as the misapplied *Work Equation*, and even invented entirely new theories, such as *General Relativity Theory* – but to no avail. We have been unable to find true scientific justification for Newton's gravitational force, yet we also have been unable to develop a truly viable theory to completely replace it. As a result, Newtonian gravitational theory remains our main and most compelling explanation for falling objects and orbiting bodies, while also clearly being a fatally flawed theory in our science.

The reason Newton's gravitational explanation was so revolutionary when it was proposed is that it was thought to have finally provided a *physical* understanding of the underlying cause for these observations – something mankind had wondered about through the ages.

However, if a gravitational force is *not* a viable scientific explanation for the underlying cause, then what is? An answer to this question that provides a clear physical explanation for gravity and resolves all of the mysteries and violations mentioned so far is provided in the following chapter, where a new principle in nature is presented – *one that has been overlooked so far in our science*.