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ORIGINS

The Day the Earth was Smashed like a Cup

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PREVIEW

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Bernard Paul Badham

'A Thousand years is like a day unto the Lord,
and a day a thousand years.'

EINSTEIN

'Time and Space is Relative.'

CONTENTS

Foreword

When we look back in time at our own recorded history, archaeological or written in stone or in religious and mythological texts, we have a simplified and sterile view of our origins. Truth may be stranger than fact. Our ancestors interpreted terrestrial and astronomical events through the eyes of their own misunderstandings and religious and cultural beliefs, today, with science and logic, these events may be interpreted more correctly, but it is important to note that myth always has some basis in fact.

The origins of life, human kind, civilization and the validity of mythical historical events need to be re-examined through the looking-glass of science, archaeology, astrophysics, mathematics and of course sacred ancient written accounts and legends.

When we look up at the heavens, the planets, stars and galaxies, we interpret their origins based on modern scientific evidence, but this evidence may be interpreted to give a different picture to what we traditionally understand concerning our origins, for instance in the Theory of the Big Bang. One of the most puzzling things to be examined by this book is the origin of water on our planet Earth, the vast oceans of water, essential to life should not be there. New evidence about the geology of our Earth is coming to light which may provide a surprising conclusion about its origins and eventual consequences in how it affected human development and the origins of civilization.

This book is made up of short essays on important topics which affect our origins, it is best read in the order presented, but may be used as a 'dip in read' according to what interests you.

Introduction

The purpose of this book is to examine the scientific evidence and religious, cultural and historical accounts concerning our origins, the origins of the universe, space, time and matter, life itself and the birth of civilization. Today we have a distinct separation between what we believe (faith) and science, for our ancestors this distinction did not exist, that which they saw and experienced was interpreted by what they believed, but in the beginning this knowledge experience led to belief. The ancient Egyptians saw a harmony between their everyday experiences and what they believed, one was entwined with the other. The world around them needed explanation and so they interpreted their experience of daily phenomena in a way they could understand. The great giver of life, warmth and light, which traversed the heavens each day was interpreted as a living, powerful being, the sun god Ra, it was therefore no surprise that they worshipped the sun and prayed each morning before sunrise for its return to deliver them from the coldness and darkness of night.

Their interpretation of the sun's disappearance under the earth-sky horizon in the west each evening and its rise each morning in the eastern horizon gave birth to the beliefs of the underworld and the resurrection of life. They interpreted what they saw and experienced in the only way they could, by applying their own human experiences of life, birth and death to the 'inanimate' universe around them. Today science has a clear distinction between the living (animate) and the non-living (in-animate), the ancients did not have such distinctions, the whole universe was animate, and alive.

As modern, educated humans we have a simplistic view of our ancestors, we see their culture and beliefs as primeval, pagan even and misinformed, but in a way they had the advantage of being 'in touch with nature' and their thinking was not limited by educational dogma, they were free thinkers. One of the greatest scientists of our modern times, Albert Einstein, said that he had to undo, put aside that which he had been taught in order to free himself to see and explain scientific phenomena with unfettered thinking.

This view of a living, breathing universe is evidenced in their mythological beliefs and in their scientific, medical and astronomical knowledge. Their hieroglyphic written language for instance refers to inanimate objects as either feminine or masculine.

ra, the sun (masculine)

akhet, the horizon (feminine)

It is not surprising that the sun, as in the male sun god Ra was referred to as masculine. The horizon as feminine may have come from the fact that the sky goddess Nut swallowed the sun each evening and gave birth to it each morning.

Modern science is confined to time frames, whether historical, geological or astronomical, time plays a fundamental role in the perception of our origins and the origin and evolution of the universe and life itself. But the concept of time is as elusive as the definition and true understanding of the nature of energy, matter and light. Many arguments rage between traditional scientists, atheists and the like 'the evolutionists' and religious thinkers, the 'creationists' concerning our origins, much of this debate falters around historical time frames, but maybe we should simply search for the truth about such matters, therefore, we need to re-examine the evidence, unfettered and unbiased and without emotion, if that were possible. We need to think freely, but in the light of modern historical, geological and astronomical scientific evidence. This dualistic approach may reveal some interesting conclusions. Let us start with the concept of time.

Time is a constant in a measured frame of reference, clocks 'tick-tock' constantly, but time can vary between one frame of reference and another in our universe and even over time itself.

Time is one of the hardest things to explain, we understand it until we come to explain it, but time and particularly astronomical, geological and historical time scales are absolutely key in understanding our origins:

1. Modern Scientific Timeline from the Big Bang to the Birth of Civilization

Scientifically our universe has been dated to being 13.8 billion years old, this timing comes from the Big Bang and Expansion of the Universe theory which we will look at in detail. The age of our Solar System and the formation of the Earth are estimated to be 4.5 billion years. The emergence of life on our planet in the form of simple (prokaryotic) cells 3.6 billion years, complex (eukaryotic) cells 2 billion years, multicellular life 1 billion years, simple animals 600 million years, land plants 475 million years, mammals 200 million years, primates 60 million years, human predecessors (genus *Homo*) 2.5 million years and modern humans (*Homo Sapiens*), 200,000 years:

Homo Sapiens (Africa) 200,000 years ago

Human colonization of continents 50,000 a

Giant lizards die out 40,000 a

Woolly rhinoceros becomes extinct 15,000 a

Bears, giant sloth and all equidae (in North America) die out 11,000 a

Late Glacial Maximum 13,000 - 10,000 a

After an incredible time span of nearly 200,000 years, then an only then, do we see the emergence of civilization? This unbelievably long time gap needs explanation. Traditionally we are told that we wandered the Earth for generation upon generation as nomads, hunter gatherers, with no thought of permanent settlements or farming of the land, but historical and mythological records tell us otherwise, of great kings and kingdoms, were our ancestors fantasying about their own history?

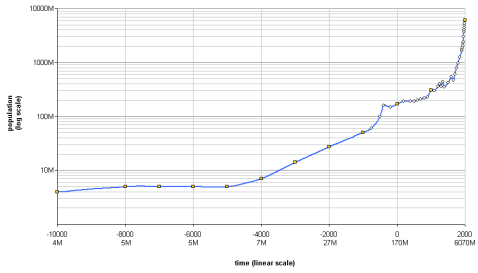
I think not, in a later chapter we will examine some of these so called myths about pre-civilizations, in the meantime let us continue to examine the traditional theories of our origins.

Start of the Modern Warm Period 8,000 BC

Agricultural Revolution 8,000 - 5000 BC
(In the Fertile Crescent)
Egypt - Phoenicia - Mesopotamia

Humans began the systematic husbandry of plants and animals. Agriculture advanced, and most humans transitioned from a nomadic to a settled lifestyle as farmers in permanent settlements.

The Fertile Crescent from where civilization emerges includes Egypt, Phoenicia and Mesopotamia, the land in and around the Tigris and Euphrates rivers. The modern-day countries with significant territory within the Fertile Crescent are Iraq, Kuwait, Syria, Lebanon, Jordan, Israel, Cyprus, and Egypt, besides the south-eastern fringe of Turkey and the western fringes of Iran.



World population growth since 10,000 BC to present

Note: using highly conservative calculations for population growth from an original pair to today's numbers yields that our origins date back only 5000 years!

The region is often called the cradle of civilization; it saw the development of many of the earliest human civilizations. Some of its technological inventions are writing, glass, the wheel and the use of irrigation. The earliest known western civilizations manifestly arose and flourished using the water supplies and agricultural resources available in the Fertile Crescent. They were not necessarily the first or the only source of civilization. Moreover, plants and animals were not domesticated there but in the surrounding areas.

Ancient recorded history begins with the invention of writing, however, the roots of civilization reach back to the period before the invention of writing. Prehistory begins in the Paleolithic Era, or 'Early Stone Age,' which is followed by the Neolithic Era, or New Stone Age, and the Agricultural Revolution in the Fertile Crescent.

The Agricultural Revolution marked a change in human history, as humans began the systematic husbandry of plants and animals. Agriculture advanced, and most humans transitioned from a nomadic to a settled lifestyle as farmers in permanent settlements. Nomadism continued in some locations, especially in isolated regions.

As farming developed, grain agriculture became more sophisticated and prompted a division of labor to store food between growing seasons. Labor divisions then led to the rise of a leisured upper class and the development of cities. The growing complexity of human societies necessitated systems of writing and accounting. Many cities developed on the banks of lakes and rivers; as early as 3000 BC some of the first prominent, well-developed settlements had arisen in Mesopotamia, on the banks of Egypt's River Nile, and in the Indus River valley. Similar civilizations probably developed along major rivers in China, but archaeological evidence for extensive urban construction there is less conclusive.

Thus begins the origins of our civilization.

2. In the Beginning - The Trouble with Time

Time is essential to understanding our origins, for out of universal time comes astronomical, geological and historical time lines. As stated above our universe is said to have come into existence 13.8 billion years ago and our Earth Solar System and Sun, around 4.5 billion years ago. Our whole dating system for the age of the universe comes from one fundamental assumption that time itself is constant. This is not the case. So where did the time scale of 13.8 billion years for the Big Bang and the age and origins of the universe come from? The answer of course is from modern scientific evidence. The main source of evidence for this is from our modern view of the present universe, that it is expanding, for after the Big Bang where matter, light, space and time came into existence, the universe expanded to its present size and state.

Evidence for the Expansion of the Universe and the Big Bang

The Big Bang theory is the prevailing cosmological model for the early development of the universe. The key idea is that the universe is expanding. Consequently, the universe was denser and hotter in the past. Moreover, the Big Bang model suggests that at some moment all matter in the universe was contained in a single point, which is considered the beginning of the universe. Modern measurements place this moment at approximately 13.8 billion years ago; which is therefore considered the age of the universe. After the initial expansion, the universe cooled sufficiently to allow the formation of subatomic particles, including protons, neutrons, and electrons. Though simple atomic nuclei formed within the first three minutes after the Big Bang, thousands of years passed before the first electrically neutral atoms formed. The majority of atoms that were produced by the Big Bang were hydrogen, along with helium and traces of lithium. Giant clouds of these primordial elements later coalesced through gravity to form stars and galaxies, and the heavier elements were synthesized either within stars or during supernovae.

The two main sources of evidence for the Big Bang and the expansion of the universe are:

1. The Red Shift of light from distant galaxies:

In 1929, Edwin Hubble discovered that the distances to far away galaxies were strongly correlated with their redshifts. Hubble's observation was taken to indicate that all distant galaxies and clusters have an apparent velocity directly away from our vantage point: that is, the farther away, the higher the apparent velocity, regardless of direction.

Assuming that we are not at the center of the universe,

the only remaining interpretation is that all observable regions of the universe are receding from each other - the universe is expanding.

2. Cosmic Microwave Background Radiation:

The cosmic microwave background radiation (CMBR) is the thermal radiation assumed to be left over from the 'Big Bang' of cosmology. CMBR is also referred to as 'relic radiation.' The CMBR is a cosmic background radiation that is fundamental to observational cosmology because it is the oldest light in the universe. Sensitive radio telescopes show a faint background glow in space, almost exactly the same in all directions; this radiation is not associated with any star, galaxy, or other object. This glow is strongest in the microwave region of the radio spectrum.

The CMBR is well explained as radiation left over from an early stage in the development of the universe, and its discovery is considered a *landmark test of the Big Bang model of the universe*. When the universe was young, before the formation of stars and planets, it was denser, much hotter and filled with a uniform glow from a white-hot fog of hydrogen plasma. As the universe expanded, both the plasma and the radiation filling it grew cooler. When the universe cooled enough, protons and electrons combined to form neutral atoms. These atoms could no longer absorb the thermal radiation, and so the universe became transparent. The temperature of this background radiation is only just above absolute zero (0 kelvin, -273 Celsius), its peak microwave wavelength temperature is 2.73 kelvin.

It is assumed therefore that if today the universe is expanding, less dense and cold, that in the past it must have been contracted, more dense and hotter. This is an extrapolation of the current nature of the universe back in time and assumes that the rate of expansion was a 'constant.' One of the first things I teach my physics students when plotting acquired experimental data is to not extrapolate their graphs beyond the data, for that is not science, but assumption.

Extrapolation of the expansion of the universe backwards in time using general relativity yields an infinite density and temperature at a finite time in the past. This singularity signals the breakdown of general relativity. How closely we can extrapolate towards the singularity is debated. This singularity is sometimes called 'the Big Bang', but the term can also refer to the early hot, dense phase itself, which can be considered the 'birth' of our universe.

In our expanding universe model, it is space itself which is expanding, not galaxies themselves. Imagine sticking small beads on the surface of a rubber balloon, as the balloon is inflated the beads move further away from each other. This expansion of space leads to the increasing wavelength of light producing a shift in its spectrum towards the longer wavelength red end, this is the red shift.

Apart from the above assumptions, that time is constant and that the expansion was 'constant', there is another assumption that gravity between masses in the universe was constant, i.e. Newton's gravitational constant (G) is actually a constant over time and expansion and since gravity is the known breaking force on expansion then the way gravity behaves over time is important.

One thing we know for sure is that our universe exists and has been around for a long time, but is it really expanding? Is the universe really 13.8 billions of years old? Are there any other explanations for CMBR and Red Shift? And over the history of the universe is time and gravity truly constant?

3. The Constant Nature of Time and the Speed of Light

We all understand time; it ticks by with perfect order. Our ancient ancestors recorded the passage of time by the movements of the heavenly bodies, particularly the sun and moon. One rotation of the Earth gives us one day divided into 24 hours; the seasonal changes governed by the orbit of the Earth around the sun gave us the year. Today modern clocks can measure time extremely accurately and with a precision of trillionths of a second. But what governs the phenomenon of time and why is it regarded as constant?

Until Einstein we had a cozy view of the universe, space and of time, but in the early twentieth century he caused a major upset in the scientific community, the main reason being his Special and General Relativity theory which states that space and time are not constant, but relative. Space and time can vary depending on position, speed and gravity.

Special Relativity: at terrestrial speeds time is seemingly unaffected, but as one approaches the speed of light time slows down exponentially. Theoretically at the speed of light, time stops.

Note: also an object's mass increases exponentially as the speed of light is approached.

General Relativity: in a gravitational field time slows down and in extreme gravity fields such as at the event horizon of a Black Hole, time stops.

This all being relative to a stationary observer: in the SR case; and to an observer outside a gravity field in the GR case. Not only does position and speed affect time, it also affects space length. To a stationary observer, a spaceship approaching near light speed would appear to contract in length. Einstein's relativity theories regard these effects as space and time dilation. Thus from his theory came the concept space-time.

The most weird, and wonderful, thing to come out of relativity is that anyone on board a spaceship approaching the speed of light or near the event horizon of a black hole would not notice, or be able to measure, these space and time dilations. If measured under these extreme conditions, the speed of light would still have the same value (c) and time would appear to tick normally, it is only an outside observer who would notice that clocks inside the spaceship run slower. Also for those on board, a meter ruler would still appear the correct length. These relativistic effects Einstein referred to has giving harmony to the universe, no matter where you are or at what speed you are travelling everything appears normal, time, length and the speed of light. Space and time dilation are not just relativistic effects, but are very real and measurable, and proven by scientists across the world over the last century.

This leaves the question, why? What is actually happening to cause space and time dilation? How do these effects affect the evolution of an expanding universe and its apparent age?

4. The General Theory of Relativity

Einstein describes space and time as space-time, space and time are inseparable. It is the distortion of this space-time matrix which results in space and time dilation. In GTR a gravitational field is a distortion of the space-time matrix, the matrix being the mathematical geometry of space-time. This matrix has 4 dimensions, three of space (3D) and one of time. Any mass causes a distortion of this space-time matrix, the larger the mass the greater the distortion and hence the greater the space and time dilation.

This raises another question: how can space (and time) be distorted since the vacuum of space contains nothing to distort? If space has substance, then the distortion of the fabric substance of space makes sense, but herein lies a century raging augment concerning whether what we see as empty space is not empty at all. Space is filled with an invisible and almost undetectable substance, primarily this inferred substance of the fabric of space is called the ether, a phenomenon which almost all modern scientists refuse to believe exists, for there is 'no evidence' of its existence. Einstein referred to this particular problem in his 1920 Leyden lecture:

'...Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense. But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it.'

If the ether exists, then the GTR makes sense, space has substance and physical properties which can be distorted by a gravitating mass. With regards to the physical nature of the ether, Einstein suggests that it is not made of substance (ponderable matter) as we know it; it is invisible and 'undetectable.'

In Einstein's GTR it can no longer be accepted that the curvature of space-time is purely a mathematical concept, space must have physical substance and properties which affect the speed of light and hence time. The effects of this 'imponderable matter' must also be related to the known effects of STR: this physical substance of space must affect objects travelling at speed. The *physical nature of space* must be responsible for the observable and measurable effects in both General Relativity *and* Special Relativity?

Recapitulating:

General Theory of Relativity

1. In the vacuum of space with a zero gravitational field time ticks away 'normally,' length is not contracted and the speed of light is (c).

2. In the vacuum of space with a gravitational field time is slowed down, length is contracted and the speed of light is slowed down, less than (c)

These effects seen in 2 are by an observer in 1,
but an observer in 2 would not see these effects.

5. Special Theory of Relativity

In the vacuum of space for an object travelling at near light speeds, time slows down, length is contracted and its mass increases, this is because as the craft approaches the speed of light, the energy-density within the craft moving through the space vacuum approaches infinity, therefore, length and time approach zero and space-vacuum drag (mass) approaches infinity.

The effects in GTR and STR must be related and as Einstein stated for GTR, these effects have their cause anchored in the physical nature of space.

The following discuses GR, for in order to understand special relativity*, we need to be able to explain the effects in general relativity. It is clear from both theories that somehow length, time, mass and the speed of light are interwoven with each other and with the physical nature of space, the ether. Without regard at this point to the physical composition of the substance (imponderable matter) of the ether, can these relativistic effects be linked and explained? Classical Newtonian physics may already have the answer and may be the key to the whole explanation is the speed of light.

Note*: for a full explanation of how the effects of GR explain SR refer to my book: '*The Enigma of Gravity*.'

In classical physics the speed of light is affected by the transparent medium through which it travels, in a vacuum the speed of light (c) is constant:

c = 300,000 kilometers per second

Einstein said the speed of light *in a vacuum* is a constant, he did not say that the speed of light is constant, in fact he went out of his way to say that this constancy only applies to the empty vacuum of space free of gravitational fields. When light is travelling through the transparent medium of glass this speed drops to 200,000 km per second. In diamond, which is optically denser, it is even slower. It is the optical density of the medium which affects the speed of light, the more dense the medium the slower the speed of light. So this would suggest that in GTR, where a gravitational field slows down light, that the space vacuum is optically more dense. A gravitational field increases the optical density of the space vacuum (more imponderable matter per volume of space). Herein we have in GTR an explanation for the gravitational effects on the speed of light: the space vacuum is not an empty mathematical construct, but a transparent medium filled with imponderable (invisible) matter. The imponderable matter density (D) we will call mass-energy density. This leads us to two postulates:

1. The space vacuum imponderable matter (mass-energy) density (D) affects the speed of light.

2. The speed of light is inversely proportional to the space vacuum mass-energy density.

$$c = k/D$$

Where k is an exponential constant.

In this explanation for the variance of the speed of light for GTR we also have an explanation for time dilation: In defining time, only one explanation seems to make sense, we see the timeline for the evolution of the universe as ordered, timely, change. For the process of physical change, we need physical time, time can therefore be best defined as rate of change and herein the speed of light is the key; all change whether chemical or physical takes place over time and these chemical and physical changes are governed by the speed of light. All electro-magnetic interactions in chemical and physical reactions act at the speed of electromagnetic light. All electro-magnetic and gravitational forces (force fields) act at the speed of light, therefore we can state that:

Time is rate of change at the speed of light.

The speed of light governs time and change.

This explains time dilation in GTR:

An optically more dense region of space (a gravitational field) slows down light and therefore slows down physical and chemicals changes - slows down time.

Length contraction in a gravitational field can also be explained using this model:

In a gravitational field the optical medium of the space vacuum mass-energy density is higher (curved space-time) compared with normal space (flat space-time). The fact that this increasing energy density is increasing in the direction of a gravitating mass means that length in this direction is contracted.

Length in this medium of imponderable matter is contracted if its energy density increases - think of this as like having a one metre rubber ball ruler made with 10 rubber balls stuck together, squash the rubber balls closer together (more dense) and the ruler contracts in length.

Note: the odd thing about matter particles is that more massive particles are physically smaller in size.

This model of the space vacuum, that it is an optical medium filled with imponderable matter at various densities seems to explain all the effects of GTR.

The curvature of space-time being a smoothly varying space vacuum mass-energy density of imponderable matter

The speed of light would be measured as (c) in curved or flat space, in curved space since length *and* time are contracted *equally,* the measured value of the speed (c) would not change. Along a contracted ruler, light travels slower and so the measured speed would be the same. Even with the slowing down of time in a gravitational field an observer in this field would not notice clocks ticking slower because his brain and body and all physical processes (chemical and physicals reactions) slow down equally.

This model for the space vacuum, if true, should also explain the effects observed in STR.
In Einstein's Special Theory of Relativity, time slows down and mass increases exponentially as the speed of light is approached. Let us imagine a spacecraft travelling through this imponderable matter of space and gradually approaching the speed of light. What effects would this imponderable matter of space have on the spaceship and the environment and its crew inside?

Mass Dilation

It takes a Newtonian force to accelerate a mass through the vacuum of space and in Newton's second law of motion the amount of force needed to accelerate an object by a given amount is its measure of mass. This is what Einstein describes as inertial mass (m_i):

inertial mass = force applied/acceleration gained

But why does it require a force to accelerate a mass through the empty vacuum of space? Space appears to resist acceleration; it applies a drag force, similar to the drag of water when pushing an object through it, except that this drag only occurs during relative acceleration between the mass and the medium of space. The answer to this phenomenon of inertial mass lies in the fact that space is not empty but filled with 'imponderable matter' which resists acceleration.

Relative acceleration between a mass object and the imponderable matter of the space vacuum exerts a drag force on the object - action and reaction

Another measure of mass, is gravitational mass (m_g), we can measure mass by the amount of gravitational force acting on a mass - its weight. Again Newton gave us the answer:

gravitational mass = force experienced (weight)/gravitational acceleration

Einstein noted that there were two ways for measuring mass and that whichever way you used: the force applied to accelerate an object or the weight of an object in a gravity field; both would give you the same answer.

6. The Illusion of Mass

One of the major problems for interstellar space travel is mass. In order to place a spaceship in orbit about our earth requires enormous rocket propellant thrust to overcome the spacecraft's **gravitational** mass, then subsequent acceleration of the space ship to near light speeds also requires rocket propellant thrust to overcome **inertial** mass, but this is not the end of the problem, as the craft approaches near light speeds, its **relativistic** mass increases exponentially thus making it impossible to reach the speed of light. It seems, therefore, that the mass of the spacecraft presents us with a fundamental problem of reaching luminal and superluminal speeds.

What is mass and why does gravity, acceleration and near light speeds affect mass?

If we could eliminate these effects on mass we could easily reach star ship speeds for interstellar space travel.

The Illusion of Mass

1. **Inertial Mass**: caused by relative acceleration through space.

A mass stationary in space or in constant motion will only appear to have mass if we try and change its velocity (acceleration) relative to the space in which it is immersed. We 'feel' an object's inertial mass when we push it with a force or try and slow it down or change its direction.

2. **Gravitational Mass**: experienced as a force we call weight because of the **relative** acceleration of the space vacuum and a mass

3. **Relativistic Mass:** the increased force required to accelerate a mass through space as it approaches the speed of light.

In all cases mass is only experienced when we try to **relatively accelerate a mass through space**, something the Higgs field theorists neglect to state. It seems therefore that in order to build space craft which can travel at interstellar speeds we need to overcome the mass-effect of space on acceleration. This new science is called Quantum Engineering of the Space Vacuum.

The mass energy density of the space vacuum exerts a mass effect on an object during acceleration and limits the speed of light and therefore quantum engineering of this mass-energy density of the space vacuum seems the only way forward. The future of space travel lies in methods of slip streaming through the space vacuum where these relative acceleration mass effects are reduced.

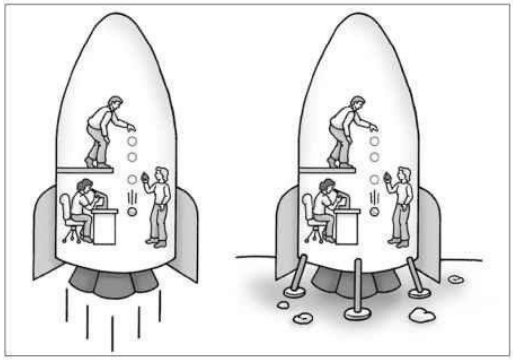
This type of quantum engineering will in principle give rise to anti-gravity and space-time warp drives.

THE KEY

Since inertial mass is produced by relative acceleration of an object through the space vacuum, does this mean that gravitational mass is a relative acceleration of the space vacuum *through* the mass?

The answer to this must be yes, gravitational mass must be the drag force of the space vacuum imponderable mass-energy as it accelerates down through the object, thus pinning it to the floor.

7. THE KEY - Origins of Mass



The following discussion is quite 'lengthy' but it leads to some very important concepts concerning gravity.

Einstein was pleased to theorize that accelerated motion of a space craft through space produced 'artificial' gravity on board the craft. There was no difference in his mind, between the effects of acceleration and gravity, and therefore gravity was acceleration. In General Relativity gravitational acceleration was a space-time distortion created by a mass. One could not tell the difference between standing on a planet and feeling the effects of gravity or standing inside an accelerating space craft and feeling the same effects, one's own weight.

This must logically lead to the conclusion that when standing on a planet, something must be accelerating!

Since the two situations are equivalent, then it must be that when you are standing on a planet, space-time is accelerating through you.

This acceleration of the fabric of space through a stationary mass creates a force on the mass (you) which you feel as weight. Throw an object up in the air and it is accelerated back down by the physical acceleration of the space vacuum down into the Earth. This model would suggest that space is not empty, but must have substance. This physical substance of the space fabric Einstein referred to as 'imponderable matter' (ether).

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In the left hand picture above the rocket is accelerating upwards through space and therefore space is accelerating downwards through the rocket and in the right hand picture, the same situation exists. In the second picture there must be a relative acceleration between the rocket and the space vacuum, and since the rocket is not moving relative to the Earth, then space must be the accelerating down through the rocket.

There remain two questions following on from this model of gravity

(In my book *The Enigma of Gravity*, I call this model of gravity Quantum Gravitational Flux Theory (QGFT):

1. If gravity is an acceleration of space into a mass and the accelerating space exerts a force on a mass placed in this flux, then space must have substance, so what is the physical nature of the substance of space?

Answer: Possibly an energetic flux of an exotic quantum soup of neutrinos, virtual (short lived) photons and virtual particle pairs.

2. If a mass such as the Earth causes an acceleration of this quantum soup into it, what property of matter particles (atoms) in the Earth or any other matter causes this acceleration of space?

Answer: matter particles interact with this energetic quantum soup by absorption and emission, this interaction being evidenced by known quantum energy shifts in sub-atomic particles.

Einstein refers to the mathematical geometry of space as space-time, the 3 dimensions of space and the 4th of time.

Distortion of this four dimensional geometry of space by a gravitating mass such as the Earth causes an acceleration of a test mass placed in this distortion.

But if space is being distorted, what exactly is being distorted? The General Relativity Theory of Einstein tells us that it is a distortion of the geometry (fabric) of space-time. In physics we can measure the dimensions of space (using a ruler) and the dimension of time (using a clock). Also in physics, anything which can be physically measured must have physical reality. In order to understand the physical nature of space-time we must treat space and time separately and then see how one is linked to the other and how a mass distorts both as space-time.

In his 1920 Leyden lecture Albert Einstein acknowledges that space must have substance.

In the 20th century the ether hypothesis became unfashionable since the substance of space, the ether, could not be detected by any experiments. Today we have two phenomena which prove the existence of the physical nature of the space vacuum:

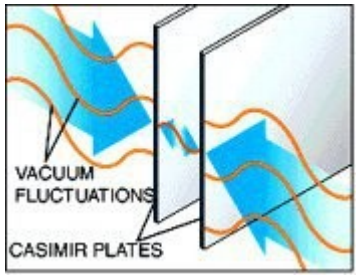
1. **Lamb Shift** of the energy of electrons: light emission lines have 'fuzziness' to them. This is due to self-interaction of the electron and the electrons interaction with the space vacuum.

Most of the Lamb shift can be explained by two basic phenomena: self-energy and polarized vacuum:

a) **Self Energy:** the self-energy effect occurs when electrons subjected to electric and magnetic fields spontaneously and randomly emit photons and, within an incredibly short time span, reabsorb them.

b) **The polarized vacuum effect**: this involves pairs of virtual (short lived) particles one with a positive charge and one with a negative charge. Such pairs are created spontaneously from a vacuum in the presence of a positive or negative field and then are polarized, or aligned, by the field's charge.

2. **Casimir Effect**: two mirrors in a vacuum are attracted to each other. This results from a pressure difference in space, where it is greater outside the plates than between them. (Only certain modes of electromagnetic standing wave oscillations can exist between the plates (half wavelengths), whereas outside an infinite number of wavelengths are allowed.



Summary

Quantum effects in atoms, energy shifts, are indicative that matter particles interact with the energy of the space vacuum as evidenced in Lamb Shift and the Casimir Effect. There may be a continuous flux of this energetic space vacuum into matter, which as a collapsing sphere of space around the Earth the acceleration rate (g) of which would follow an inverse square law.

Any mass particle placed in this energetic flow would experience a drag and be taken along with the flow, this we would see as free fall. A mass on the surface of the Earth would experience the drag of the space vacuum flux through it, this we would see as weight (W = mg). Here (m) equals gravitational mass and (g) the acceleration of space.

This is equivalent to inertial acceleration where by Newton's 2nd Law a mass particle accelerated through the space vacuum experiences a drag which we see as inertial mass. Since as stated above, any relative acceleration between the space vacuum and a mass causes a drag force on the mass, therefore gravitational mass and inertial mass are equivalent:

inertial mass = gravitational mss.

It is possible that this ethereal flow of space vacuum energy into matter not only causes matter particles to shift in energy levels as they absorb the energy quanta, but that the energy flux sustains matter in the ground state.

The following bits of mathematics are provided for evidence of the conclusions; you may skip the maths and go straight to the conclusions:

The ratio of the Lamb Shift energy (E_L) of a hydrogen electron to the mass-energy (mc^2) of the electron gives a value close to G:

$$\mathbf{G \text{ approximates } E_L/mc^2}$$

Where G is Newton's Universal Gravitational Constant which determines the magnitude of gravitational forces.

The exact value of G may be an average of all Lamb energy shifts in matter.

$$\mathbf{\text{Since } E_L = (\text{alpha}^5)(mc^2)k}$$

Where alpha is the Fine Structure Constant and where k depends on the electron configuration and type of atom, then:

$$\mathbf{G = E_L/mc^2 = \text{alpha}^5 k}$$

Conclusion
Thus G is proportional to the fundamental constant of electromagnetic interactions, alpha, the Fine Structure (God) Constant. This makes sense since alpha determines the strength of particle interactions with the quantum energy of the space vacuum.

Using Newton's universal Law of Gravitation:

Newton's gravitational constant (G) is a constant which determines the strength of a gravitational field. Calculating the base units for G using Newton's formula for gravity:

Since $F = GMm/r^2$

F = force between two masses in newtons (N)
M = mass one in kilograms (kg)
m = mass two in kilograms (kg)
s = time in seconds (s)
r = the distance between the centre's of the two masses in metres (m)

Since $F = GMm/r^2$

Then $G = Fr^2/Mm$

$= N.m.m/kg.kg$

Since $F = ma$

Then $N = kg.m/s^2$

Substituting the base units for newtons (N) we get:

$G = kg.m.m.m/kg.kg.s^2$

Thus $G = m^3/kg.s^2$

Since m^3 is **volume** and s^2 is **rate of change** then:

G = Volume/s^2 per unit mass

Conclusion
Indicating that this gravitational constant is related to:

The rate of change of volume (of space) per unit mass

This demonstrates that base units for G are equivalent to the rate of change (flux) of volume (of space) per unit mass, suggesting that gravity may be an accelerating flux of the space vacuum energy into a mass.

If this model is correct then gravity is part of a great energy cycle in the universe.

Another way of looking at this mass equivalence is by the way we measure the acceleration experienced by inertial and gravitational mass:

Measuring Acceleration Using Inertial Mass

Accelerometers

An accelerometer is a sensor for testing the acceleration along a given axis. When a physical body accelerates in a certain direction, it becomes subject to a force equal to:

$$\mathbf{F=m_i}$$

In accordance with Newton's Second Law.

In this formula, ($\mathbf{m_i}$) is the mass and (**a)** the acceleration. Therefore, accelerometers are built on the principle of measuring the force exerted on a test body of a known mass along a given axis. The following drawing schematically shows the structure of an accelerometer.

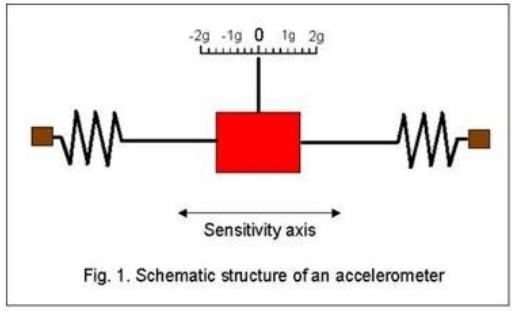
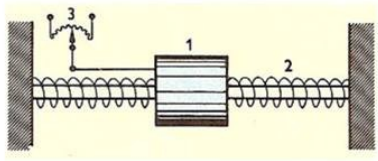


Fig. 1. Schematic structure of an accelerometer

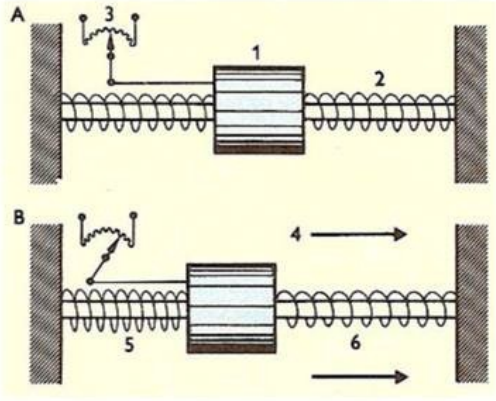
In Newton's day, accelerometers where built using a test mass (shown in red) held at rest with springs and having a scale showing the acceleration along the sensitivity axis. Note that the unit (**g**) is equal to the acceleration subject to all bodies at the surface of the earth due to gravity, and is equal to about 9.8 meters per second per second. The same gravity is the acceleration that translates our body mass to a weight we can measure when we stand on a scale.

Linear Acceleration



If the device is moving at constant velocity, the mass (1), supported on a bar by springs (2), remains static and an intermediate reading is registered on the zero centred voltmeter (3). This corresponds to zero relative acceleration between the mass and the space-time frame of reference. On acceleration in the direction of the supporting bar, i.e., along the accelerometer's sensitive axis, inertia causes the mass to lag behind, compressing the spring behind it and stretching the spring ahead of it: a positive voltage is registered. On deceleration, inertia causes the mass to compress the spring ahead of it and stretch that behind it, and thus a negative voltage is registered on the potentiometer. This corresponds to relative acceleration between the mass and the space-time reference in which it sits.

Stationary and Moving at a Constant Speed



When the system is moving at a constant speed it gives the same result as a stationary system: the mass remains in the middle and at equilibrium with the springs ie *no relative acceleration.*

Conclusion

The spring system during acceleration exerts a force on the inertial mass, the mass (mass being its *resistance to acceleration*) exerts an equal and opposite force on the spring system. Newton's 3rd Law: to every action there is an equal and opposite reaction. So why is the mass reluctant to **relative acceleration** within the (**static**) space-time frame of reference? There must another 3rd Law pair of forces making the mass resist relative acceleration:

<u>1st 3rd Law Pair of Forces:</u>

Force of Spring on Mass = - Force of Mass on Spring

<u>2nd 3rd Law Pair of Forces:</u>

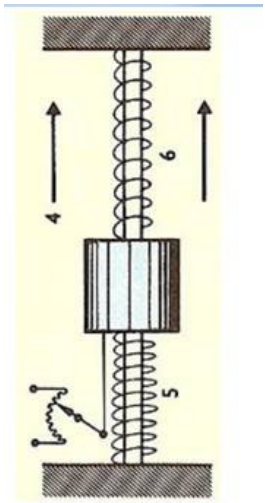
Force of Mass on Space-Time Reference Frame = Force* of Space-Time Reference Frame on Mass

*This is the resistive force *to relative acceleration between the mass and the space-time reference frame*, what I call **inertial drag** on the mass by space-time whenever there is relative acceleration between the two, this *drag force of space-time is what we see as mass*.

But how can space-time exert a drag force on a mass during acceleration? Einstein pointed the way to this in his mass equivalence theory.

2. **Gravitational mass** is a quantitative measure that is proportional to the magnitude of the gravitational force which is exerted by an object (active gravitational mass), or experienced by an object (passive gravitational force) when interacting with a second object.

Important Observation
What is interesting about an accelerometer is that if it is placed stationary on a table in the Earth's gravitational field, but orientated vertically it give this result:



The mass moves downward from the equilibrium position.

This demonstrates that there is a relative acceleration between the system and the space-time matrix. Since the system is not moving upwards relative to the Earth or the observer, then the space time matrix in which it is immersed *must be accelerating downwards into the earth* thus pushing down with a drag force on the gravitational mass ($\mathbf{m_g}$).

Here: $\mathbf{Weight = m_g g}$

Where g is the gravitational acceleration of space.

Conclusion

Inertial mass and gravitational mass are equivalent, where *the mass is in relative acceleration with the space-time matrix:*

$$\mathbf{m_i = m_g}$$

$$\mathbf{F/a = W/g}$$

$$\mathbf{W = m_g g = F = m_i a}$$

Where W and F are the equivalent drag forces which the mass experiences when in relative acceleration with the space-time matrix.

In simple terms, when holding out by the hand a mass and we experience the weight of the mass, we are actually experiencing the *drag of the space-time matrix which is accelerating into the earth* and when we try and throw a mass we also experience the drag of the space-time matrix, this is because in both cases there is a relative acceleration between the mass and the space-time matrix.

8. Understanding the Evidence for the Big Bang and the Age of Our Universe

Our understanding of the concept of time as being a constant is erroneous, true for an observer in his own space-time frame, but not relative to another observer in a different space-time frame. Time changes depending upon position (in space and in time) and speed and it is incorrect to extrapolate far back to the beginnings of our universe and state its age, for over that time-period space and time may have changed. It is enough to look back at the unfolding ages of the universe and state that it has undergone 13.8 billion years of change, but to state that it happed 13.8 billion years ago relative to the rate of modern time is incorrect.

With regard to the evidence for the expansion of the universe i.e. the red shift of light from distant galaxies, there are other explanations for this reddening of light over distances and time, one of which is:

Gravitational Red Shift

In Einstein's GTR light leaving a gravitational field into the flatness of space will increase in wavelength, become redder. The early expanding universe was hot, contracted and denser in terms of mass-energy, therefore light leaving the Big Bang gravity well to the present day expanded universe will experience gravitational red shift. When we observe distant galaxies we would expect to see their light red shifted even if they were now motionless and not expanding away from us. In observing more distant earlier galaxies we would expect to see more red shift. This model would suggest expansion to a static universe.

How would this gravity well affect time over the evolution of the universe? If the space vacuum was more dense with imponderable matter in an early more dense universe, then at that time, time would tick slower than it does today and in this early universe light and all electromagnetic reactions would also run slower, so looking back at these early processes we may see 13.8 billion years of change but the whole process may have taken an eternity to unfold and over time-change everything speeded up to its current rate of time-change. The converse to this is even more interesting, assuming the early space vacuum was almost devoid of imponderable matter (not yet made by stellar processes), then time and change would have started at a phenomenal rate and gradually slowed to the current rate of time change. Looking back then to our remote past we may be observing 13.8 billion years of change, not time, and that it all came about in a matter of current earth time years or even days! The universe may only be several thousand 'years' old.

We cannot state that the universe is 13.8 billion years old, only that it has undergone 13.8 billion years of change.

Newton's Gravitational Constant in an Expanding Universe

In my book *'The Enigma of Gravity'* I pursue through classical and modern physics the cause and physical nature of gravity concluding that gravity is an acceleration of the imponderable substance of the space vacuum into a gravitating mass, thus gravity is an accelerating energy flow into matter, this invisible energy flow not only is it gravity but it may also sustain the very physical nature of matter and the universe. Gravity may be part of a universal energy cycle involving stellar, black hole and quasar processes, the space vacuum imponderable matter mass-energy density and ordinary matter. This invisible energy flow may even be responsible for stellar heating, and therefore solar nuclear fusion and planetary heating. There is only one thing in nature that can detect this flow, anything which has mass. Throw a ball up into the air and it will be dragged back down and pinned to the floor by this gravitational energy flow. Hold out you arm for some time and feel the weight (drag) of this flow.

Earlier I showed that the derived units for Newton's Universal Gravity Constant G is related to acceleration of space volume into a gravitating mass:

$$G = m^3/kg.s^2$$

Since m^3 is volume and s^2 rate of change then:

$$G = Volume/s^2 \text{ per unit mass}$$

Indicating that this gravitational constant is related to:

The rate of change of volume (of space) per unit mass

This demonstrates that the base units for G are equivalent to the rate of change of volume (of space) per unit mass, suggesting that gravity may be an accelerating flux of the space vacuum energy into a mass.

The value of Newton's gravitational constant (G) determines the strength of gravity. It has a very small value; hence gravity is classed as a very weak force even though it is one of the most fundamental and most important forces in the universe:

1. Gravity puts the breaks on expansion, because gravity acts between every mass object in the universe, pulling them together.

2. Gravity is the force that holds galaxies and solar systems together.

3. Gravity drives the nuclear processes within stars to produce heat and light.

4. Gravity keeps the planets in orbit around a star such as our sun.

5. Gravity keeps us, our atmosphere, our oceans and everything else upon the earth.

6. Gravity caused the early universe primordial matter to clump together and form planets and stars.

7. Gravity, as an energy flow, may be the mechanism which holds and sustains the universe.

For all of the above processes the magnitude of the constant G is critical, for example too large and the universe would have expanded and collapsed under gravity very quickly. Too small and the universe would have expanded at an ever increasing rate. Its magnitude is just right for all of these processes to occur and stars, planets and even life to exist. So what determines the magnitude of the gravitational constant? Does the value of G change over time?

To answer these two important questions we need to understand what special physical property of mass particles (atoms) cause the acceleration of space-time. All mass objects, independent of the elements they are composed of, produce gravitational acceleration, so the cause of gravity is not related to the type of atoms present in a substance, but only to the amount of substance i.e. more mass (m) equals more gravitational acceleration (g).

So the cause must be related to the fundamental structure of the atom. Atoms are not passive structures; they are composed of dynamic particles, protons, neutrons and electrons. These particles are in constant oscillatory motion and are composed of electromagnetic energy (light) oscillating at frequency (f) at the speed of light (c). It is best to think of an atomic particle as a standing wave* of electromagnetic energy (E).

* When a guitar string is plucked its oscillation is a standing wave.

The mass-energy of a particle is given by Einstein's famous equation:

$$E = mc^2$$

So mass is equal to the amount of energy per speed of light squared:

$$m = E/c^2$$

Using Planck's constant (h) and his formula (E = hf) for the energy of a wave we can derive a new formula for mass:

$$m = hf/c^2$$

And since $c^2 = 1/(U_oE_o)$ where U_o is the magnetic constant of free-space and E_o is the electric constant, then:

$$\textbf{mass} = \textbf{hf}U_oE_o$$

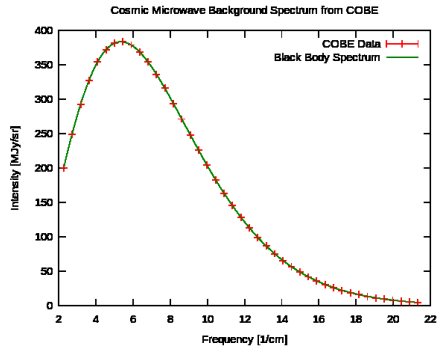
This equation shows that mass is proportional to the frequency (f) of oscillation of an atomic particle and the electromagnetic properties of the space-vacuum.

Since gravitational acceleration is proportional to mass, it is fundamentally proportional to the frequency of mass-energy oscillation in an atomic particle. This would suggest that atomic particles are the dynamic machines which cause the acceleration of the space vacuum energy. If mass particles are absorbing this space vacuum energy (the imponderable matter), where does it go?

As surmised, this gravitational energy absorbed by matter may be sustaining matter, but what goes in must come out? There is evidence that oscillating atomic particles (namely the electron) interact with the space vacuum sea of energetic particles (the ether). This interaction causes the electron to jitter in energy levels, this jitter is called the Lamb Shift and analysis of the magnitude of this energy jitter is equivalent to microwave radiation.

A possible model for gravitational acceleration of the space vacuum sea of imponderable mass-energy is that:

Oscillating mass particles interact with the imponderable mass-energy of the space vacuum, thus absorbing energy out of the space vacuum causing its acceleration into a mass, the energy absorbed maintains matter (the particle wave standing oscillations) and in the process the space vacuum mass-energy is converted to microwave energy.



If this model for gravity is correct it would explain why Cosmic Microwave Background Radiation can be found in every direction in the universe a radio telescope is pointed. It could also explain planetary (microwave) heating and stellar heating which causes nuclear fusion in the core of the sun. Jupiter radiates more energy than it receives from the sun, the Earth has remained hot and molten for billions of years, and in both cases this related to the fact that the Earth (and maybe Jupiter) has a metal core: metal in a microwave oven heats up as it absorbs the microwave radiation.

Whatever the fundamental cause of gravity it may certainly not be a constant over the history of the universe, for if gravity is related and dependant on the imponderable substance of space (U_oE_o), then the energy density of the space vacuum will determine (fix the magnitude of) Newton's gravitational constant.

If the energy density of the space vacuum decreases with time as the universe expands, then G will become smaller and thus gravity weaker, this may be the cause of the recently discovered accelerated expansion of the universe.

9. The Earthly Void

There are many accounts of the origins of all things, myths, legends, stories, beliefs and of course scientific theory, but one of the questions that my physics students ask me concerning the Big Bang is that how can something come out of nothing, if there was nothing before the Big Bang where did all this (the universe) come from? From the Biblical Genesis account, what was before creation was God, but leaving beliefs aside science has some answers:

Firstly, the question of 'before the Big Bang,' since time and space are inseparable, without space and matter there was no time, there was no before. 'Outside of time, matter and space,' time has no meaning. There just is. It is the physical nature of this universe which limits the speed of light and therefore limits the speed of change, outside of this physical universe light has no limit and time has no meaning.

The universe is made up of mass-energy, matter and light which occupy space, without this universal substance, space would contract to nothing, for space itself (the 3 dimensions of volume) is a physical mass-energy substance, the imponderable matter. So where did all this mass energy come from?

If I throw a ball up into the air, the ball has been given mass-energy (kinetic energy) and as it rises this kinetic energy decreases, the ball slows down to a stop at its highest point and all of its original kinetic energy is converted to Gravitational Potential Energy (GPE) stored within the surrounding gravitational field. This is a bit like stretching an elastic band where the original kinetic energy to stretch the band is stored in the elastic (strain energy), the bonds between the molecules are stretched. The ball returns to my hand during which the GPE is converted back to kinetic energy and this energy is given up by the ball back to the hand which initially threw it up.

During the whole time of its rise and fall the ball had no energy of its own, it was borrowed energy and also during its rise and fall its total energy was a constant, for at every stage the sum of the potential and kinetic energies is constant.

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