A Multidimensional Geometric Expansion of Spacetime

John M. Kulick - Reverse Engineer - June 23, 2013

This First Edition work is copyrighted ©

 Individuals are free to copy any and all parts of this work for personal use only.

 Any person, profit, or non-profit organization which receives financial compensation for disseminating or sharing information that wants to use any part of this work must ask for permission from the copyright holder, which is presently the Author, John M. Kulick.

 This restriction includes teachers and educational institutions, but there will be no financial cost for educational purposes other than the time and effort to ask for permission and a reference to the original source.

 The email address to request permissions; submit suggestions, comments, kudos, critiques and verifications is… snowflakeunivers@aol.com (note, no “e” due to character limitation). Regular mail address is John Kulick, P.O.B 137, Collinsville, CT 06022.

 Printed copies are available for purchase for a nominal cost. Send request to the email account or by mail.

 Version 1.2 ___ of 11 Copies
Section 1 – Organization, Introduction and Brief Description of Model
Chapter 1 Organization of Book

1.1.1 Organization of book
This book is organized into parts, which breakdown into successively smaller parts.

The five major sections are…
1. Outline, Introduction and Brief Description of Model
2. Premises of the Model
3. Expansion of Observable Space
4. Expanding the Dimensional Expansion
5. Verification and Correlation to Observation

Each Section is then broken down into Chapters. Each Chapter deals with a basic concept or physical description within the Section. Chapters are further partitioned when additional ideas or relationships are associated within the Chapter.

1.1.2 Where is Section 5?
Section 5 is not yet complete. The number of applications of the model within the field of astronomy is quite numerous and it will take a fair amount of time to address. Holding back the publication of the model until this Section was completed would unnecessarily delay the publication of the theory.

Despite the present exclusion of Section 5, there are a number of practical applications within the development of the presented model that verifies the validity of the model. Some of these described applications resolve fundamental issues in astronomy and theoretical physics.

Also, those familiar with Astronomy can readily determine for themselves if the predictions of the model conform to observation. For example, the theoretically predicted acceleration called Aic is very close to the necessary acceleration necessary to explain the rotational rate of stars in galaxies and this is something anyone familiar with the field can verify, using the proper Age of the Universe.

Actually the best test of the model will occur when an independent parties verify the model’s conformance to observation.

1.1.2 Numerical outline
The first number above a paragraph corresponds to the Section number, the second number corresponds to the Chapter and the third, fourth or even 5th numbers correspond to a more detailed breakdown or description of the model.

For example, the above demarcation of 1.1.2 Corresponds to the second concept described in the first Chapter within the first Section.

1.1.3 Figures and Graphs Numeration
Figures and Graphs are numerated by their sequence within each Section. For example Figure 2-4 corresponds to the fourth figure in the Second Section.

1.1.4 Numeration of Formulas
First number in Equation designates the Section, second indicates the Chapter, third is the sequence in the Chapter that the Formula is derived.

1.1.5 Outline of Multidimensional, Geometric Expansion Model
Outline begins on next page. Blank pages are interspersed for notes.
Outline of Book
Section 1. Organization, Introduction and Brief Description of Model

Chapter 1. Organization of Book
1. Organization of Book
2. Numerical Outline
3. Numeration of Figures and Graphs
4. Numeration of Formulas
5. Outline

Chapter 2. Characteristics of Unified Models of the Universe

Chapter 3. Preliminary Comments
1. Expansion Models Proposed by Others
2. Acknowledgement of Help from Others
3. Offers to Help and Request for Help
4. Translation Help
5. Copyright
6. Purchasing Copies of the Work

Chapter 4. Brief Description of the Multidimensional Geometric Expansion Model

Chapter 5. Advantages of GEM (Geometric Expansion Model)
1. No Dark Matter is Required
2. No Dark Energy is Required
3. No Stars Older Than the Universe
4. Metallicity and No “After the Fact” Population III Stars
5. No Unexpected Quasars
   1. A Predicted Energy Output From Young Galaxies
   2. Why Quasars Generate So Much Variable Light
6. Evidence of the Quasar or Explosive Era in Our Solar System
   1. Strange Xeon
   2. Formation of “Rocky Inner Planets”
   3. Angular Momentum Issues Resolved
   4. Evidence of Collisions Resulting From Mini Supernova
      1. Why Uranus’ Axis of Rotation Changed
      2. Why Less Heat is Emitted From Uranus
      3. Venus Spinning Backwards
      4. Ceres, Asteroid Belt and Titus - Bode “Law”
      5. Our Moon
      6. A Wave of Meteors; The Late Bombardment Era
7. More Evidence of an Increased Gravitational Effect in the Past
   1. Nobel Prize Winners of Physics
   2. Energy and Heat from Jupiter and the Great Red Spot
   3. The Young Sun Paradox
   4. Water on Mars
8. Resolve a Conflict or Ambiguity between Special Relativity and General Relativity
9. Inconsistency Regarding Equivalency of Matter and Energy

Chapter 6. Problems with Expansion Based Models
1. Rush to Judgment
2. Dynamic Stability
3. Irrelevant
4. “Breaks” the Structure of Space (“Spacetime”)
Section 2 – Assumptions, Conventions and the Structure of Space and Fields

Chapter 1. Spacetime and Fields
1. Spacetime and Fields
2. Space and Spacetime – Terminology
3. Speed of Light
4. The Double “==”
5. Local Spacetime is Invariant
6. Local and Global
7. Field Relationship Reveals the Structural Relationships of Space
   1. Magnetic Fields
   2. Gravitational Fields
   3. Another perspective on field relationships

Chapter 2. Dimensions
1. What are Dimensions?
2. Dimensions of (Observable) Spatial Space
3. More Dimensions of Distance
4. Spin as a dimension
5. And More Dimensions for Galaxies and the Nucleus

Section 3 – The Expansion of Observable Space

Chapter 1. Absolute and Relative Measures
Chapter 2. The Geometry
1. The Geometry of Expanding Observable Space
2. Definitions and Notation
3. Derivation of Formulas
4. “k” and Distance
5. Value of k and To
6. The Ratios of Time
7. Observable Expansion Space Formulas

Chapter 3. Issues with Time
1. Period or Intervals of Time Increase
2. Time and Structure
3. Do Relative Measures of Time Stay the Same?

Chapter 4. The Kinematic Cost of Expansion
1. Expanding Balloon Analogy
2. Quantum Structure of Space and the Kinematic Connection
3. Crinkled
4. Bits of Spacetime
5. Velocity Diminishes
6. Object Moving Through the Expanding Spatial Fabric
7. How Should the Velocity Change Over Time?
8. Assumption - The Geometry of Energy Loss
9. Generalizing the Equations to Acceleration
10. Ratio of Times Formulas Applied to Objects
11. Graphic Representation of Kinematics of Objects in Space

Chapter 5. Intervals of Time
1. Intervals of Relative and Absolute Time
2. Intervals of Time and Velocity
3. The Light Clock
4. Angular Momentum
5. The Pendulum
6. Orbiting Systems – Keplers 3rd Law
Section 3 – The Expansion of Observable Space (continued)

Chapter 6. Forces pg 54
1. Forces and Dimensional Check
2. Balance Between Spatial and Inertial Forces
3. Inverse Square Laws

Chapter 7. Energy pg 56
1. Checking the Relationships of Energy
2. Work
3. Potential Energy – Inverse Square Law
4. Kinetic Energy
5. Potential Energy – Constant Field
7. Nuclear Energy

Chapter 8. Energy of a Photon pg 58
1. Problem with Energy of a Photon?
2. Equivalency Issue
4. Cosmological Redshift Issue for Model

Chapter 9. Special and General Relativity pg 60
1. Special and General Relativity
2. Special Relativity Relationships Preserved Locally and the Lorentz Factor
3. General Relativity’s Relationships Preserved Locally

Chapter 10. Measures of Time pg 61
1. Comparing Two Measures of Time
2. Absolute, Cosmological or Historical Measures of Time
3. Evolutionary of Experiential Measure of Time
4. Experiential Time Caution—Unfinished Model
5. Experiential Time Derivation (Observable Space Only)
6. Cosmological Implications (Observable Space Only)
7. Cosmological Experiential Time

Chapter 11. Cosmological Measures of Distance and Time pg 65
1. Consecutive Measures Using a Light Clock
2. Cosmological Measures of Distance and Time Overview—Look Back Time and Look Back Distance
3. Fundamental Cosmological Problem for Model

Chapter 12. Cosmological Time Dilation pg 70
1. Cosmological Time Dilation
2. Time Dilation is Observed (Except in Quasars)
3. Derivation of Dilated Intervals
4. Time Dilation - Problem for Model as Presented
Section 3 – The Expansion of Observable Space (continued)

Chapter 13. The First Equation
1. Search for the Key
2. Suspicious About Gravity
3. Dimensional Properties of the Constant of Gravity
4. Dimensional Analysis
5. Changing Einstein’s Equivalency Principle
6. The Challenge, Based on Dimensional Analysis
7. Clocks, Rulers and Mass
8. Volume as a Fundamental Physical Characteristic
9. Because Space Changes, Time Exists
10. Equation Dimensionally Validated
11. Finding the Key, Balance Preserved

Chapter 14. Expansion of Observable Space Summary and Predictions
1. Summary
2. Connection to Quantum Mechanics
3. Conclusion – Observable Space
4. Formulas of Observable Space

Section 4 Expanding the Dimensions of Expansion

Chapter 1. Six Spatial Perspectives
1. Necessity for Expanding the Model and a Solution
2. Six Kinds of Spatial Descriptions
3. Relative or Local Space
4. Observable or Expanding Observable Space
5. Absolute Space
6. Observable Space in Motion Along Unobserved Dimension
7. Unified Space
8. Unified Local Space or Local Unified Space
9. Illustrations of Extra Dimensional Space
10. Notation for Measures of Distance and Time and Perspective

Chapter 2. Moving in an Unobserved Dimension
1. Some Intrinsic Properties from Motion Through Unobserved Space
2. FlatlandAnalogy
3. Intrinsic Velocity
4. Intrinsic Energy, the Speed of Light and \( E = mc^2 \)
5. Variations on Speed of Light Conjecture
6. Intrinsic Acceleration
7. Inertia
8. Special Relativity and Inertia
9. Centrifugal Effect and Inertia

Chapter 3. What Makes Photons Move?
1. The Interaction of Observed and Unobserved Space
2. Why do Photons Move?
3. Figures Illustrating the Interaction of Fields
4. Expansion Allows Change

Chapter 4. More on the Cosmological Redshift
1. Cosmological Redshift continued
2. Forming the Wavelength and \( Vu \)
3. Cosmological Redshift and Energy
4. The Deal Breaker
Section 4 - Expanding the Dimensions of Expansion ( Continued )

Chapter 5. Diminishing Intrinsic Properties
1. Diminishing Intrinsic Properties
2. Basic Formula for Expanding Unobserved Space
3. Notation – “U” or Italic
4. Unifying k and k
5. Ratio of Time Formulas – Unobserved Space
7. Worrisome Loss of Inertia and Consequences
8. Varying the Speed of Light
9. Loss of Intrinsic Energy and Stars
10. Loss of Intrinsic Deceleration

Chapter 6. Spatial and Inertial Mass and Force
1. Spatial and Inertial Mass and Force
2. Non-Equivalency of Inertial Mass and Spatial Mass
3. Relationships of Spatial Mass and Inertial Mass
4. Spatial and Inertial Forces
5. Balance Lost – Collapsing Orbits

Chapter 7. Conservation of Motion
1. Conservation of Motion, Rotational and Linear Intervals

Chapter 8. “Orbits” With Decreasing Inertial Mass
1. Orbits Represent Systems Balanced by Inertial and Spatial Forces
2. Orbital Relationships Change
3. Shrinking Celestial Orbits and Shrinking Rulers
4. Balancing Orbital Relationships
5. Orbital Velocity and Radius
6. Orbital Periods and Clock Rates
7. Local and Cosmological Measures
8. Formulas for Orbital Relationships of Unobserved Space

Chapter 9. Cosmological Redshift
1. Cosmological Redshift Continued in Unobserved Space
2. Cosmological Redshift and Electrostatic Fields
3. Energy Variation Over Cosmological Time
4. Cosmological Redshift, \( \lambda \)

Chapter 10. Equivalency Between Matter and Energy Restored

Chapter 11. Shrinking Rulers and Faster Clocks
1. Shrinking Rulers
2. Faster Clocks and Time Dilation Restored

Chapter 12. Radial Acceleration for Orbits
1. Radial Acceleration
2. Effect Very Small

Chapter 13. Formulas of Unobserved Space

Chapter 14. Perspectives in Unified Space
1. Unified Space
2. Three Perspectives in Unified Space
3. Absolute Unified Space – Absolute perspective
4. Local Unified Space – Local Observer with Local Perspective
5. Local Cosmological Unified Space;
   Local Observer with Historical or Cosmological Perspective
6. Notation
Section 4 - Expanding the Dimensions of Expansion (Continued)

Chapter 15. Orbital Relationships in Unified Space
1. Unified Space
2. Orbital = Dynamic
3. Absolute Distance Measures of Orbital Relationships in Unified Space
4. Absolute Velocity of Orbiting Objects in Unified Space
5. Absolute Acceleration Within Orbiting Objects in Unified Space
6. Absolute Orbital Intervals of Time in Unified Space
7. Absolute Spatial and Inertial Mass
8. Acceleration and Check for Dimensional Consistency
9. Energy Check of Orbital Relationships in Unified Space

Chapter 16. Spectra of Light in Absolute Unified Space, Cosmological Perspective
1. Cosmological Redshift in Unified Space, Absolute Perspective
2. Spectral Energy and Wavelength Issues Resolved in Unified Space

Chapter 17. Using Local Rulers and Local Clocks, Local Cosmological
1. Using Local Rulers and Clocks Measuring Cosmological Objects
2. Apparent Observed Image Size of Distant Ruler
3. Apparent Spatial Dilation
4. Apparent Temporal Dilation
5. Dilation Effect Does Not Match Stretch of Observable Space
6. Alters Distance Estimates using Cepheid Variable Stars
7. Local Rulers and Clocks Measuring the Cosmological Redshift
8. Local Experiential Time – “Orbital” Systems
9. Experiential Time Intervals Compared
10. Cumulative Measures of Unified Local/Cosmological Experiential Time-te
11. Application of te, Evolution and Stars

Chapter 18. Intrinsic Centrifugal Acceleration = Aic
1. Physical Basis for Aic
2. An Intrinsic Centrifugal Acceleration Verifies the Model
3. Deriving Formula for Aic
4. Vector Projections From a 4 Dimensional Space. 1/2 Factor for Aic.
5. Experienced Aic Reduces Aic by 1/2
6. Theoretical Value of Aic
   1. Ve, The Velocity of Expansion
   2. Ve and Ho
   3. Ho, Hot to Aic
   5. Ao and Aico “1/2” for 10 x 10^9 Year Old Universe
7. Inertia and Aic
   1. Inertial Effects on Physical Response to Aic
   2. Notation Subscript “i” Dropping the “1/2 Inertial Motion”
   3. Integrating for Velocity and Distance, the “ln” Functions
   4. Comparing Formulas for Galactic Motion With Inertial Effects Considered
   5. Accelerations Compared
   6. Would Galaxies be in the Right Place with the Passage of Time?
Section 4 - Expanding the Dimensions of Expansion (Continued)

Chapter 18. Aic Intrinsic Centrifugal Acceleration

8. The “2/3rds” Model – Location of Galaxies Based on Deceleration
   1. The “2/3rds” Model – Location of Galaxies Based on Deceleration

9. Fundamental Cosmological Issue, the Even Distribution of Galaxies

10. Vio, Veo, and the Constant of Integration “a”
   1. Evaluating the Velocity Vio and or Veo for the Constant of Integration “a”
   2. Velocities Compared

11. Distances Compared

12. “ln” Model Corresponds to “2/3rds” Model, Cosmological Distribution and Aic

13. Geometric Age of the Universe, Tt

14. The “Offset Model”
   1. The “Offset Model”
   2. True To, Tt, Tt = 1/Ho
   3. Tg, Start of Galaxies
   4. Tt and Cosmological Redshift Ratio
   5. Redshift Ratio When Quasars or Matter First Enters Universe

15. The Evolving Offset Model
   1. Resolving the Redshift Quasar Issue
   2. Review of Quasar and Galaxy Location Justifies Model
   3. Benefits of Universe “Offset” Model
   4. Babies Younger than Their Adolescent Twins
   5. Babies Playing with Their Own Adolescent Twins
   6. Why Don’t We See More Very High Redshift Quasars?
   7. The Lack of Time Dilation Associated with Quasars

Chapter 19. Summary of Benefits and List of Equations for Unified Space

   2. Formula summary, Unified Space, Local and Absolute
Section 1 – Chapter 2
1.2 Characteristics of Unified Models of the Universe

My name is John Kulick…the following is the description of my model of a Multidimensional Geometric Expansion of Spacetime.

The model establishes a Unified Field Theory, which means that all the relationships of nature can be described by a geometrically defined model. The theory can be categorized as a Keplerian model since it conforms to an underlying geometry, the same philosophical foundation of Johannes Kepler.

First, a review of a couple of historical examples of earlier geometric models of the Universe will help provide some context for the proposed model.

One of the first geometric descriptions of the Universe consisted of the Earth at the center, with the Sun, moon, stars and planets orbiting the Earth in perfect circles. Nice, simple and the model seemed to correspond to observation. Figure 1-1.

Sometime before his death in 230 B.C, the astronomer, Aristarchus of Samos, proposed that the Sun was at the Center of the Universe and the Earth was but one of the planets, which all orbited the Sun. The daily motion of the Sun, stars and planets across the sky was the result of the Earth rotating each day. Figure 1-1.

There are historical records indicating that Aristarchus was not the first to propose such a model, but he was probably the first person to determine the size of the Sun, moon and the corresponding distances from Earth.

Initially the Sun centered model sounded preposterous. After all, any idiot can clearly see the Sun rises, transverses the sky and then sets. Also, if the Earth did spin, wouldn’t we fly off the surface of the Earth like peas on a spinning plate? If the Earth was in orbit around the Sun, its motion would cause the observed location of the stars to exhibit some kind of parallax or variation in their observed location, unless they were an unimaginable distance away. If they were that far away then they would have to be bright like our sun and if that were the case the sky would be full of suns and potentially other planets as well. These fantastic ideas were too much to believe.

The Sun centered model also opposed philosophical and religious beliefs; The Earth lost its sacred “Centeredness” and Uniqueness. The smartest people in the world knew the Sun centered model was wrong and any further discussion of the proposed model would be a waste of time.

Despite the conformance to observation of the Sun centered model, Aristarchus was condemned for impiety.

The reincarnation of Aristarchus’ model came 1800 years later, this time by Nicolaus Copernicus, who waited until after or very near his death to publish his work. This delay was probably because he was aware of the sacrilege he would be accused of. A few decades later, Galileo was sentenced to house arrest and all his scientific papers censored for advocating the Sun centered theory, or what we would now call an “out of the mainstream” model.

Centuries have passed and the nature of mankind has not really changed. Ideas and beliefs that we have been taught become entrenched, and they do so for good reason; they allow us to make sense of the world. It is from this sense of order, that progress can be made. After all, if there weren’t some kind of initial confirmation of a model’s validity in the first place, the model would have never been initially accepted.
However, any challenge to what we believe we know threatens order and antagonizes those with authority. Any individual proposing an alternative perspective will run headfirst into the same type of people who “clearly see that it is the sun that crosses the sky”.

It is an unfortunate weakness in the human race that beliefs, which are simply thoughts in a small region within a comparatively small brain, turn into ideology and prejudices that will motivate people to censor, ignore, criticize, disparage, and worse.

There are two generalized characteristics of any geometrically based model defining the Universe. First, it can be drawn and second, if it differs from what the smartest people in the world presently believe, the initial reaction will be to ignore the ideas, or even actively censor the work.

If the assumptions of the proposed model initially sound impossible, like peas flying off a spinning plate, wait and see if the issues are not resolved in the course of the development of the model. Perhaps you could prove me wrong. I would much rather be criticized than ignored or censored.

Thank you for your time. Hopefully it will not take another 1800 years for a valid consideration.

Respectfully yours,

John M. Kulick, a.k.a. Snowflake Universe or “Snowflake” for short.
Earth Centered Model

Sun, Stars and “wandering Stars” (planets), orbit Earth

Sun Center Model

Earth orbits Sun and spins once each day to give the illusion that the Sun and stars orbit Earth

Figure 1-1 Two geometrically defined models of the Universe
1.3.1. Expansion Models Proposed by Others
First, I am not the only person that has proposed a model based on the expansion of Spacetime. The other two people I am aware of are John Hunter of England, and C. Johan Masreliez of the USA. John Hunter’s work can be found by an Internet search under www.rescalingsymmetry.com or www.gravity.uk.com. John Masreliez’s work can be found under a search using the terms “expanding spacetime theory”. Their work is relativistic based. For those familiar with General Relativity, the relationships derived by Masreliez will be of interest to review. Both Hunter’s and Masreliez’ work is based on a relative measure of time, whereas my relationships are derived using a constant or absolute measure of time. I presented a paper that proved the models were geometrically transformable one to the other at a conference for the American Physical Society in April of 2005.

1.3.2 Acknowledgement of Help from Others with the Model
Also, I would like to thank what were originally the web sites Bad Astronomy and Universe Today for allowing me to present various aspects of my model for discussion. The information and critiques provided by others was extremely helpful. I particularly appreciated the opportunity to discuss my work without being ignored or censored. It is of some importance to note that none of my work was ever disproved, despite long and extensive discussions. Unfortunately, I no longer make postings to the site since it now censors the development of alternative models. Some of the past discussions of the model may be of interest. My nom de plume for the site was Snowflake Universe. (The forum name was “BAUT”, but now is under Cosmoquest, http://cosmoquest.org/forum/forum.php)

1.3.3. Offers to Help and Request for Help
If you are a member of academia and you find the ideas interesting, I would be glad to make a presentation at your school. If you are a physicist and feel that model is worth considering, please apply the relationships proposed to prove or disprove the model’s correlation to observation. Please have the courage to step out of where it is safe and help. Since the model proposed is a fundamental paper, those who first apply the relationships will also be writing fundamental papers.

1.3.4 Translation Help
If you are fluent in another language, I would like your assistance. I would like my work to be accessible for review by anyone who wishes it. I am not a wealthy person; spending time doing theoretical physics as an amateur does not earn an income. I can afford a couple of hundred dollars for each translation for at least 10 languages. If you would like to help in this regard, please let me know. (Email snowflakeunivers@aol.com (note e is missing, character limitation)).

1.3.5 Copyright
This presentation is copyrighted and owned by the author, except for a few of the pictures or drawings made publicly available for everyone from Wikipedia. Everyone is free to use the ideas and formulas to apply in their own field of study. My only request is that I would appreciate any use of the model be acknowledged as to the source. Also, any commercial use of all or parts of my work requires my approval.

1.3.6 Purchasing Copies of the Work
Any individual wishing to have a written copy of this work may purchase the book. Cost, including the shipping is $20 for an unsigned First Edition, which includes the physical description and the derivation of the fundamental relationships involved. Section 5, the application chapter is not included since it is not finished. $40 will pay for the initial copy with an updated version that will include at least 30 pages of Section 5 once it is finished. $200 will pay for the updated version and will each copy will be personally signed copies of the first edition, (limited to 100 copies).
Section 1 Chapter 4 – Brief Description of Model
1.4 Brief Description of the Multidimensional Geometric Expansion Model

The following is a brief description of the proposed model.

1. Imagine a Volume of Spacetime. This Volume is expanding, along with everything in it, so locally everything remains proportionally the same in terms of distance measures. My ruler expands as I expand. This expansion is very slow; for example, it takes more than 1,000 million years for a ruler to become twice as long.

2. All local clocks or measures of intervals of time proportionally slow with the expansion of Space. As a pendulum expands or lengthens, its measure of intervals of time expands.

3. An “Eye of God” perspective outside of the expansion is used, with an Absolute Ruler and Absolute Clock to describe or measure the local expansion of Space.

4. This volume is contained or is a part of another volume of Space, called Unobserved Space. If we imagine ink dissolved in water, the ink would represent our observed Spacetime, while the water around the ink particles represents an Unobserved Space. The volume of both the water and ink expand at the same proportional rate together.

5. The observed space, analogously represented as the ink, is also in motion through the water but since we can only see our observed space, the ink, we have no direct awareness of our motion through the water. Just as we can imagine a two dimensional flatland Universe in motion along an unobserved vertical dimension, so too is our observable Universe in motion along an unobserved dimension.

6. The volume of spacetime (S), which includes our observable and unobserved space, varies geometrically to the square of the cosmic age of the universe. \( S \sim T^2 \). (Double the age of the universe and the volume increases 4 times.) This expansion even includes the Space or spacetime around and within the atom.

7. Since density decreases over time, the effect of gravity decreases over time. For example, if the Earth were 1/2 its present size in the past, the effect of gravity on and in the Earth would have been 4 times greater in the past.

8. Expansion comes at a kinematic cost. The velocity of all objects decreases as they travel through an expanding spacetime field. Since the property of inertia is tied to the velocity along the unobserved dimension, and this velocity similarly decreases, the property of inertia diminishes over time.

9. Two dimensions of time are a part of the model, relative and absolute. Relative intervals of time describe the local temporal separation between spatially separated points. Absolute, or Cosmic or Historical time describes a point's location relative to the beginning of Time. The fundamental geometry of the model is built on this extra independent measure of Time.

10. This expansion occurs incrementally. A small “piece” of spacetime integrates itself upon the existing structure of reality a piece at a time. The scale of this integration is at the atomic level of observation. This integration process is responsible for the probabilistic based relationships associated with quantum mechanics. For example, the location of an electron and its velocity can only be described probabilistically due to the disturbance created around the existing structure of reality of which the electron is a part.

11. The Universe is like a growing snowflake. A snowflake grows upon the existing structure and change can only occur from this established foundation; around the edges. Our Universe similarly grows from existing structure and change can only occur around the edges, or in the present. We are located now, at the Edge of the Universe, from which we, and everything else, is expanding and growing. If expansion did not occur, nothing would change. \( \frac{dS}{dT} = T; \) because space changes, time exists.)
The following two figures illustrate the difference between the current “mainstream” “Limited Expansion Model” and the proposed “Geometric Expansion Model”. The third picture helps describe a universe that is expanding and in motion along an unobserved dimension using a Flatland Universe analogy.

**The Current “Limited Expansion Model”**

**Expanding Balloon Analogy**

Dots represent “fixed sized,” gravitationally bound galaxies

Arrows represent a relative rate of expansion of spacetime

The expanding balloon analogy is often used to illustrate the expansion of the Universe. The current “mainstream” model is a “Limited Expansion Model” since the Expansion of the Universe is assumed to stop at the boundary of gravitationally bound galaxies.

**One Issue with Limited Expansion Model**

One major issue with the Mainstream Limited Expansion Model is revealed when considering the early Universe. Fixed sized galaxies eventually take up more space than the Universe itself.

Also, when the universe was very young and small, the energy concentration would be so great that everything would be thoroughly mixed up down to the constituents of matter itself. How can such a chaotic state produce any kind of galactic sized structures throughout the entire Universe?

**Figure 1-2 The Limited Expansion Model**
Galaxies and matter expand with the expansion of Space.
This time, galaxies in the very distant past would be seen as converging to a point and not piling up on each other. Each galaxy is initially formed with a spatial separation between them. Matter flows into the Universe from the core of galaxies.

Figure 1-3 Geometric Expansion Model
An expanding Flatland Universe is the result of a geometric interaction caused by its motion in an unobserved “vertical” dimension relative to a geometric structure of space time, which is represented here as a cone. As the Flatland Universe travels along the cone, or field relationship, the expansion of the flatland universe is established.

The uniform expansion of a Flatland universe is composed of two relationships described by Absolute time. As time passes, Flatland expands, and it moves along an unobserved dimension.

Extending the idea to a three-dimensional space results in three-dimensional space expanding while the three-dimensional space is also in motion along an unobserved dimension.
Section 1 Chapter 5 Advantages of (GEM) Geometric Expansion Model

The following is a brief description of the Advantages of the GEM Model and why this is so.

1.5.1 No Dark Matter is Required

The first step towards the “Dark Side” in astrophysics began with Dark Matter. The “after the fact” assumption of Dark Matter was used to explain the dynamic structure of Spiral Galaxies. The orbiting Stars in the disk part of Spiral galaxies are moving too fast to be gravitationally bound to the galaxy. The orbiting stars should be flying away out of the galaxy. For example if the Earth had an orbital velocity that was two times greater than it presently is, it would no longer be gravitationally bound to our sun and the Earth would fly off into space. This lack of dynamic stability is a problem for galaxies which have to be stable since they are observed to exist over thousands of millions of years.

It was proposed that problem could be solved if there was some kind of unobserved matter within the galaxy, the gravitational effect of this unobserved matter could keep these galaxies together.

It was also discovered that as the scale of observation included even larger structures, such as orbiting galaxies or orbiting clusters of galaxies, even larger amounts of “dark matter” would be required to preserve dynamic stability.


The amount of this hypothesized and unobserved mass required to keep the present model is not quite as astounding as that of Dark Energy, but it is still impressive.

One of the more representative “Mainstream” calculations of the amount of Dark Matter and Dark Energy is found in the analysis of the Seven Year Wilkinson Microwave Anisotropy Probe. http://lambda.gsfc.nasa.gov/product/map/dr4/pub_papers/sevenyear/basic_results/wmap_7yr_basic_results.pdf page 39.

Dark Matter represents 83 percent of the matter in the universe and the matter we can see or are aware of, represents 17 percent.

At present there has been no observational verification of the existence of Dark Matter, other than the unexplained orbital relationships. No labs have detected this Dark Matter on Earth and no local scales have weighed it.

Why Dark Matter is Not Needed. An Extra Dimensional Centrifugal Effect

A centrifugal effect or acceleration is felt when an object in motion changes its direction. For example, if you were in a moving car and the car was turning, you would feel acceleration and a force opposite to the turn. If you turned to the left, there would be a force experienced that pushes to the right, resisting the turn.

If the entire observable Universe was in motion along an unobserved dimension, as proposed by the model and it was also expanding, then that would mean that every point in the universe would be changing its direction of motion. This would result in an acceleration that resists the Expansion of Space. This acceleration that resists the Expansion of Space is responsible for keeping galaxies together.

The formal derivation of this accelerated relationship, along with one of the most simple to understand derivations of E = mc^2 is provided in Section 4. The predicted value established by the geometry of the model is very close to the acceleration necessary to account for the dynamic structure in spiral galaxies, to be shown in Section 5. Dark Matter is not needed.
1.5.2 No Dark Energy is Required

The second step to the Dark Side was necessary to keep the assumed distance to galaxies in accordance with the observed cosmological red shift based on the expected slowing of the expansion of the Universe due to gravitational interaction, according to the principles of General Relativity. This “after the fact” correction resulted when it was discovered Type 1a Supernovas were dimmer, and therefore further away than expected.

The discovery that galaxies were further away than they should have been was made by two teams, the High-z Supernova Search Team[7] in 1998 and the Supernova Cosmology Project[8] in 1999.

A brief analogy may be helpful explaining the “need” for Dark Energy.

The Apple example

If an apple is thrown upwards against gravity, the velocity of the apple slows down. The rate the velocity changes is in proportion to the accelerative field the apple is traveling through. The greater the effect of gravity the more quickly the velocity of the apple diminishes. Also, knowing the initial velocity, and the effect of gravity, it would be possible to determine the location and velocity of the apple as either a function of time elapsed, or distance traveled.

Now let’s say when the position of this moving apple was recorded, instead of being where we predicted it would be, it was actually further away. Somehow something was fighting against the effect of gravity. An unaccounted energy was pulling the apple upwards.

This is similar to what is observed with respect to the location of galaxies being carried by the expansion of space. Galaxies are observed to be expanding away from each other, and gravity should be slowing this recessional velocity. When the estimated distance traveled was correlated to the elapsed time it was found that for some reason every galaxy in the entire Universe is further away from each other than expected; something is fighting the effect of gravity. In order for all the galaxies in the entire Universe to be further away than expected, some kind of energy has been assumed to be opposing the gravitational slowing of the expansion of the Universe. Since there is no observable source of the energy and there is no local experiment that has detected its existence, this energy has been called “Dark Energy”.

The amount of energy required to expand all the galaxies in the entire universe to their assumed distances is staggering. The Mass Energy relationship, $E = mc^2$, allows a conversion of the energy required to be converted to mass. Once this conversion is done, it is found that over 70 percent of the entire Universe is supposedly composed of Dark Energy.

Current Measures

A current (2011), Wikipedia article lists the amount of Dark Energy to presently represent 71.3% of the Universe and the rest, 27.4%, being of a combination of dark matter and baryonic matter.[11] This means $.17 \times .27 = \text{less than 5% of the Universe is “real”}. The rest of the entire Universe is an “after the fact” assumption required to keep our present model.
**Why Dark Energy is Not Needed. “Standard Candles”**

The assumption that our “standard candles” used to determine distance based on the observed brightness is not correct, if the Geometric Expansion Model (GEM) is correct. The period luminosity function used for Cepheid Variable Stars is significantly changed by the increased effect of gravity in the past, as well as the increase in inertial mass of objects in the past. The stars are brighter, and the period is shortened and if this effect is not accounted for it would be assumed that these variable stars are closer than they really are.

The magnitude of this error is significant. As will be determined in the Verification section of this work, a typical published rate of expansion between two galaxies using Cepheid Variable Stars is about 65 km/s per mega parsec which is predicted to be off by about a factor of 2.

This change in the distance to nearby galaxies means that the galaxies have more time to expand away from each other than presently assumed. Type 1a supernovas have not been somehow pulled further away, they have had more time than realized to reach their locations.

Referring back to the apple analogy, instead of the apples being further away due to some energy pulling them away, the apples are further away than we thought because they have had more time to get away.

Once the “standard candles” are adjusted for their predicted variation, there is no need for Dark Energy.

**1.5.3 No Stars Older Than the Universe**

It is a common belief among people that are casually interested in astronomy that the issue of stars being older than the Universe is resolved; after all, it would be impossible for stars to be older than the Universe. This is not the case, and the majority of papers written on the topic have consistently determined that there are some stars that are, most likely older than the Universe.

**Description of the Problem; Lack of Fuel**

The problem of stars being older than the Universe has to do with the physical response of stars of a certain size and what they do when they run out of Hydrogen fuel. For example, if we start a fire using a certain amount of wood, it is possible to observe and estimate how long the fire will last. Similarly, it is possible to consider how long a star with a certain amount of mass will last or continue to “burn”.

Stars of a particular mass, about 1/4 to 1/2 that of our sun, near the end of burning their hydrogen fuel, enter into the Red Giant phase of their evolution. This rather dramatic departure from the stars previous appearance affords a measuring point that allows the determination as to how long the star has been burning fuel and its luminosity helps determine how massive the star is.


When Stellar Astrophysicists determined how long it would take stars to evolve to the point of becoming Red Giants in Globular Clusters, the majority of them determined that these stars have been burning fuel longer then the accepted age of the Universe.

The current estimated age of the Universe is 13.7 billion years old.

On January 17, 2004 I posted a list of all the abstracts published from 1982 through 2003 that determined the age of the Stars observed in Globular Clusters that have entered the Giant Stage. I posted the result of this summary in a Blog hosted by the Bad Astronomy and Universe Today web site. This link leads to a discussion this board had on the topic. [http://www.badastronomy.com/phpBB/viewtopic.php?p=194222&highlight=#194222](http://www.badastronomy.com/phpBB/viewtopic.php?p=194222&highlight=#194222)

If the link does not work, try a search based on the publish date.
The summary of the age of these giant stars are listed below, in “American Billion” which equals 1,000 million or 10^9 years.

number less than 14 \(= 27\) \(23\%\)
number greater than or equal to 14\(= 35\)
number greater than or equal to 15\(= 32\)
number greater than or equal to 16\(= 22\)

77\% calculate stars are older than Universe

As can be seen, the majority of the papers listed the age of these stars to be older than 13.7 billion years old. (Also, in my opinion, at least half of the 27 papers with the age of these stars less than 14 billion years appear to be “forced”. Some kind of imagined process is assumed to be speeding up the rates of fusion).

Since 2003, more papers have been written which have attempted to decrease the age of these stars, primarily by suggesting that certain metals or convection currents would cause the rate of evolution to occur faster. In part, this is counter intuitive as too many “metals” would tend to block or slow down the fusion since they would come between fusing particles. The balance would have to be just right. Convective currents that yield a more efficient rate of fusion are speculative at best and are obviously “after the fact” corrections made to keep what is observed consistent with the Limited Expansion Model.

What makes the issue worse is that all the age estimates assume that these stars in globular clusters formed right when the Universe began. Adding a half a billion years to the ages of these stars to allow a reasonable period of time for the stars to form in the first place makes the age problem even more troublesome.

**Why Stars are Not Older than the Universe**

If the effect of gravity is greater in the past, due to the higher density of Space in the past, then stars would evolve significantly faster than they do now. This is a predicted effect and it is observed.

**1.5.4 Metallicity and No “After the Fact” Population III Stars**

Astronomers assign the term “metals” very broadly to include all matter heavier than Lithium and Beryllium. These heavier elements or “metals” are not from the result of the Big Bang where Hydrogen is initially fused to Helium, but from the evolution of stars that have lived a lifetime, collapsed, and then exploded, thereby spreading their newly forged nuclei across the Universe.

The Wikipedia article explains this nicely under Metallicity: [http://en.wikipedia.org/wiki/Metallicity](http://en.wikipedia.org/wiki/Metallicity)

Population I stars contain the most amount of “metals”. These are observed locally, or closer to the present, and are thus older, at least when compared to stars observed very far away, which are observed when the universe was younger. The increase in metals in stars that are older corresponds to what would be expected with the evolutionary development of stars. Massive stars burn their fuels quickly, explode, and send their contents into space to be absorbed by newly forming stars. Population II stars are observed further away and the proportion of metals detected from looking at the spectra from the star is less than the older population I stars. Evidence of the ever increasing amounts of “metals” in stars over time is evidence of an evolving Universe with a beginning.

A problem arose when galaxies were observed when the Universe was very young and evidence of metals was indicated in the spectra. These galaxies were observed so far back in time that it should be impossible for metals to be observed. In order for metals to be observed in a star, a star would have to first form, then live a lifetime, then blow up and then reform into another star. When the Universe is very young, there is not enough time for all these processes to have transpired. Since the Age of the Universe was becoming fairly defined and established, there had to be some methodology by which Stars in the past could have evolved faster than they do in the present.
The solution was to propose that in the Early Universe a new kind of super massive star existed. These super massive stars would evolve very quickly. (Typical stars burn energy close to the fourth power of the mass of the star. These hypothetical stars would produce energy very prodigiously, a rate probably less than at the 4th power of its mass, but with enough mass, even a linear relationship of mass to energy could be argued to work). These stars are not observed at all locally and are theorized to only occur when the Universe was very young. This hypothesis was based on the assumption that the extra dense conditions existing in the early universe would allow the formation of these behemoth stars and that the less dense conditions of today would not allow such stars to form. (The feasibility of these stars is questionable. Such massive stars would be extremely unstable, I believe too unstable to exist. Also, the temperatures in the early universe would tend to keep such stars from forming in the first place.)

These hypothesized Population III stars were not observed beforehand and it is debatable as to the possibility of ever seeing these stars. If metals speed up evolution, shouldn’t their paucity slow the rate of evolution? Population III stars were not predicted, they were an “after the fact” fix used to keep the present limited expansion model.

**Why there are “Metals” in the Early Universe**
When the Universe first began, the effect of gravity was intense due to the denser structure of space. Imagine how much faster stars would evolve if the effect of gravity was 100 times greater than it is now. Stars would be much smaller; the size of moons. These early Stars would evolve quicker than they do now. Once these miniature stars lived their lifetime, they could explode and deposit their higher mass remains for the next generation of stars.

### 1.5.5 No Unexpected Quasars

Quasars were a bit of a surprise. They apparently generate 100 to 1,000 times the light of an entire galaxy, yet they appear to be much smaller than a galaxy. Located very far away these objects only existed when the Universe was young. Since there are no quasars observed in the “present”, the only logical conclusion is that quasars were a part of early galaxies.

The proposed “after the fact” explanation for the incredible amounts of energy produced was to assume that there are super massive black holes at the center of galaxies with matter rushing into the black hole, and as the matter falls towards the hole it collides with other matter, thereby generating a tremendous amount of energy.

There are a few issues with this model. For example, the amount of mass accumulating in the black hole would be more than we presently see in the centers of galaxies. Also, the consumption of so much matter would leave nothing much around the black hole in the present, but we see in many galaxies that matter is still located or orbiting near the “black hole”. However debatable the detail, the model is at least another “after the fact” solution.

### 1.5.5.1 A Predicted Energy Output from Young Galaxies
As mentioned earlier with respect to the observation of “metals” in the early universe, in the past the effect of gravity was dramatically stronger. This means that in the past stars would be much smaller, there would be more of them and they would evolve much faster than they do now.

### 1.5.5.2 Why Quasars Generate So Much Variable Light
Since the effect of gravity varies over time, stars evolve very quickly in the past. If this is the case, when we look back in time to the early Universe, we should see small stars evolving so quickly in a much denser environment with one next to the other. Planets with the mass of Jupiter could become
stars in the early Universe. When one proto star ended its life in a mini-supernova, nearby stars would pop like popcorn in a hot skillet due to a cascading chain like a series of explosions. It is this effect that produces the energy variation observed in quasars, not the in-rushing of matter into a black hole.

1.5.6 Evidence of the Quasar or Explosive Era in Our Solar system
There is powerful evidence of this explosive quasar era within our Solar System, described by the following:

1.5.6.1 Strange Xe
There is a radioactive element called Strange Xe. It is produced by the explosion of a star. When nuclear physicist O.K. Manuel discovered this element on samples from the moon, and other astronomical sources within our solar system, he concluded that our sun had blown up about $4 \times 10^9$ years ago. His work has largely been ignored since the assertion that our Sun blew up seems ridiculous since all our current observations of stars that have blown up leave nothing behind other than a small core. All the planets would have been blown away.

However, if the size of the star was much smaller, about $1/10$th the mass of our sun now, this would leave most of the matter in our solar system as a nebular cloud of debris. Once the mini proto star reached the end of its life and exploded the consequences would not be as devastating. The explosion would be smaller, there would be more matter around to absorb the blast and the effect of gravity would be more powerful to keep the matter from being blown out of the solar system.

1.5.6.2 Formation of “Rocky Inner Planets”
If our proto sun blew up, it would have stripped the atmospheres from the nearby stars of Mercury, Venus, Earth and Mars. This explosive event is why these inner stars became the “rocky planets”.

The previous explanation for the inner stars not containing large atmospheres of Hydrogen and Helium gas was that the Sun began radiating energy which blew the gasses outwards from the nebular cloud from which the planets and Sun were forming. With the discovery of many distant stars with large Gas Giants close to their mother Star, this explanation had to be “fixed”. The current “after the fact” solution was to have the large gaseous planets initially form far away from the central star and for them to now migrate inwards.

1.5.6.3 Angular Momentum Issues Resolved
The Nebular Cloud hypothesis is the current accepted model from which our solar system had its beginning. One consequence of this initial cloud-like beginning is that the angular momentum would be initially evenly distributed within the cloud. If any region was moving much faster than a nearby region, its angular momentum would be distributed by collisions. There would not be one region in the cloud rotating in another direction. There would be no localized collections of matter spinning at an odd angle or in a direction opposite to the general rotation of the cloud for very long nor could these reverse or odd directions of matter represent a very large proportion of the nebular cloud.

As planets coalesced out of the cloud any planets that would form would move in the same direction as the nebular cloud. Any moons that may also form around a planet would also have to be in the same orbital direction of spin as the nebular cloud and they would have to be much smaller than the planet since larger collections of reverse motion or counter rotating sections of the nebular cloud are absorbed and averaged into the nebular cloud.

As matter is drawn inwards to form the Sun, the angular momentum of the nebular cloud is drawn in as well. It would be expected that since 99.99 percent of the mass of the Solar System is found in the
Sun then it would be expected that 99.99 percent of the angular momentum of the Solar System would be found in the Sun.

Based on the nebular cloud hypothesis and principles of angular momentum the following characteristics of our Solar System should be observed:

a. Most of the angular momentum of the Solar System should be located in the Sun,
b. All the planets should be orbiting the Sun in the same direction with the same orbital inclination.
c. All the planets should have the same direction of orbital spin and their axis of rotation would be parallel to the axis of rotation of the Sun.
d. Moons should be much smaller than their Planets

**Why Jupiter has Most of the Angular Momentum Instead of the Sun**

Most of the angular momentum of the Solar System is held by Jupiter, not the Sun. This is because when the proto Sun blew up, it dispersed the angular momentum outwards.

### 1.5.6.4 Evidence of Collisions from Mini Supernova:

**1.5.6.4.1 Why Uranus’ Axis of Rotation is Changed**

Uranus’ axis of rotation is inclined more than 90 degrees to its orbital plane. A collision would explain how this happen and the exploding proto sun becomes the cause.

**1.5.6.4.2 Why Less Heat is Emitted from Uranus**

Uranus also has less heat emitted from it than reaches it from the Sun. The hot core making up the planet, which initially was the interior of a star, was lost in the collision.


**1.5.6.4.3 Venus Spinning Backwards**

Venus is spinning on its axis in a retro grade direction. One way to feasibly do this is for some kind of impact that reversed the direction of motion from the direction associated with the rotation of the nebular cloud.

**1.5.6.4.4 Ceres, Asteroid Belt and Titus-Bode “Law”**

The Titus – Bode Law or rule is based on the observation that the radius of the planets tend to fall into a pattern. http://en.wikipedia.org/wiki/Titius%e2%80%93Bode_law . For example, each planet is 2 times further than the next is a very crude illustration of the model. While some work has provided some underlying justification for the pattern, one of the strongest criticisms of the observed “law” is that Ceres, even when combined with the rest of the mass found in the Asteroid Belt does not have anywhere near enough mass to be consistent with planets conforming to a pattern.

Before the proto sun blew up, the Solar System was very young and the proto-planet/ stars were small and still gathering mass from the debris field that comprised the bulk of the nebular cloud. The smaller more intense gravitational field that existed in the early universe helped establish the pattern seen in Bode/Titus Law.

Once our Proto Sun blew up, the planet/star that was located near Ceres was smashed. The reason there is less mass there, than the planets of today, is because all the planets were still accumulating mass. Ceres and the associated asteroid debris is actually a record of the size of the early planet at the time of the Sun’s explosion.

**1.5.6.4.5 Our Moon**

The most currently accepted method for creating Earth’s moon is that it was created by a collision with a mass that was about the size of Mars.
Again, the likelihood of such a devastating impact is realized if there is an explosive era in the early evolution of the Solar System.

1.5.6.4.6 A Wave of Meteors; The Late Bombardment Era
About 4 x 10^9 years ago Meteors have impacted Earth in a “Wave” called the Late Bombardment Era. [http://en.wikipedia.org/wiki/Late_Heavy_Bombardment](http://en.wikipedia.org/wiki/Late_Heavy_Bombardment)

Where did all these meteors come from? One would think that an occasional meteor may pass through the solar system after about 10 x 10^9 years have passed but not a great era of Meteors. Where did this wave of meteors come from so late in the evolution of the solar system?

If the proto sun blew up, and destroyed another proto-star/planet in our Solar system, there would be a fresh crop of debris.

1.5.7 More Evidence of Increased Gravitational Effect in the Past:
1.5.7.1 Nobel Prize Winners of Physics
Paul Dirac, a Nobel Prize winner in physics who predicted the existence of anti-matter, believed that the effect of gravity varied somewhat linearly with the passage of Cosmic time. George Gamow, another physics prize winner, believed that Dirac “may very well be right”.

1.5.7.2 Energy and Heat from Jupiter and the Great Red Spot
There are two energy issues with respect to Jupiter. 1. Jupiter produces more heat energy than it takes in from the Sun 2. There is no obvious energy source for driving the super, larger than Earth sized hurricane called the Great Red Spot, which has lasted over 400 years, as well as the hurricane like bands of atmosphere circulating the planet. (Unfortunately the energy issues associated with Jupiter have been removed from Wikipedia as of this date. (May 2013).

Answer…
If Jupiter was initially a star, as predicted by the model, it would have much more residual heat than thought, and it would contain in its core much more fissionable material than presently thought, thereby providing another source of heat.

1.5.7.3 The Young Sun Paradox
This paradox is based on the evidence of liquid water on Earth when the Earth was fairly young, despite the estimates that the energy output of a young Sun would be so weak, (70% of what it is now), that there could only be ice on the Earth.

This issue is addressed by the proposed model in three ways.
1. The Sun is much more evolved than thought. The increased effect of gravity and inertial mass in the past accelerated the evolution of the Sun. Also the Sun would have reformed itself upon the core left behind from its mini supernova phase. There should be an Earth sized core of heavy elements, primarily iron and fissionable elements, located in the center of the Sun. This iron core stabilizes the Sun’s energy output and prevents oscillations associated with a variable star.
2. The increased effect of gravity in the past increases the rate of energy produced from the Sun in the past.
3. The heat from within the Earth itself is more than expected, especially in the past. This is because even the Earth would have at one time been a star, and heavy elements would be
located in the core. The extra initial heat, and more importantly the extra fissionable matter would add to the heat of the Earth.

1.5.7.4 Water on Mars [http://en.wikipedia.org/wiki/Water_on_Mars_(planet)#Hydrology]
The evidence of flowing Water on the Surface of Mars is fairly convincing. However this observation presents two issues. How did Mars ever hold on to water in the first place? Its surface gravity presently is too weak to hold on to a dense atmosphere, making the existence of rain hard to explain. Also, Mars is about 1.5 times as far away from the Sun as the Earth, resulting in less than 1/2 the amount of solar input of energy. If there was water on Mars, it should be frozen.

If the sun put out more energy in the past, Mars would be warmer than it is now. Also, if the gravitational effect on the surface of Mars was stronger in the past, it would be possible for Mars to hold on to an atmosphere dense enough to produce rain.

1.5.8 Resolve a Conflict or Ambiguity between Special Relativity and General Relativity
The conflict or ambiguity between Special Relativity and General Relativity is revealed when the light from galaxies is considered. (This is a bold statement, please reserve judgment).

General Relativity and the Cosmological Redshift
The further away a galaxy is, the “redder” it appears to be. This Cosmological Redshift is predicted by General Relativity because of the expansion of Spacetime. Photons lose energy and increase their wavelength while traveling through an expanding Universe. The Cosmological Redshift is not a Doppler effect due to the motion of galaxies through Space. The Cosmological Redshift is the result of the expansion of Space. This increase in the wavelength of light covers the entire electromagnetic spectrum, not just the visual light we see, so in some ways stating the light is “redder” is a bit limiting, but it is a common and meaningful description. Wikipedia provides further explanation of this under “Cosmological Redshift”. [http://en.wikipedia.org/wiki/Redshift]

Special Relativity and Change
Special Relativity predicts that the faster an object is moving, the slower physical processes will transpire, relative to a “stationary” observer. It is common to illustrate this effect using twins. One twin flies away in a rocket ship that travels near the speed of light while the other twin stays home. A couple decades elapse and when the near light speed traveling twin returns, it is discovered that the traveling twin has hardly aged, whereas the stay at home twin is two decades older. This slowing of physical processes predicted by Special Relativity is experimentally observed in the decay of atomic particles.

Contradiction
A photon travels at the speed of light, which according to special relativity, requires all measures of physical change to stop, yet general relativity predicts that the photon would change; the photon’s wavelength increases and it’s energy content diminishes. The two theories contradict each other, one predicts change, and the other does not allow change.
1.5.9 Inconsistency Regarding the Equivalency of Matter and Energy
Light as it travels through an expanding spacetime field loses energy and its wavelength increases. Where did the energy of the photon go? Its energy is no longer in the Universe. This would be a violation of the Principle of Conservation of Energy.

I do not have an issue with this loss of energy from our observed universe since the energy can be recovered if the expansion were to reverse, although a larger perspective outside of our observable universe is required to account for the energy loss. But still, within observable space the energy is lost.

What really concerns me is the loss of equivalency between mass and energy. It is a major inconsistency.

The relationship \( E = mc^2 \) establishes that mass equals energy times some constant, with the constant being the speed of light squared. \((\text{Energy} = \text{Mass} \times (\text{a constant}))\) so Matter and Energy are Equivalent.

Now consider the following example. In deep space, somewhere between two galaxies, one gram of matter is floating in the void of space and another gram of matter is converted into a beam of light. The beam of light travels across space to a very distant mirror, and eventually returns to the floating gram of matter after traveling billions of years through an expanding spacetime field. The returning light is “redder” or has lost energy while traveling through the expanding spacetime.

The returning energy is now converted back into matter, but since energy has been “lost” while traveling through spacetime, the reconstructed matter will weigh less than the one-gram that was floating in space. If matter and energy were truly equivalent, their energy content would be the same. The issue for me is not where did the energy from the traveling photons go, but why is the equivalency between matter and energy lost?

This issue is resolved by the Geometric Expansion Model (GEM) since the intrinsic rest energy of matter also diminishes over time.

Section 1 Chapter 6 Problems with Expansion Based Models
1.6.1 Rush to Judgment
There are three common “rush to judgment” problems with expansion models. They …

1. Destroy the dynamic stability of systems,
2. are irrelevant and they
3. “Break” the relationship between space and time, the very foundation the Universe is built.

1.6.2 Dynamic Stability
If the Earth were expanding away from the Sun, the gravitational effect keeping the Earth in orbit around the sun would diminish faster than the centrifugal force. (Gravitational force varies by the inverse square of the centroidal distances, \((1/R^2)\), while centrifugal force varies by the inverse of the distance \((1/R)\). Planets in solar systems would go flying out of their orbits making solar systems unstable and non-existent. Since our solar systems exist, the model must be wrong.

Also, electrons are in orbital relationships in atoms. If the force containing the electrons were to diminish, atoms would no longer exist. Since atoms exist, the model must be wrong.

I will address this issue in detail. Not only will the dynamic stability be preserved, it will be a predicted characteristic or property of the Universe.
1.6.3 Irrelevant
Another issue with the proposed model is that the model would be irrelevant, as expressed in the writings of John Archibald Wheeler.

(As an aside, it should be stated that John Archibald Wheeler co-wrote the pioneering text "Gravitation", and was a leader in the field of Physics. A review of his accomplishments in Wikipedia is recommended. ( http://en.wikipedia.org/wiki/John_Archibald_Wheeler ). I have adopted Professor Wheeler’s use of the word spacetime as one word as opposed to the hyphenated word space-time since it conveys a philosophical message that space and time are integrated or structurally tied one to the other. The reader may notice instead of using the word “spacetime”, I have further shortened the expression by simply capitalizing the word “Space”.

Professor Wheeler writes in his book, a “Journey into Gravity and Spacetime”, about a “misconception” a student had about the Expansion of the Universe. The student thought that if the universe were expanding, then everything, including ourselves would be expanding. Professor Wheeler wrote, “if the distance between one cluster of galaxies and another expands, then the distance between the Sun and Earth expands, the length of a meter stick expand, the diameter of every atom also expands. But if all that were true, it would make no sense to speak of any expansion at all. Expansion relative to what?”

Professor Wheeler then proceeds to describe the Expansion of the Universe by using the analogy of pennies taped to an expanding balloon. The pennies represent a galaxy that are fixed in size, and as the balloon expands, the distance between the pennies increases, but the size of the pennies, representing the galaxies, do not change their size. Gravity keeps the galaxies fixed in size. He says, "As the balloon expands, the distance between penny and penny expands, but not one penny itself expands."

The argument that such a proportional expansion of everything is trivial or not worth discussing since everything stays the same is a weak argument. It is just as true to assert it is trivial to assume that everything is staying the same size. More importantly, a continuous expansion is not a trivial consideration.

If an object, or a system of objects, is uniformly expanded, then density decreases with the passage of time. This results in a decrease in the effect of Gravity with the passage of time. Allowing the effect of gravity to vary with the passage of time is not trivial. For example, a stronger gravitational effect in the past would mean that stars in the past would evolve more quickly than assumed with the current limited expansion model.

Just to add a bit of credence to the proposed model I will refer to a book called “Thirty Years that Shook Physics” by Physics Nobel Prize winner George Gamow. Professor Gamow states that Paul Dirac, who also won the Nobel Prize in physics, believed that the effect of gravity should vary with the passage of Cosmic Time. Also, as stated and even illustrated in the same book, Paul Dirac believed that reality may be part of some extra space, using the analogy of fish in a sea with the fish not aware that it is in an ocean.

Now just because one physicist believed in certain aspects of the proposed model does not make the proposed model true, but it should make the proposed model somewhat more interesting to consider and hopefully slow the rush to judgment reaction.

1.6.4 “Breaks” the Structure of Space (“spacetime”)
A most critical argument against the proposed model is that the structural relationship between distance and time would appear to be destroyed by such an expansion.
The time interval between two points is an important physical parameter that is tied to the structure of Space. This time interval between two points is fundamental to the relationships of Special and General Relativity, two very tested theories. The structural relationship between distance and time is often illustrated with the "light clock". A light clock is simply a beam of light traveling back and forth between two points with the time interval defined by the time elapsed for light to travel a given distance.

What happens if the distance between the two points expands? How would the interval of time between the two points change? Since the distance is greater, shouldn’t it take light a greater amount of time to travel between the two points? If a local clock is expanded, like a pendulum, would the expanding clock slow its measure of intervals of time at the same exact proportional rate defined by the light clock? Would all local measures of intervals of time all slow at the same proportional rate? Considering all the different ways intervals of time can be measured, it seems highly unlikely that they all would change at the same proportional rate. Orbital periods, light clocks intervals, "ticking pendulums", resonating electric circuits and chemical reactions would all have to keep their local proportional rate or synchronization. If locally measured values for intervals of time did not keep synchronized, then there should be evidence of this variation. If there is variation, this would make the relationships of special relativity to be somewhat selective in its generality, and this would reduce the universality of the physics of special relativity. Given the solid foundation Special Relativity establishes with the relationship of distance with time, it initially seems impossible any model could alter such fundamental measures of distance and time yet keep all local measures of distance and time proportional the same over time.

Please, do not rush to judgment.
Section 2 Assumptions, Conventions. Structure of Space and Fields
Section 2 Chapter 1 Spacetime and Fields

2.1.1 Spacetime and Fields
Fundamental to the proposed model is the idea that Spacetime has structure and that the structure is described by field relationships. Field relationships are generally invisible geometric and dynamic patterns that can be symbolically drawn or visualized as a part of space.

2.1.2 Space and Spacetime – Terminology
Since time is a part of this geometric structure, it makes sense to call space “spacetime” as mentioned previously. As a form of shorthand, the capitalization of Space will be used to express the unification of space and time.

2.1.3 Speed of Light
The speed of light geometrically unites an interval of time and an interval of distance establishing a structural relationship between the two. The locally observed speed of light is represented by the term “c” which will be approximated as 3 x 10^8 meters per second. The geometric relationship is

\[ c == \text{a distance interval per time interval} \]

2.1.4 The Double “==”
The double == sign will be used to equate a geometrically defined relationship.

Physically, what the speed of light describes is the spatial and temporal relationship between two points. Just as two points are physically separated by an interval of distance, the two points are also separated by an interval of time. If two points are separated by 3 x 10^8 meters, the two points are also separated by an interval of time of one second. Why this relationship is tied to the speed of light will be explained later.
Two points in spacetime have a spatial and a temporal relationship of one to the other.

Figure 2-1  Local points in spacetime are invariant, or define a structural relationship to each other.
2.1.5 Local Spacetime is Invariant

The Structure of Local Spacetime is Invariant

![Diagram of spacetime grid]

The intersection of each line in the matrix demarcates a point’s relative location in spacetime. Each point is also separated by a specific relative measure of time.

Note, the local relationships are fixed over the passage of time or “invariant”.

(For those familiar with special relativity the geometrical relationship between spacetime measures, spatial and temporal measures are locally expressed as…

(\text{The spacetime interval between two points})^2 = (\text{space interval})^2 - (\text{time interval})^2

The mixed units of distance intervals – time intervals are resolved by the speed of light establishing a geometrical relationship between distance and time.

Figure 2-2 Points in Spacetime form a matrix or the metric of relative spacetime

2.1.6 Local and Global

The terms Local and Global refer to the perspective used to measure relationships. Local measures are made “now” with a local frame of reference. (A local frame of reference is a coordinates system from which physical measurements are made with the local observer at the center of the coordinate system. Global measures are made with a historical perspective that is fixed and “outside” of the local frame of reference. This invokes the imagery of an “Eye of God” perspective that is outside of our local frame of reference,

2.1.7 Field Relationships Reveal the Structural Relationships of Space

The structure of Space, by itself, is “invisible". The structure of Space is revealed, and altered by the field properties of matter or energy interacting with the structure of Space.

2.1.7.1 Magnetic Fields

For example, in the following drawing provided by contributors to Wikipedia, we see the field relationships in Space imposed by a bar magnet. The iron filings, which contain physical properties at the atomic scale of observation, are interacting with the field relationships established in Space.
This apparent invisible property of field relationships is a concept that is worth discussing more. Here we have a common horseshoe magnet. We see no structure above it. If I move my hand through it, I feel nothing, yet if I allow iron filings, which have their own field properties to interact with the field of the horseshoe magnet, the structure of the field is revealed.

2.1.7.2 Gravitational Fields
Gravity is another field-based relationship and is illustrated in the following example. If we take a ball on a string and twirl it around, we feel a tension in the string. Without this tension, the ball flies off. Now the moon and Earth are twirling or orbiting around each other. This raises the question, where is the string holding the Moon and Earth together?

The “invisible” force of gravity can be, well, astronomical. The force keeping the moon and Earth in orbit around each other is roughly equivalent to the weight of $2 \times 10^{19}$ kilograms or about $4.4 \times 10^{19}$ lbs.

Gravity is a field-based phenomenon. The field structure defining the mass of the Earth and Moon also alters the field structure of Space, which produces the force of gravity.

2.1.7.3 Another Perspective on Field Relationships
If we were to look at the ball and string example more closely, we would see that the string is not a solid connecting object but a series of field producing objects or atoms bound by the interaction of fields at an atomic scale.

Field relationships or interacting spatial and temporal relationships are fundamental in this model.
Section 2 Chapter 2 Dimensions

2.2.1 What are Dimensions?
Fundamental to the development of the model is the physical meaning of dimension.

The definition used for dimensions is unconventional and simple.

1. Dimensions are measures of change. If you can describe how something changes, such as one physical measure compared to another physical measure, then a dimensional relationship is established. How many times I smile in a day would be, by my definition, a dimensional relationship, “The Smile Dimension.”

2. Fundamental or elemental dimensions are the basic or essential relationships used to describe nature. Elemental dimensions are unique, meaning that they are not the result of a combination of two more elemental dimensional relationships. (The smile dimension would not be unique or fundamental).

3. Fundamental dimensions are geometric. The relationship of one dimensional measure to another can be described by geometry; you can “draw” the relationships. For example, the speed of light expresses a geometric relationship between distance and time. You can draw a graph illustrating distance traveled over time elapsed.

4. Measures of distance and time reveal the dimensional relationships and the geometry of the Universe. The only “tools” we have to describe the Universe are rulers and clocks. This means that ultimately all physical properties will be a geometric combination of measures of distance and time.

2.2.2 The Dimensions of (Observable) Spatial Space
The definition for dimension also alters the description of common three-dimensional space, ("small" s). What is commonly understood to be three-dimensional space is actually described by 3 fundamental dimensions or measures of change between two points. The three elemental or fundamental dimensions associated with two points in space are distance, the degrees of freedom, and sense.

The dimension of distance defines how far away a point is.
The dimension of degrees of freedom, which is composed of three possible states in space, defines direction or the orientation of the distance measured from a point.
The dimension of sense determines an opposite or negative measure of distance as mapped along the three possible axes associated with the three degrees of freedom.

These three dimensions of space are necessary to define the relationship between two points in space. The point is so far away from a point, and it is either up or down, left or right, and forward or backward from that point.

Adding extra dimensions to describe physical properties is incredibly liberating in that it makes the description of nature much simpler. The tricky part is establishing the “rules” necessary to unite these dimensions into one geometric structure.

(Observable)
The word observable in parenthesis indicates that there will be another spatial dimension added later when the expansion includes another spatial dimension).

2.2.3 More Dimensions of Distance
Given the above definition for dimension, the distance measured for determining gravitational relationships is a different dimensional distance measure that is used to describe electromagnetic relationships, since each distance measured correlates to a unique physical property. This is illustrated in the following figure.
The dimensional relationship of gravity only has one orientation, whereas the dimensional relationships of electrostatic and electromagnetic forces are shown with a positive and negative sense relative to the dimensional orientation described by gravity.

The orientation and sizes of the various dimensional measures of distance are not to scale.

**Figure 2-4** Three distance dimensions corresponding to three fundamental physical properties, Gravity, Charge and Magnetism

Another dimension would be the “Spin” Dimension. This physical property, which is also a part of the structure of Space is important when describing structure of Space at the atomic or “Quantum Scale” of observation.

At the “Quantum” or atomic scale of observation there are other dimensions or physical properties.
Note that the gravitational distance dimension is larger than that of the distance dimensions associated with charge or magnetism.

This variation in length will be important when the effect or response to expansion is considered. When an incremental “piece” of spacetime is integrated onto the existing structure of reality, the proportional change in length along gravity’s spatial dimension will be much smaller than the proportional change along the spatial dimension associated with charge. Roughly, the dimensional length of gravity is about $10^{20}$ times bigger than the dimensional length of charge.

2.2.4 Spin as a Dimension
Spin is another fundamental dimension of Nature. Its relevance is particularly important at the Atomic, or what I refer to as the Quantum Scale of observation. Certain physical properties of atomic scale objects, such as electrons, protons, and photons, to list a few, have the physical property of spin. The “spin” dimension is unique and independent of the spatial dimensions. The independence of the spin dimension is important in that it helps explain the physical property of entanglement associated with the spin of a photon. While two photons may appear to be very far apart, and the spin of one should not affect the spin of the other, the physical separation is not a dimensional measure associated with the photons. Both photons share the same moment of creation and keep that unifying measure, also the spin of one is still tied to the other, not through our three dimensional space, but through the dimension of Spin and the measure of time associated with when the photon is created.

2.2.5 And More Dimensions for Galaxies and the Nucleus
It is tempting to associate a dimension to each physical characteristic observed in nature. For example, gravity defines solar systems and charge defines the atom. Similarly there would be expected to find dimensions associated with the constituents or the parts of the atom, and perhaps even associated with galaxies. The extension of dimensions to these types of structures will be saved for a future paper.
Section 3 - The Expansion of Observable Space
Section 3 Chapter 1 Absolute and Relative Measures
3.1 Absolute and Relative Measures
The following figures will help establish some of the concepts and terminology of the model which are important for understanding the formulas generated.

Suppose a pizza below is uniformly expanded, along with all the local rulers. The pizza will keep its relative measure of size. In order to describe how the pizza expanded, some kind of “fixed” or “absolute” ruler is necessary.

“Eye of God” perspective “sees” the pizza is 1 and 2/3rds bigger using an “absolute” ruler that was established at T1. A relative ruler shows that the pizza has not changed its relative size.

This illustration also introduces some of the notation used; a “1” and “2” correlate to an earlier and later measure, respectively. Capital letters will be used for measures of Absolute measures while lower case letter will refer to relative measures.

Figure 3-1 A uniform expansion results in a relative and “absolute” measure of length
Section 3 Chapter 2 The Geometry

3.2.1 The Geometry of Expanding Observable Space
The geometry of Expanding Observable Space is defined by a very specific relationship. A volume of Spacetime varies to the Square of the Cosmological Time Elapsed. Double the age of the Universe and the volume of Spacetime, and all the objects within it, will increase 4 times.

\[ S = T^2 \quad \text{Equation 3-2, 1} \]

This variation in volume is based on an Absolute or “Eye of God” perspective outside of the Expansion. Based on local or relative measures there is no locally observed variation in the measures of distance or volume. Even local measures of time show no local variation, which will be discussed later.

3.2.2 Definitions and Notation
- \( S = \) an “Absolute” measure of the Volume of a region of space or object as seen from an “Eye of God” perspective, Space with a capitol S.
- “==” means “geometrically proportional to”
- \( T = \) Historical measure of time.

Capital letters will correspond to Absolute measures, Lower case letters will correspond to Relative measures.
In Relative measures the volume is constant, \( s = \text{Constant} \)

Given the above “Absolute” relationship a number of formulas describing distance and time can be expressed using “Absolute” measures.

3.2.3 Derivation of Formulas

\[ S == T^2 \quad \text{Equation 3-2, 1} \]
(There is an equation 1-0 but that is saved for the end of this Section).

3.2.4 “k” and Distance
Since the volume of anything is some constant times a length measure of that object cubed,

\[ S = \frac{1}{k} D^3 \quad \text{Equation 3-2, 2} \]
(The inverse for a k is used to make the form of the following formulas easier)
Equating equation 1 and 2

\[ S = \frac{1}{k} D^3 = T^2 \quad \text{Equation 3-2, 3} \]

Which results in

\[ D^3 = kT^2 \quad \text{Equation 3-2, 4} \] (Does this look familiar? (Kepler’s !?))

Which leads to

\[ D = kT^{2/3} \quad \text{Equation 3-2, 5} \]
3.2.5 Value of k and To
The value of k can be determined by the relationship that the speed of light establishes between distance and time. The size of the observable universe is equal to the speed of light times the age of the Universe, To.

\[ D = k \frac{T}{T_o} = \frac{(T_o \times c)}{T_o^{2/3}} = c \frac{T}{T_o}^{1/3} \quad \text{Equation 3-2, 7} \]

3.2.6 The Ratios of Time
The geometry of the model allows comparisons to be made over time. At one point in time, T1, the volume and distance measures are a certain size, and at T2 the volume and distance measures are another. Dividing the two relationships by each other allows the elimination of the constant k.

\[ D_1 = k(T_1)^{2/3} \quad \text{Equation 3-2, 8} \]
\[ D_2 = k(T_2)^{2/3} \quad \text{Equation 3-2, 8} \]

Divide one equation by the other results in

\[ \frac{D_1}{D_2} = (T_1/T_2)^{2/3} \quad \text{Equation 3-2, 9} \]

The first derivative with respect to absolute time of the distance measure described in equation 5 yields a velocity term and the second derivative of the distance measure yields an accelerative relationship.

\[ dT D = dT kT^{2/3} = V = \frac{(k 2/3)}{T} \quad \text{Equation 3-2, 10} \]
\[ dT V = dT(k 2/3)/T^{1/3} = A =(-k2/9 ) / T^{4/3} \quad \text{Equation 3-2, 11} \]

Repeating the ratio type derivation for acceleration and velocity

\[ \frac{V_2}{V_1} = (T_1/T_2)^{(1/3)} \quad \text{and} \quad \text{Equation 3-2, 12} \]
\[ \frac{A_2}{A_1} == (T_1/T_2)^{(4/3)} \quad \text{Equation 3-2, 13} \]

The kinetic energy of a system is described by …

\[ E = \text{Energy} = 1/2mV^2. \quad \text{Equation 3-2, 14} \]

The “constants” of 1/2 and m can be eliminated by the same ratio procedure used before.

\[ \frac{E_2}{E_1} == (T_1/T_2)^{(2/3)} \quad \text{Equation 3-2, 15} \]

While this derivation for energy is only presented as kinematic, it has a broader application to other physical relationships within an expanding spacetime field, as will be developed later.
3.2.7 Observable (Expanding) Space Formulas

(First number in Equation designates the Section, second indicates the Chapter, third is sequence in chapter that the Chapter Formula is derived)

\[ S = \frac{T^2}{2} \quad \text{Eq 3-2, 1} \quad \text{Absolute Volume over measure of Absolute Time} \]

\[ D = kT^{2/3} \quad \text{Eq 3-2, 4} \quad \text{Absolute Distance over measure of Absolute Time} \]

\[ V = \frac{(k \ 2/3)/T^{1/3}}{1} \quad \text{Eq 3-2, 10} \quad \text{Absolute Velocity over measure of Absolute Time} \]

\[ A = \frac{(-k2/9 )/T^{4/3}}{1} \quad \text{Eq 3-2, 11} \quad \text{Absolute Acceleration over measure of Absolute Time} \]

\[ k = c T^{1/3} \quad \text{Eq 3-2, 7} \]

The Ratios of Time Formulas

\[ \frac{D_1}{D_2} = \left( \frac{T_1}{T_2} \right)^{2/3} \quad \text{Eq 3-2, 9} \quad \text{Absolute Distance Ratio To Historical Time Ratio} \]

\[ \frac{V_2}{V_1} = \left( \frac{T_1}{T_2} \right)^{1/3} \quad \text{Eq 3-2, 12} \quad \text{Absolute Velocity Ratio To Historical Time Ratio} \]

\[ \frac{A_2}{A_1} = \left( \frac{T_1}{T_2} \right)^{4/3} \quad \text{Eq 3-2, 13} \quad \text{Absolute Acceleration Ratio To Historical Time Ratio} \]

\[ \frac{E_2}{E_1} = \left( \frac{T_1}{T_2} \right)^{2/3} \quad \text{Eq 3-2, 15} \quad \text{Absolute Energy Ratio To Historical Time Ratio} \]

Ratio of Time Formulas with simplified notation.
The addition of an Underline symbol “_” designates the term as a ratio, with the earlier measure “1” over the later measure “2”.

\[ \underline{D} = T^{2/3} \quad \text{Eq 3-2, 9} \]

\[ \underline{V} = T^{-1/3} \quad \text{Eq 3-2, 12} \]

\[ \underline{A} = T^{-4/3} \quad \text{Eq 3-2, 13} \]

\[ \underline{E} = T^{-2/3} \quad \text{Eq 3-2, 15} \]

Note, the Ratio of Times formulas have an additional physical application and their relationships are further explained in Section 3.4.10
The following figure illustrates the variation in an objects' linear measure with the passage of absolute time.

Expanding Absolute Volume of Space or Object

D1 and D2 describe the absolute distance between two points. The relative distance is constant

\[ \frac{D1}{D2} = \left( \frac{T1}{T2} \right)^{\frac{2}{3}} \]

Absolute time is represented along the vertical axis.

T1 represents an early measure of Absolute time.
T2 represents a later measure of Absolute time.

All relative measures of the object remain the same.

Two points separated a constant relative distance increase their absolute distance.

Figure 3-2  The uniform expansion of spacetime
Section 3 Chapter 3   Issues with Time

3.3.1 Periods or Intervals of Time Increase
It is obvious that proportional measures of distance keep their proportional relationship since everything is proportionally expanding equally. However, what about intervals of time? For example, consider a pendulum. At T1 it has a given length while at T2 it is longer. Since the period increases as the length of the pendulum increases, one would expect that from an absolute perspective that intervals of relative time would slow over the passage of historical time.

Expanding a Pendulum implies that its period increases

If a pendulum were expanded, the period of the pendulum would be longer, but if all local measures of time also proportionally slowed the same amount, then some kind of fixed or “absolute” measure of time is needed to describe how local measures of time are slowing down.

An “absolute” clock, “outside” the expansion of spacetime.

Figure 3-3 An “Absolute” clock can describe how relative measures of time are changing.
3.3.2 Time and Structure
Time is a part of the fabric of spacetime. If we expand space, time must be affected. This is illustrated in the following figure which represents a matrix like expansion of a metric, or structure of Space.

In order for the structure of spacetime to be locally preserved, then local measures of intervals of distance and time must keep their proportional relationship with the passage of time.

For example, every point in the first matrix is separated by 300,000,000 meters, with a relative temporal separation of one second. After expansion, according to the proposed model, each point in the matrix would still be separated by a relative interval of distance of 300,000,000 meters. After expansion would there still be a relative temporal separation between points of one second of time?

In order for the model to be correct, expanding the structure of spacetime requires all relative measures of distance and time between points to stay the same, or be locally invariant.

Figure 3-4  Preserving relative measures of spacetime
3.3.3 Do Relative Measures of Intervals of Time Stay the Same?
This variation in the measure of an interval of time raises some issues. Given the proposed expanding spacetime metric would intervals of time maintain their local proportional measure in all physical relationships? For example, would an interval of time described by a light clock change at the same rate that an interval of time described by orbiting or vibrating objects? This issue will be addressed after some of the dynamic consequences of expansion are considered.

Section 3 - Chapter 4  The Kinematic Cost of Expansion

3.4.1 Expanding Balloon Analogy
The first observation or stipulation of the model is that expansion comes at a kinematic cost. Energy is lost from any system that is expanded. For example, consider an expanding balloon.

If the surface tension of a balloon decreases, the balloon expands and the kinetic energy or temperature of the gas in the balloon decreases.

Initially the balloon is Warm with molecules possessing Kinetic Energy

After expansion the balloon is cooler and the molecules have less velocity, or less kinetic energy

**Figure 3-5  Expansion and Kinetic Energy Loss**
3.4.2 The Quantum Structure of Space and the Kinematic Connection
This balloon analogy with the proposed expansion of space is not perfect since the process is different. In the balloon, the kinetic energy is lost as a result of the rebounding of the atoms or molecules from a surface that is retreating away. The loss of energy is then shared within the rest of the atoms or molecules in the balloon. In the proposed expansion, the expansion is everywhere. The “Boundary” is a part of space itself. The scale of this boundary is found at the scale associated with Quantum mechanics, smaller than the atom.

3.4.3 Crinkled
If a surface like construction within three-dimensional space is to be visualized, it would be a very “crinkled” surface that acts like a three dimensional volume. This is similar to the fractal based geometry in which a crinkled up piece of paper is dimensionally described as containing a 2.5 dimension. If the paper were sufficiently crinkled, the dimensional representation would increase above 2.5 dimensions which would now “fill” a 3 dimensional space.

3.4.4 Bits of Spacetime
The expansion of Space is proposed to occur incrementally; a subatomic volume of spacetime integrates itself upon the existing fabric of reality a bit at a time. (Called “Vits” ?)

3.4.5 Velocity Diminishes
These incremental “voids” or “pieces” of spacetime exist within the structure of space and any moving object through Space would encounter these quanta bits of space, called “Quas” or “Vits”. The “retreat” of Space, or the fabric of Space due to expansion would mean that any object passing through such a sub atomic scaled void, would have to travel further, and absorb the void, resulting in a slowing of the objects motion. More accurately, kinetic energy would diminish.

3.4.6 Object Moving Through the Expanding Spatial Fabric
The other expectation of the model is that the rate that the velocity diminishes should be proportional to the velocity of the object based on the physical characteristics of the model.

If objects in motion are moving through an existing invisible expanding field structure, the faster they move through the expanding field the more of the expansion the objects would have to pass through. The more of the expanding field the object passes through, the more kinetic energy would be “absorbed” by the expansion.

\[ V_2 = \frac{V_1 T^1/3}{T^1/3} \]

“Grain” structure represents the quanta or micro atomic sized volumes of spacetime integrating upon the existing structure of reality.

The greater the velocity, the more “quanta volumes” of expansion that are encountered, and the greater the slowing effect.

Figure 3-6  Velocity loss is proportional to velocity
3.4.7 How Should the Velocity Change Over Time?
The next question becomes how fast or by what kind of relationship should the proportional reduction in velocity occur? I propose that the same geometric relationships that describe the expansion of observable space also describe the geometry of absolute measures of distance, velocity and acceleration associated with an object within this expanding metric.

3.4.8 Assumption - The Geometry of Energy Loss
If an object in observable space is moving away from a point in Observable space, as seen from the “Eye of God” perspective, then the proportional change in the velocity of the object moving in an expanding spacetime field is defined by the same Geometric Expansion Formulas derived for the variation in the measures associated with a volume of Space.

For example, if the present rate of expansion is 1/2 of what it was at some point in the past, the velocity of an object traveling through the expanding space time field during that time, if uninfluenced by other factors, would also be reduced by a half.

3.4.9 Generalizing the Equations to Acceleration
Since the velocity of moving objects is changing at a specific geometrically defined rate, the same effect would be realized with acceleration. The proposed formulas describing the effect on objects moving in an expanding spacetime metric is…

3.4.10 Ratio of Times Formulas Applied to Objects

<table>
<thead>
<tr>
<th>Formula</th>
<th>Equation</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{V_2}{V_1} = (\frac{T_1}{T_2})^{1/3}$</td>
<td>Eq 3-4, 1 = Eq 3-2, 12</td>
<td>Velocity of object at $T_1$ / Velocity of object at $T_2$</td>
</tr>
<tr>
<td>$\frac{A_2}{A_1} = (\frac{T_1}{T_2})^{4/3}$</td>
<td>Eq 3-4, 2 = Eq 3-2, 13</td>
<td>Acceleration of object at $T_1$ / Acceleration of object at $T_2$</td>
</tr>
<tr>
<td>$\frac{D_1}{D_2} = (\frac{T_1}{T_2})^{2/3}$</td>
<td>Eq 3-4, 3 = Eq 3-2, 9</td>
<td>Distance measure of object at $T_1$ / Distance measure of object at $T_2$</td>
</tr>
</tbody>
</table>

Note that this is similar in form to the spatial measure of an object in expanding observable space,

This assumption with respect to a more generalized use of the Ratio of Times formulas to include objects moving in an expanding spacetime field, and not just to describe the rate of expansion, will be shown to define a formal structure to Space. Fundamental properties of Space are being established, such as Conservation of Momentum and Conservation of Energy and the Inverse square laws are being predicted based on an expansion based geometry. The relationships will be shown to not only preserve all relative measures of time, but allow a consistent description of reality using “Absolute” measures of time.
3.4.11 Graphic Representation of Kinematics of Objects in Space
The following graph illustrates how distance measures, velocity, acceleration and energy of an object changes, as seen from an “Eye of God” perspective. Note that the acceleration of the object has been multiplied by -1 to reduce the size of the graph.

\[
\begin{align*}
D_1/D_2 &= (T_1/T_2)^{2/3} \\
V_2/V_1 &= (T_1/T_2)^{1/3} \\
A_2/A_1 &= -(T_1/T_2)^{4/3} \\
E_2/E_1 &= (T_1/T_2)^{2/3}
\end{align*}
\]

Absolute Distance Ratio To Historical Time Ratio \hspace{1cm} Eq 3-2, 9
Absolute Velocity Ratio To Historical Time Ratio \hspace{1cm} Eq 3-2, 12
Absolute Acceleration Ratio To Historical Time Ratio \hspace{1cm} Eq 3-2, 13
Absolute Energy Ratio To Historical Time Ratio \hspace{1cm} Eq 3-2, 14

**Figure 3.7 Ratio Times Formulas**
3.5.1 Intervals of Relative and Absolute Time

It has been proposed that objects moving in an Expanding Spacetime field change their velocity and acceleration according to the Ratio of Times formulas. This would have a dramatic effect on the mechanical measure of time.

This poses a rather interesting test for the model. The measure of local or relative measures of time must be preserved or measured to be invariant, while the proportional change observed from the “Eye of God” perspective must be consistent, no matter what dynamical system is considered.

This stark condition is required if space and time are locally invariant.

Intervals of Time

What is going to be done now is apply the Geometry of an expanding Space to some common relationships in Nature. Measures of Time will be shown that from an “Eye of God” perspective everything is changing according to a dynamic geometry, yet locally all measures will appear to be unchanged.

Once this is done for time, the relationships will be tested for consistency with other fundamental descriptions of nature including, Momentum, forces, and energy.

3.5.2 Intervals of Time and Velocity

One of the most fundamental relationships in physics or nature is the relationship between distance, time and velocity. Most probably the very first physics problem a student encountered while going to school involved problems that required calculating various algebraic, or more accurately, geometric manipulations of the relationship $V = D/T$; Velocity = Distance divided by time. The first test will be the application to light.

<table>
<thead>
<tr>
<th>$V = D/T$</th>
<th>Velocity, Distance and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T = D/V$</td>
<td></td>
</tr>
<tr>
<td>$V = $Velocity</td>
<td></td>
</tr>
<tr>
<td>$D = $Distance</td>
<td></td>
</tr>
<tr>
<td>$T = $Time</td>
<td></td>
</tr>
</tbody>
</table>

| $S = T^2$ | Eq 3-2, 1 Absolute Volume over measures of Absolute Time |
| $D = kT^{2/3}$ | Eq 3-2, 4 Absolute Distance over measures of Absolute Time |
| $V = (k^{2/3}/T^{1/3}$ | Eq 3-2, 10 Absolute Velocity over measures of Absolute Time |
| $A = (-k2/9)/T^{4/3}$ | Eq 3-2, 11 Absolute Acceleration / measures of Absolute Time |

| $k = c T^{1/3}$ | Eq 3-2, 7 |
| $D = T^{2/3}$ | Eq 3-2, 9 Eq 3-4, 3 |
| $V = T^{-1/3}$ | Eq 3-2, 12 Eq 3-4, 1 |
| $A = T^{-4/3}$ | Eq 3-2, 13 Eq 3-4, 2 |
| $E = T^{-2/3}$ | Eq 3-2, 14 |
3.5.3 The Light Clock
One of the most fundamental relationships defining an interval of time is that of an object passing between two points, and one of the most fundamental relationships in physics utilizing that relationship is the light clock.

Sample problem:
When the Universe was 1/8th its present age, how much faster was an interval of time defined by a light clock?

\[ \frac{T\Delta_1}{T\Delta_2} = \frac{T_1}{T_2} = \frac{1}{8} \]

Clock rates were 8 times faster.
As seen from the “Eye of God” perspective, in the past the speed of light was two times as fast and the length of the light clock was 1/4 as long.
Note that in order for the model to allow local measures of time to be locally consistent; all clock rates must “tick” 8 times faster in the past.

### 3.5.4 Angular Momentum

Now let's look at the time interval described by an object with angular momentum.

We see, based on the relationships of absolute measures that the intervals of time defined by the rotating object is the same as defined by the light clock.

So if one were using a light clock, no change in momentum would be observed. Locally, or from a relative perspective, Conservation of momentum would be preserved and the local measure of an interval of time would be invariant.

---

**Time and Angular Momentum**

\[
\begin{align*}
D_1/D_2 &= (T_1/T_2)^{2/3} & D &= \text{diameter} \\
W_2/W_1 &= (T_1/T_2)^{1/3} & W &= \text{angular rotation rate} \\
T_\Delta &= D/V, \quad T_{\Delta 1} = D_1/V_1 & \text{Eq 3-5, 1} \\
T_{\Delta 1}/T_{\Delta 2} &= (T_1/T_2)^{2/3}/(T_2/T_1)^{1/3} = T^{(2/3)}/(T^{(-1/3)}) = T & \text{Eq 3-5, 2}
\end{align*}
\]

Here you can see the introduction of the notation shorthand, adding an underline defines it as a ratio. If the ratio has a “1” term over a “2” term it is normal and if the terms are inverted, the ratio is expressed as an inverse.

\[
T_{\Delta} = T \quad \text{Eq 3-5, 2}
\]

---

**Figure 3-9**  Time and Expanding Rotating Systems, Momentum
3.5.5 The Pendulum

Now let’s look at a pendulum and a gravitational relationship

The period of a pendulum is proportional to the square root of the length of the pendulum divided by the accelerative field the pendulum experiences. Applying the predicted relationships for distance and acceleration to the model shows that the interval of time described by the pendulum is the same as the light clock.

The relative interval of time is the same as it was for the light clock and the rotating object.

Locally intervals of time are measured as invariant but globally all measures of time are proportionally slowing down at a geometrically defined rate.

The period of a pendulum is described by:
\[ \text{Period} = 2 \pi \times \left( \frac{l}{g} \right)^{\frac{1}{2}} \]

\[ l = \text{length of pendulum, } D \text{ used in following formulas} \]

\[ g = \text{accelerative field pendulum is experiencing} \]

The absolute measures of distance and the acceleration experience by the pendulum are described by:
\[ \frac{D_1}{D_2} = \left( \frac{T_1}{T_2} \right)^{\frac{2}{3}} \]
\[ \frac{A_1}{A_2} = \left( \frac{T_2}{T_1} \right)^{\frac{4}{3}} \]

Substituting these values for the period of the pendulum at T1 and T2 to describe intervals of absolute time results in:
\[ t_\Delta \approx \left( \frac{l}{g} \right)^{\frac{1}{2}} \]
\[ \frac{T_\Delta}{T} = \left( \frac{D}{g} \right)^{\frac{1}{2}} \]
\[ \frac{T_\Delta}{T} = \left( \frac{T^{\frac{2}{3}}}{T^{\frac{4}{3}}} \right)^{\frac{1}{2}} = 1 \]
\[ \frac{T_\Delta_1}{T_\Delta_2} = \frac{T_1}{T_2} \]
\[ T_\Delta = T \]  
Eq 3-5, 2

Figure 3-10 Time and the Expanding Pendulum
Even Kepler’s 3rd law keeps the necessary proportional relationship.

It is interesting to note that this relationship was also found in the original derivation of the Ratio of Time Formulas \( S == T \) squared when the volume is replaced by distance measures cubed. A rather profound structure to Spacetime is being confirmed.

In every example all relative measures of time have kept their proportional measure, while using an “absolute” clock it can be seen that all the relationships keep their geometric relationship.

**Intervals of time**

The preceding examples show that Local Intervals of time vary proportionally to their Absolute Ratio in Time.

\[
T\Delta 1/T\Delta 2 = T1/T2 \quad \text{Eq 3-5, 2}
\]

**Ratio of times Formulas**

\[
\begin{align*}
D &= T^{2/3} \\
V &= T^{1/3} \\
A &= T^{4/3} \\
E &= T^{2/3} \\
T\Delta &= T
\end{align*}
\]

\[
\begin{align*}
\text{Eq 3-2, 9} & \quad \text{Eq 3-4, 3} \\
\text{Eq 3-2, 12} & \quad \text{Eq 3-4, 1} \\
\text{Eq 3-2, 13} & \quad \text{Eq 3-4, 2} \\
\text{Eq 3-2, 14} & \quad \text{Eq 3-5, 2}
\end{align*}
\]
Section 3 Chapter 6 Forces

3.6.1 Forces and Dimensional Check
According to the geometry of the model all dynamic measures of intervals of time are locally invariant yet are globally shown to vary based on absolute measures.

Applying the relationship to determine if forces also maintain their proportional value is perhaps a bit redundant, but it helps confirm the model. In fact, as mentioned earlier, it was the check on the perseverance between centrifugal and gravitational forces that initially provided confidence in the model. The invariance of local measures of time evolved later. This time a check on the models dimensional consistency will be made.

The Ratio of Time formulas predicts that acceleration and force effects on a mass varies over time by

\[ \frac{F_1}{F_2} = \frac{A_1}{A_2} = \left(\frac{T_2}{T_1}\right)^{\frac{4}{3}} \]  
Eq 3-6, 1 Eq 3-2, 13

Now to check for dimensional consistency by reverting to measures of distance and time...

\[ F = MA \]

Assuming that mass is constant over time we have in dimensional terms...

\[ F = M A = M \frac{D}{T^2} \]  
Eq 3-6, 2

The Distance measure associated with the acceleration will vary by ...

\[ \frac{D_1}{D_2} = \left(\frac{T_1}{T_2}\right)^{\frac{2}{3}} \]

The interval of time associated with the acceleration will vary by...

\[ \frac{T_{\Delta 1}}{T_{\Delta 2}} = \frac{T_1}{T_2} \]

Continuing on we get...

\[ F = MA = M \frac{D}{T^2} \]

\[ \frac{A_1}{A_2} = \left(\frac{D}{T}\right)^2 = \left(\frac{T_1}{T_2}\right)^{\frac{2}{3}} / \left(\frac{T_1}{T_2}\right)^{\frac{4}{3}} = \left(\frac{T_1}{T_2}\right)^{-\frac{4}{3}} \]
Dimensions balance

Or using the notational shorthand we get this, the absolute force varies to the inverse 4/3 power of the absolute time ratio.

\[ A = \frac{T^{\frac{2}{3}}}{(T^{\frac{1}{3}})} = \frac{T^{\frac{1}{3}}}{(T^{\frac{1}{3}} -1)} = \frac{T^{\frac{4}{3}}}{T^{\frac{4}{3}} -1} = Eq 3-6, 3 \]

3.6.2 Balance Between Spatial and Inertial Forces
Gravity and Charge are spatial based effects, meaning there connection is through the structure of Space itself. Inertial based forces are the result of a change in velocity. What appears to be happening is that the proposed relationships are maintaining, or actually requiring that these effects are always in balance according to a kind of dynamic geometry.

Centrifugal Force = Gravitational Force = Spatial forces
Now, a two for one check. Orbiting systems require a balance between Centrifugal and field forces, be it by gravity or charge. Perseverance of this equivalency of forces over time in this case not only shows that Centrifugal and Gravitational / Spatial forces keep their proportional measure with the passage of time, it establishes the necessary balance in orbiting systems like solar systems and atoms.
Centrifugal force varies in absolute terms by the following change in absolute measures.

**Centrifugal part varies by...**
\[ V^2 / R \] Now substituting the variation over time.
\[ V_2^2 / R_2 / V_1^2 / R_1 = ((T_1/T_2)^{(1/3)})^2 \times (T_1/T_2)^{(2/3)} = (T_1/T_2)^{(4/3)} \] Eq 3-6, 4

**Gravitational part varies by ...**
\[ (a \text{ constant}) / R^2 \] Now substituting the variation over time.
\[ (R_1/R_2)^2 = ((T_1/T_2)^{(2/3)})^2 = (T_1/T_2)^{(4/3)} \] Eq 3-6, 5

Which equals the same value as found for Centrifugal force
\[ A_2/A_1 = (T_1/T_2)^{(4/3)} \] Eq 3-2, 13 Eq 3-4, 2

They vary at the same proportional rate over time. Dimensional balance is preserved-predicted.

### 3.6.3 The Inverse Square Laws
Orbiting objects are stable in the proposed expanding spacetime field. In fact the proposed expanding geometry is responsible for the structure observed locally. In essence the inverse square laws associated with gravity and charges are the result of the geometric expansion of Space.

The proposed dynamic geometry predicts the properties of Centrifugal Force to be the result of expansion, and it predicts that Spatial Forces also are produced because of expansion.

This was the initial issue that motivated my search for some kind of geometric model that produced fundamental relationships.

For example, the force of gravity in Newtonian physics and for the force associated with charge is dependent upon an experimentally derived determination for the Gravitational Constant G and coulombs constant.

\[ F = G \times m_1 \times m_2 / R^2 \]
\[ F = k \times q_1 \times q_2 / R^2 \]

In order for the relationship to work, G and k have to carry with it dimensions in order to balance the dimensions on one side of the equation to the other.

These extra dimensions of G are not predicted by the geometry of the model for Newton’s law of gravity, they were assumed in order for the Newtonian based relationship to work.

The inverse square laws are now being predicted as a part of the dynamic structure of Space. The primary difference between the force associated with gravity and the force associated with Charge is the dimensional measure of distance with charge is much smaller than the dimensional measure associated with gravity. (About 10^20 times smaller). Charge also has a positive and negative sense.

The proposed Geometric Expansion model is not perfect or complete since a justification for the difference in the dimensional distance for gravity and the dimensional distance for charge is not geometrically predicted or physically explained as to why the difference is so great.
Section 3 - Chapter 7  Energy

3.7.1 Checking the Relationships of Energy
Do the relationships of Energy keep their proportional relative measures while changing in Absolute measures?

3.7.2 Work
One description of work it is the product of a Force applied over a distance measure

\[ \text{Work} = F \times D \text{ or,} \]
\[ \text{Work} = \text{mass x acceleration x distance} \]

Since mass is assumed to be constant so when we transform the relationship to absolute measures we get the relationship stating that the Absolute Work or Energy varies by the inverse 2/3rds power of the Absolute Time Ratio

\[ \text{Work} = A \times D \]
\[ \text{Work} = T^{(-4/3)} \times T^{2/3} = T^{(-2/3)} \]
\[ E = T^{-2/3} \text{ Eq 3-7, 1} \]

This is the same relationship predicted for the variation of an objects kinematic energy. The model is proving to be locally invariant, but globally variant.

3.7.3 Potential Energy – Inverse Square Law
The potential energy for an object subject to the inverse square laws are for gravity…

\[ U_g = -Gma \times mb / r \]

Where \( G, ma, mb \) are constant we get
\[ U_g \approx -1/R \]

And for the charge relationship of the electron to the nucleus

\[ U_c = Cq \times qa \times qb / r \]

Where Coulombs constant is constant, as well as the charges, we get
\[ U_c \approx -1/R \]

Establishing a ratio for two measures of potential energy at two different distances, for objects that experience a force described by the inverse square laws, we get

\[ U_1/U_2 = R_2/R_1 \]

Since it is the Absolute Measures that define the potential energy relationship and that it is the absolute distances that vary over measures of absolute time we get…

\[ U_1/U_2 = R_2/R_1 \times D_2/D_1 = (T_2/T_1)^{2/3} = T^{(-2/3)} \text{ Eq 3-7, 1 (2)} \]

3.7.4 Kinetic Energy

\[ K.E. = V^2 = T^{-2/3} \text{ Eq 3-7, 1 (3)} \]

Note that this is the same proportional decrease in absolute potential energy that was initially derived for the prediction of how the Kinetic Energy of an object would decrease while traveling through an expanding spacetime field.
3.7.5 Potential Energy – Constant Field

The potential energy of an object near the surface of the earth is expressed as the mass of the object times the accelerative field (usually understood as the weight of the object), times the high differential available.

\[ U_{gs} = m \cdot g \cdot \Delta h \]

Applying the Ratio of time formulas we get

\[ \frac{U_{gs1}}{U_{gs2}} = \frac{m}{m} \times \frac{g1}{g2} \times \frac{\Delta h1}{\Delta h2} = \left( \frac{T1}{T2} \right)^{\frac{4}{3}} \times \left( \frac{T2}{T1} \right)^{\frac{2}{3}} \]

\[ \frac{U_{gs1}}{U_{g2}} = \left( \frac{T2}{T1} \right)^{\frac{2}{3}} = \left( \frac{T2}{T1} \right)^{-\frac{2}{3}} \quad \text{Eq 3-7, 1 (4)} \]

3.7.6 Elastic Potential Energy

A common example of elastic potential energy is that of a compressed spring. The elastic potential energy is expressed as

\[ U_e = \frac{1}{2} k \cdot y^2 \]

where \( k \) is a constant of the spring, and \( y \) is the distance the spring is stretched.

This is an important example since many relationships derive intervals of time using a spring like oscillation to establish intervals of time. For example, resonating crystals or resonating electric circuits are common in clocks. Initially one may think that this example no longer keeps the necessary proportional equivalence between absolute and relative measures. However, this would be to ignore the fact that the atoms of the spring have similarly expanded, which would reduce the amount of potential energy stored within the field relationships of the atom for a given displacement. The magnitude of the force would be reduced proportionally by the proportional expansion of the atom since it is the proportional strain on the atom that produces the force.

\[ \frac{U_{e1}}{U_{e2}} = \left( \frac{y2}{y1} \times \left( \frac{T2}{T1} \right)^{\frac{2}{3}} \right)^2 \times \left( \frac{T2}{T1} \right)^{\frac{2}{3}} = \left( \frac{T2}{T1} \right)^{-\frac{2}{3}} \quad \text{Eq 3-7, 1 (5)} \]

3.7.7 Nuclear Energy

\[ E = M \cdot c^2 \quad \text{(Formula actually to be derived in section 4, a given assumed now)} \]

Assuming that mass is constant the mass will divide out in a ratio so

\[ E = m \cdot c^2 \]

\[ E = c^2 \times c = \left( \frac{T}{\left( T^{1/3} \right)^2} \right)^{\frac{2}{3}} \quad \text{Eq 3-7, 1 (6)} \]

Equations 3-7, 1 to 5 maintain proportional value over time; this is confirming the model nicely, until the energy of a photon is considered.
3.8.1 Problem with the Energy of a Photon?
There initially appears to be a problem in the application of the Geometric Expansion model when it comes to describing the Energy of a photon over the passage of time. There is no longer the perfect perseverance of the proportional relationships over time.

A photon’s energy
\[ E = f = \frac{c}{\lambda} \]

The frequency of the photon establishes a clock like interval, and should vary according to the same principals predicted in dynamic systems. (frequency is inverse to intervals)

\[ T \Delta = T \]
\[ E_{\text{photon}} = f = \frac{1}{T} \quad \text{Eq 3-8, 1} \]

Also as another check of the relationships there is…

\[ E = \frac{c}{\lambda} \]

Which changes over time in observable space by…

\[ E_{\text{photon}} = \frac{c}{\lambda} = \frac{T^{-1/3}}{T^{2/3}} = T^{-1} \quad \text{check} \]

\[ E = \frac{hc}{\lambda} \quad \text{Energy content of a photon} \]
\[ E_{\text{photon}} = \frac{c}{\lambda} = \frac{T^{-1/3}}{T^{2/3}} = T^{-1} \quad \text{Eq 3-8, 1} \]

\[ T^{-1} \neq T^{-2/3} \quad \text{Eq 3-8, 2} \]

3.8.2 Equivalency Issue
Matter and radiant energy are still apparently not equivalent in that over time since they have not maintained their proportional value. A gram of matter does not change its relative measure at the same rate that a gram of light changes its relative measure.

3.8.3 Comparison of the Energy of a Photon Produced in the Past to a Photon Produced in the Present.

Initial Energy
A photon produced in the past from an atom due to the denser electrostatic field, would have a higher energy value of…

\[ E = T^{-2/3} \]

E Photon in produced in Past
\[ E_1 = E_2 \text{present} \times T^{-2/3} \]
Energy Lost
As the photon travels through an expanding spacetime field the photon produced in the past would lose energy. Resulting energy of a traveling or “old” Photon…

\[ E_{\text{Traveling photon}} = \text{Greater initial energy} \times \text{Energy loss of photon} \]

The loss from expansion would be the inverse of the energy assumed to be greater in the past, i.e. the inverse of \( E_{\text{photon}} = \frac{1}{T} \) resulting in…

\[ E \text{ observed now of traveling old Photon} = E_{2 \text{ present}} \times T^{-2/3} \times T^{1} = T^{1/3} \]

The energy of the “old” photon would be less than the currently produced photon. This seems to indicate a cosmological redshift.

3.8.4 Cosmological Redshift issue for Model

If the wavelength changes at \( \lambda = T^{(2/3)} \), a condition of special relativity, there would be no observable cosmological redshift since the wavelength is changing at the same rate as local rulers.

However, if the energy content of the observed “old” photon was less, one would expect the wavelength to be correspondingly longer. However the variation in the speed of light apparently cancels the effect and there is still no observed cosmological redshift.

\[ E = f = \frac{c}{\lambda} \]

\[ E \text{ present of traveling old Photon} = T^{1/3} = \frac{c}{\lambda} \]

\[ \lambda_{\text{cosmological red shift ratio old photon}} = \frac{c}{E_{\text{old traveling photon}}} = T^{(-1/3)} / T^{(1/3)} = T^{(-2/3)} \]

The longer wavelength predicted by the lower energy is countered by the slower speed of light resulting in a wavelength that varies the same as the stretch of space and local rulers. This is a problem for the model since a cosmological redshift is observed.
Section 3 - Chapter 9  Special and General Relativity

3.9.1 Special and General Relativity
A criticism of the proposed model that could be posed is that while Newtonian relationships may be predicted by the proposed model, Newtonian physics is only an approximation derived from the more accurate or fundamental theoretical models of Special and General Relativity.

First it must be noted that nothing in the model proposed so far has run counter to the principals of Special and general relativity, when local or relative measures are used. Length measures stay proportionally the same and intervals of time stay proportionally the same with the proposed geometric expansion of time.

3.9.2 Special Relativity Relationships are Preserved Locally and the Lorentz Factor
As the speed of an object becomes some measurable proportion of the speed of light, fundamental properties of the object appear to change, according to an observer in an inertial frame of reference not attached to the object. Time dilation, an increase in mass, and spatial compression, are a few of the effects that have been theoretically predicted and experimentally observed.

The variation in time dilation, mass and linear measures can be expressed as a specific proportion called the Lorentz factor or “Gamma”. If Gamma keeps its proportional measure with the passage of time, all the effects of Special Relativity keep their local proportional value over time. The proposed expansion would not alter the effects of Special Relativity.

\[ \gamma = \frac{1}{\sqrt{1 - \left(\frac{v}{c}\right)^2}} \]

The Lorentz factor or “Gamma”

\[ \gamma = \sqrt[1 - \left(\frac{v}{c}\right)^2} \]

Since \(v\) and \(c\) are both proposed to proportionally vary according to the same ratios of time relationship we get

\( \frac{v}{c} = \frac{V}{C} \)

Eq 3-9-1

And,

\( \frac{V_1}{C_1} = \frac{V_2}{C_2} \)

Eq 3-9-2 Hence, Lorentz factor is unchanging in proposed model

Since the proportional value of \(v\) and \(c\) are constant with the expansion of space, Gamma is unchanged locally with the passage of time. Time dilation, the increase in inertial mass, and the change in length all proportionally maintain their local proportional relationships with the variance of the speed of an object.
The proposed model will make some fundamental changes to the physical explanation for special relativity, but that will require the second part of the proposed model. For now it will simply be stated that the reason objects cannot exceed the speed of light barrier is that objects can only move as fast as the opportunity to do so exists.

3.9.3 General Relativity’s Relationships Preserved Locally
Since the line element, ds, and local time interval dt, are locally invariant, all the relationships of general relativity are preserved for local relationships. However, this is not true when global, or long term effects are compared using the “Eye of God” perspective. General Relativity, when applied over historical measures assumes that the line element of space is locally unchanging with the passage of time. The effect of Gravity would not be predicted to vary over time under simple applications of General relativity.

So long as local measures are used, none of the relationships of general relativity are altered. The local application of the relationships of special and general relativity are unaffected by the proposed expansion.

Section 3 - Chapter 10  Measures of Time

3.10.1 Comparing Two Measures of Time
Two dimensions of time are emerging from this model. They are unique and geometrically related one to the other. Local intervals of time using local clocks are invariant, or unchanging, while the use of a global or “absolute” clock reveals that local measures of intervals of time are changing based on measures of absolute time. The local intervals of time are always the same while from an Eye of God perspective intervals of time are proportionally changing. This relationship is expressed as follows with relative measures symbolized with lower case letters and Absolute measures represented by Capitol letters.

\[ t_1 = t_2 \text{ locally invariant} \]
\[ T_1 = T_2 \times \frac{T_1}{T_2} \text{ globally variant (Eq 3-17)} \]

When the universe was 1/2 its present age, local clocks ran twice as fast based on an absolute clock, within observable space.

A few terms will help give a more physical meaning to the two dimension of time.

3.10.2 Absolute, Cosmological or Historical Measure of Time
The absolute, cosmological or historical measure of intervals of time are based on using “absolute” or fixed rate clocks that do not change with the passage of time. Cosmological interval of Time is the measure of absolute intervals of time between points. A common use of Historical Time is to describe a point’s location relative to the beginning of time, or to describe a “look back time”. More on this topic will be addressed in Chapter 11.
3.10.3 Evolutionary or Experiential Measure of Time
The sequential cumulative measure of local intervals of time using local inertial clocks describes evolutionary or experiential time.

The next graph illustrates the variation in intervals of time over measures of Cosmological time.

![Graph showing relative intervals of time vs. Cosmological Age]

\[ \frac{T_{\Delta 1}}{T_{\Delta 2}} = \frac{T_1}{T_2} \quad \text{Eq 3-17} \]

Ratio of relative intervals of time to Absolute Time

The present absolute age of the Universe, To is set equal to 1.

Time progresses faster in the past than the present but locally is perceived to be constant. For example, a clock that describes an interval of time of one second now would tick 10 times faster when the Universe was 1/10 its present age.

3.10.4 Experiential Time Caution – Unfinished Model
A word of caution about the following derived relationships. The measures of experiential time will change with the development of Part II of the proposed model where the expansion is expanded to include an extra dimensional expansion. The methodology and description is still worth describing since the effects defined now will still occur but with modifications.

3.10.5 Experiential Time Derivation (Observable Space only).
Experiential time is the sum of all the intervals or periods of local or relative measures of time from T1 to the present, To, that determine the total cumulative time experienced within the Absolute or Historical Time interval as measured using an absolute clock starting the moment of measure in the past of T1 to the present.
This summation of local intervals of time can be determined by finding the average rate for periods of time over an interval of absolute time, multiplied by the interval of Absolute time elapsed. This can be established by finding the Integrated Mean or average over specific intervals of absolute time. This measure of cumulative time is the time experienced at a location over the passage of absolute time. To determine this value, the Integrated mean is used

\[
\text{Integrated mean} = \frac{1}{(B-A)} \int F(x) \, dx
\]

Multiplying the “averaged” rate of the passage of relative time (determined from the integrated mean), multiplied times the interval of time between T1 and T2 (A to B), times the Age of the Universe, To, yields the amount of cumulative experiential or evolutionary time, te, that passes at a location over a given absolute interval of time. Substituting by convention TΔ1 to become an infinitesimal interval of dT, and T for the measure of Absolute Time, we get the following…

\[
\text{Cumulative time elapsed} = \int_{T1}^{To} \frac{1}{T} \, dT = To (\ln(To/T1))
\]

**Equation 3-10-1**

**Example:** Assume the universe is 10 billion Absolute years old. An object is observed five billion absolute years in the past. In the time it took for the light to be observed, how much evolutionary time has elapsed?

\[
Te = Tu (\ln10 – \ln5) = Tu \ln2 = 10 \times .69 = 6.93 \text{ billion years.}
\]

**3.10.6 Cosmological Implications (Observable Space Only)**

Using the above example and applying it to long lived objects, such as stars, provides an interesting test of the model. If we did not know that clock rates were faster in the past, then a star we thought was burning fuel for 5 billion years could have actually been burning fuel for 7 billion years. If we did not know this then there should be observational evidence of some stars that appear to be older than the universe, which is indeed the case. More of these types of tests of the model will be presented in the verification section.

\[
D = T^{2/3} \quad \text{Eq 3-1.10}
\]

\[
V = T^{-1/3} \quad \text{Eq 3-1.13}
\]

\[
A = T^{-4/3} \quad \text{Eq 3-1.14}
\]

\[
E = T^{-2/3} \quad \text{Eq 3-1.16}
\]

\[
\frac{T\Delta}{T} = T^{-1} \quad \text{Eq 3-17}
\]

\[
F_{\text{photon}} = T^{-1} \quad \text{Eq 3-18}
\]

\[
\frac{V_1}{C_1} = \frac{V_2}{C_2} \quad \text{Eq 3-9-2.}
\]

\[
\frac{Te}{To} = \ln(T^{-1}) \quad \text{Eq 3-10-1}
\]
3.10.7 Cosmological Experiential Time
The following graph of Evolutionary time is interesting to consider.

While look back times as far as 20 percent of the age of the Universe, \( (T_1/To = .8) \) show little variation in the difference between experiential time and our locally observed measure of time, earlier in the evolution of the universe the total amount of evolutionary time dramatically increases. This effect would mean that in the era when stars and galaxies were forming, the rate of evolution is far faster than presently assumed.

Based on the proposed relationships one could say that from an Eye of God perspective using Absolute Clocks, the Universe has a beginning and is approaching an End. However, from a relative perspective using human clocks, the universe is infinitely aged and will never end.

Again, these relationships will change when the effects of Unobserved space are considered.

(The story of God making the Universe in 7 days becomes interesting to consider since a “day” in the past could represent hundreds of millions of years today. If one were so inclined it would be possible to determine how long a day is for God as a function of the present age of the Universe).
3.11.1 Consecutive Measures Using a Light Clock

In this section intervals of distance and time are correlated to Cosmological measures of distance and time using consecutive light clocks, as shown in the following illustration for absolute (global), or relative (local) measures.

In the next figure we have a photon or beam of light traveling between point A and Point B. The light starts the trip at the historical location of B or T1 and arrives at A at T2.

T2 will be assumed to be the present and will be designated as To.

At the historical location of T1 there are 8 light clocks between the two points, all of which are 1 light year long.

The temporal separation at T1, or in the past, defines the Cosmological interval of time separating points A and B. In this case, there are 8 cosmological intervals of time separating the two points at T1.

For an Absolute observer that can see all things as they are now (To) across all distance and time, all the light clocks are separated by 8 light years, in the present or now.

For a local observer at A, the Cosmological interval of time corresponds to a Cosmological look back in time. The observer is seeing point B when the Universe was at the Age of T1. The local observer is “seeing” the absolute interval of time between points A and B established at T1.

Since all light clocks have expanded with the expansion of space, there would still be 8 light clocks connected end to end. Since all local measures of time have similarly expanded, the interval of time described by the light clock would locally appear to be the same over the passage of time.

However, from an “Eye of God” perspective it can be seen that the actual interval of time experienced locally is not constant but was actually faster in the past. This is illustrated by the comparison of the interval of time described at T1 and T2 by the light clock.
This represents a light clock that is 1 light-year long at T1 and defines an interval of time at T1.

This represents a photon traveling from point B to point A starting at T1.

Points A and B are separated by 8 light years at T1 with 8 light clocks defining the interval of time between points A and B.

Photon arrives after 8 light years have passed; each light clock is still 1 light year long in relative measures.

Interval of time defined by light clock at T2 above that defined at T1.

**Figure 3 - 14 Cosmological intervals of time**
Measures of distance and time, over time, can be illustrated with a series of light clocks laid out end to end, from point A to point B.

When the photon of light left at the historical location of T1, the clocks at point A and B were “Ticking” faster than they do now at To.

The local elapsed time experienced at point A, while the light is traveling from point A to point B is the cumulative measures of successive “ticks of the clock”. Since the clock rates were faster in the past this would mean that the cumulative measure of time actually experienced while the light traveled from A to B is greater than the Cosmological interval between A and B.
3.11.2 Measures of Distance and Time Overview – Look Back Time and Look Back Distance

1. When a local ruler is used, the Distance between our present location and a point in the past is not the current distance using the ruler we have in the present. This perspective of objects cannot be seen locally since we cannot see objects as they are now, but only as they are observed in the past.

2. When a local ruler is used, the distance from our present location to a point in the past does describe the distance between now and the past as it was in the past. This perspective includes objects we can see since we can only see objects in the past, not as they are now.

3. Since the measures of distance and time keep their proportional relationship in the proposed model, the time interval between the points A and B keep their locally observed proportional measure.

4. A geometric relationship between distance and time is defined by the speed of light which allows the “Look back time” to correlate to the “look back distance”.

5. A local observer looking far away to an object establishes both a “Look Back Distance” and a “Look Back Time”. This measure is of the interval of distance and time is a measure of intervals as they were in the past, when the light from the distant object was emitted, not as they currently are.

6. The Absolute Ratio associated with a point in the past is determined by the Age of the Universe minus the Look Back Time which is then divided by the Age of the Universe.

Look Back Distance == Look Back Time
LBD == LBT  Eq 3-11-1

The distance between two points is also defined by the time it takes for light to travel between the two points.

\[ \frac{LBD}{T_1} = \frac{LBT}{T_0} \]
Equation 3-11-2

The Absolute Ratio of Time for a location in the past.

Figure 3-16 Look back times and Age of Universe
3.11.3 Fundamental Cosmological Problem for Model

The predicted perseverance of relative measures with the passage of time presents a bit of an issue with respect to Cosmology. If each light clock in figure 3-15 represented 10 million light years (a big light clock), and a galaxy was located at the end of each light clock, then every galaxy would always maintain the same relative or local measurement of the interval of time and distance between every galaxy over time.

Place a galaxy at the end of every ruler. Over the passage of time this relative measure would remain the same. Every galaxy would retain their distance and temporal separation to every other galaxy all the time. The locally observed density of galaxies in the past would not be greater. The physical distribution of Galaxies would not correlate to an expanding Universe. It is a bit ironic that a Universal Expansion produces no observable measure of Expansion. Since the Expansion of galaxies over time is observed, this is a fundamental issue for the model, as developed so far.

Figure 3-17 Fundamental Cosmological Problem -
3.12.1 Cosmological Time Dilation
The expansion of space should cause an effect called Cosmological Time Dilation where events observed in the past are dilated or expanded in their duration. One way to visualize this is to imagine an expanding bowling alley, as shown in the following figure.

Two bowling balls are thrown down the alley at the same velocity with a 1 second interval of time separating the throws.

When the first ball hits it will be one second later for the second ball to hit.

This time the balls are thrown on an alley that stretches. Assuming there is no slipping, the spatial separation between the balls increases while the balls roll down the alley, which means the balls now have further to travel before hitting the end of the alley which results in a longer interval of time between impacts.

Figure 3-18 Time Dilation
3.12.2 Time Dilation is Observed (Except in Quasars)
Time Dilation is observed at cosmological measures and closely correlates to observation, as per expectations of the current mainstream model. The durations of events are dilated or expanded in close proportion to the cosmological expansion.

For example, the light from a Type 1a supernova takes about 20+ days to rise and fall. This duration of the light curve increases with the "stretch" of the Universe, as described by the Cosmological Redshift. If the wavelength of light or spectra of a star is stretched enough to double its wavelength, the duration of the light curve is (nearly) 2 times longer.

(Except with Quasars)
It should be noted that the fluctuations of the energy output from quasars is not dilated in proportion to the cosmological redshift.

3.12.3 Derivation of Dilated Intervals
The proposed model predicts that since it is light that is transmitting the interval between events observed in the past, the dilation observed will be effected by the amount of stretch, and the predicted variation in the speed of light.

For example; an event with a duration of 1 second that occurred when the Universe was 1/8th its present age is now observed in the present. What is the effect of dilation and the variation of the speed of light on the observed one second interval?

The stretch of space or increase in the distance traveled is...
\[ D = T^{2/3} \]

The variation in the speed of light is...
\[ V = T^{-1/3} \]

An interval of time is described by
\[ t = d/v \]
which leads to the variation in the interval of time as
\[ D/V = T^{2/3}/T^{-1/3} = T \quad \text{Eq 3-12-1} \]

For example; an event with a 1 second duration is generated when the Universe was 1/8th its present age. What is the duration of the event observed in the present?

The distance traveled will be 4 times as long and the speed of light is reduced to 1/2 its present value, so the original event with a duration of 1 second would be observed to now take 8 seconds, 8 times longer.

\[ T_{\text{dilation}} = T^{-1} \quad \text{Eq 3-12-2} \]

<table>
<thead>
<tr>
<th>Expression</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>D (= T^{2/3})</td>
<td>Eq 3-1.10</td>
</tr>
<tr>
<td>V (= T^{-1/3})</td>
<td>Eq 3-1.13</td>
</tr>
<tr>
<td>A (= T^{-4/3})</td>
<td>Eq 3-1.14</td>
</tr>
<tr>
<td>E (= T^{-2/3})</td>
<td>Eq 3-1.16</td>
</tr>
<tr>
<td>T\Delta = T^{-1}</td>
<td>Eq 3-17</td>
</tr>
<tr>
<td>E_{\text{photon}} = T^{-1}</td>
<td>Eq 3-18</td>
</tr>
<tr>
<td>V_1/C_1 = V_2/C_2</td>
<td>Eq 3-9-2</td>
</tr>
<tr>
<td>T_e/T_o = \ln(T^{-1})</td>
<td>Eq 3-10-1</td>
</tr>
<tr>
<td>LBD = LBT</td>
<td>Eq 3-11-1</td>
</tr>
<tr>
<td>T = (T_o - LBT)/T_o</td>
<td>Eq 3-11-1</td>
</tr>
<tr>
<td>T_{\text{dilation}} = T^{-1}</td>
<td>Eq 3-12-2</td>
</tr>
</tbody>
</table>
3.12.4 Time Dilation - Problem for Model as Presented
The effect of dilation is the inverse of the faster inertial clock rates that the Geometric Expansion model predicts. This means that the two effects cancel. An inertial/spatial clock observed in the past would “tic” faster, but the faster clock rate would not be observed due to the dilation of space. There would be no Cosmological Time Dilation based on the GEM as presented so far.

This is another problem for the Geometric Expansion Model since, as stated earlier, the duration of supernovas is expanded with the expansion of Space, dilation is observed. Theory must conform to observation and the theory as presented so far does not conform to observation.

Section 3 - Chapter 13 The First Equation

3.13.1 The Search for the Key
Equation, \( S = T^2 \), was not the initial formula that I started with. I waited till this point in the development of the model to describe what started the whole process off since I have learned that if I initially start with the premise or motivation that started this line of investigation I would lose any interest from anyone with a background in general relativity. By this point in the development of the work it is fairly clear that the underlying concepts establishing the basis of general relativity have not been altered; Spacetime has structure; General Relativity still works as a model to define gravitational interactions locally.

3.13.2 Suspicious about Gravity
First, I started with the suspicion that General Relativity was not necessarily the defining basis for explaining gravity. (See why I waited). One reason for the skepticism, but not the main reason, was that one of the physical ramifications of distorting or curving space due to gravitational interaction was the unusual prediction that if you could go long enough in the same direction you would end up back where you started. This seemed to me to be physically impossible. Simple Euclidian Geometry where straight lines were straight seemed to represent reality so well, abandoning it seemed to me to be a mistake.

The inflation model necessary to keep spacetime “flat” or in accordance with the notion that straight lines are straight had not yet been published. (These suspicions on my part occurred in 1971. Inflation theory was proposed by Alan Guth in 1980 and Katsuhiko Sato in 1981). So I was admittedly (and fortunately) ignorant. (And still so, as will be argued by my critics who are clinging to the idea that it is general relativity that is the basis from which the Universe is to be understood).

3.13.3 Dimensional Properties of the Constant of Gravity
There was one thing that bothered me about Newtonian Gravity. The constant G was dimensionally complex.

\[ F = G \frac{mm}{r^2} \]

For example,
The dimensional units of G in metric units of measure is …

\[ G_{\text{units}} = (\text{distance in meters})^3 / (\text{mass in kilograms} \times \text{time in seconds})^2 \].

Compare this to the constant 1/2 used in...

\[ S = \frac{1}{2} a t^2 \]
This is the distance an object falls (s) if the object starts at rest and experiences a constant acceleration (a) over elapsed time (t). One constant, 1/2, and it is a scalar number.

Another example of a simpler constant:

\[ \text{K.E.} = \frac{1}{2} \text{ m v}^2 \]

The kinetic energy of an object is ½ the mass of the object times its speed squared. (Again non relativistic speeds). Again, no constant required that has units.

And another simple constant example:

\[ E = M c^2 \]

Which is the “intrinsic” energy of a mass at rest, if the objects mass was converted to energy.

Note that the constants used in all the above relationships have no units of dimensions, nice simple small constants with NO complex dimensional units.

I believed that all true, fundamentally described relationships would always have this simple kind of equation where the constants would not carry any units. Only a scalar number would have to be used.

So I was looking for some kind of relationship for measures of distance, time and mass that would produce the inverse square laws without requiring a constant that carries units. I thought of the problem as a kind of dimensional translation.

3.13.4 Dimensional Analysis
I thought Dimensional analysis would be helpful in finding the proper relationship. Dimensional Analysis is a technique used often in engineering to try and figure out the general form of the relationships involved in describing some kind of physical response even if one is ignorant of the basis or means to generate the underlying basis for the relationships.

For example, Let’s say we are interested in knowing how far an object falls experiencing a constant accelerative field but we do not know the formula or relationship of \( s = \frac{1}{2} a t^2 \).

We know or start with the definition that a constant acceleration has the dimensional units of distance/Time², and we can “guess” that the distance an object is going to fall is going to be proportional to the acceleration imposed. Double the accelerative field and the object will cover two times as much distance.

But we are not that sure as to how measures of time determine how far the object falls, so using dimensional analysis we write

\[ S \text{ dimensional units} = (a \text{ dimensional units}) \times (\text{unknown dimensional units}) \]

\[ \text{distance} = (\text{distance} / \text{time}^2) \times (?) \]

So from the above relationship it can be seen that in order for the relationship to dimensionally balance, i.e. end up with the dimensions of distance = distance, the acceleration term with its units of
distance divided by time squared, has to have the units of time removed, so the acceleration term must be multiplied by a time dimensional unit squared.

Distance ~ a \times (T^2)

We now know the general form of the equation defining how far an object falls experiencing a constant acceleration, the acceleration term must be multiplied by units of time squared.

What we do not know is the constant term \( \frac{1}{2} \), but dimensional analysis helps in establishing what the final formula will look like. It is also a good trick if you are not sure about a relationship, check if it is dimensionally balanced, as well as have the units used match.

3.13.5 Changing Einstein’s Equivalency Principle

I felt that the force an object experiences by gravity was equal to the force an object experience’s by acceleration. The forces experienced are equivalent. This is close to the equivalency principal assumed by Einstein, however there is a big difference; Einstein assumed the accelerations are equivalent whereas in this case the forces are assumed equivalent. The mass term that is common to both relationships has not been factored out.

Since both situations have the same one Newton force applied, the expression that quantifies the force must also be the same. Again, note that one expression has no “G” with units that carry dimensions, the other does. The only way to make the relationships dimensionally balance with the same unites of measurement is to have the Gravitational constant carry dimensional units.
3.13.6 The Challenge Based on Dimensional Analysis

If there was some way to equate the two forces without resorting to a “dimensional fudge factor” then a common theoretical basis for the two identical forces could be expressed. If “G” with units could be eliminated and the expression could be balanced dimensionally without the fudge factor, fundamental dimensional relationships could be established. Dimensional analysis results in the following hint at the relationships that are involved if the proper theoretical foundation was known.

Newton = 1 Newton

\[ M_1 \times (A) = M_1 \times (GM_2 / (D^*D)) \]

(Now eliminate the dimensions of the “G fudge factor”)

\[ A = M_2 / (D^*D) \]

\[ D/T^2 = M/D^2 \]

Eq 3-13-1 Dimensions do not “Balance”

For years I played with various dimensional transformations that would allow the balancing of the dimensional relationships without resorting to the dimensional “fudge factor” of G. There had to be some basic mathematical relationship that is characteristic of space-time and matter that would allow these two equivalent forces to be dimensional equivalent.

Those who object to the loss of the gravitational constant G to balance the equation must remember that G is not a just a number, it carries with it dimensional relationships imposed to make the experimentally determined relationships work. The goal is to express all relationships as functions of distance and time alone, based on a theoretical model of the universe.

3.13.7 Clocks, Rulers and Mass

Equation Eq 3-13-1 \((D/T/T = M/D/D)\) has dimensions of distance and time and mass. Distance and time are real dimensions in that they can be plotted, and special relativity allows an equating of these two dimensional measures with the speed of light. Mass is a bit nebulous, just what makes mass have the properties of mass? Intuitively it seems that distance and time are the real measures of mass. All we really have to measure the world around us are clocks and rulers. Shouldn’t mass be also defined by clocks and rulers alone? Expressing Mass as a function of distance and time from the above formulas results in the following dimensional relationship defining Mass.

\[ M \text{ dimensionally} = D^3/T^2 \]  
\[ \text{Eq. 3-13-2} \]

This dimensional relationship defining mass was interesting to apply and in every test seemed to be justified.

Inertial Force \text{dimensionally} = M(A) = (D^3/T^2)(D/T^2) = D^4/T^4 \]  
\[ \text{Eq. 3-13-3} \]

Gravitational Force \text{dimensionally} = F = (M_1 \times M_2)/D^2 = ((D^3/T^2 \times D^3/T^2)/D^2 = D^4/T^4 \]  
\[ \text{Eq. 3-13-3} \]

In general force would be dimensionally defined by

\[ F \text{ dimensionally} = D^4/T^4 \]  
\[ \text{Eq. 3-13-3} \]

The dimensional relationships for energy also match for Newtonian and Einstein's relativistic energy equation.

\[ \text{Energy dimensionally} = F \times D = D^4/T^4 \times D = D^5/T^4 \]  
\[ \text{Eq. 3-13-4} \]

\[ E \text{ dimensionally} = mc^2 \times D^3/T^2 \times D^2/T^2 = D^5/T^4 \]  
\[ \text{Eq. 3-13-4} \]

\[ \text{Energy dimensionally} = D^5/T^4 \]  
\[ \text{Eq. 3-13-4} \]

The observation that Newton’s and Einstein’s dimensions for energy now match was another validation of the idea that mass was a function defined by distance and time.
3.13.8 Volume as a Fundamental Physical Characteristic
The fact that $D^3$ is a volume was also an encouraging clue that this dimensional representation for matter was significant. Spacetime itself can be described as a volume, Space has volume, Matter has a volume. There was a kind of unifying convergence that was exciting to consider. Matter and Space were, potentially, the same. Matter becomes more than a structure made of different quarks, (which are "pieces" of space and time), but a structure based on a dynamic relationships of space and time that are consistent from the smallest to the largest scale of observation.

However the role or physical meaning of the $T^2$ term eluded me for years.

3.13.9 Because Space Changes, Time Exists
Then one day I had the following train of thought; if nothing changed, nothing would exist; what if space itself has to change in order for anything to happen; if this is so then it is because space changes that time exists. I wrote the following relationship to express this concept.

\[ \frac{dS}{dT} = T \quad \text{This is Equation 1-0 and Eq. 3-13-5} \]

This expression is saying that "a little change in Space over a little change in time equals Time". Time itself is defined by a change in space.

3.13.10 Equation Dimensionally Validated
For those familiar with physical relationships and equations equation 1-0 would appear wrong right off the bat since the dimensional units are wrong, Space per Time on one side and Time on the other. This did not concern me since I was looking for a geometrical relationship between distance and time. For example the speed of light is often represented as, \( c = 1 \). This make no sense if all one does is look at the dimensional relationship, \( c = \text{distance/time} \), which cannot =1, but there can be an equality geometrically or according to the structure of space. For example One light year = the distance light goes in a year; this relationship can be seen equivalently as a distance between two points that is one light year away or the two points are separated in time equivalent to one year. The symbol == was adopted to indicate a geometric relationship and no just a equal relationship.

I proceeded to integrate the relationship to check for dimensional relationship and the following was derived. (== symbols use based on the hope of a geometrically defined relationship between distance and time, if one prefers the == symbols can be assume to equate to the expression, "proportional to".

\[
\begin{align*}
\frac{dS}{dt} &= T \quad \text{Eq. 1.0 which became} \\
S &= T^2 \quad \text{Eq. 1.0a} \\
S &= D^3 \quad \text{Eq. 1.0b} \quad \text{combining this, as derived earlier} \\
D^3 &= kT^2 \quad \text{Eq. 1.0c} \\
\end{align*}
\]

\[ k \text{ dimensionally } = \frac{D^3}{T^2} \quad \text{Eq. 1.0d} \quad \text{Eq 3-13-6} \]

The last equation excited me; it shared the dimensional description for matter. Matter and space were dimensionally described the same, and the equation had the same dimensional form that was indicated by dimensional analysis, Distance cubed per time squared.

3.13.11 Finding the Key - Balance preserved
The next thing I did was to derive the relationships of how velocity and acceleration would change over time. I also assumed that these relationships would define the behavior of all systems in space (kind of a lucky guess) and checked to see if there would still be a balance between centrifugal and gravitational forces over time, as explained in Section 3-21. When I found out that the balance between the two forces was preserved over time I knew I found the key.

76
3.14.1 Summary
Before developing the model further, a brief summary of what has been done so far is in order.

1. Geometrically based relationships were derived that predict the response or actions of an object within an expanding spacetime field.
2. The accelerative field associated with gravity and Coulombs force was predicted properties of an expanding spacetime field which also corresponded to inertial forces like linear and circular acceleration.
3. Relative measures of intervals of distance and time were preserved or “invariant” with the passage of time.
4. Absolute measures of time provide a means to describe how local clock rates slow with the passage of time.
5. Two dimensions of time were described.
6. The effect of gravity and charge was predicted to decrease with the passage of time, based on absolute or global measures.
7. While there is no evidence of clock rate variation directly, cumulative measures of time should be observable.
8. The proposed expansion includes the space within the atom itself.

There are at least 4 fundamental issues with the model, so far.
1. A traveling photon does not lose energy at the same rate as other field based relationships or matter. The equivalence between matter and energy is not preserved.
2. The Cosmological Redshift is non-observable, or there is ambiguity with respect to the energy of the photon over time.
3. Cosmological Time Dilation is no longer observable.
4. The distance and temporal intervals separating galaxies would be locally observed to remain the same over time. The density of galaxies over time would remain the same. There would be no Expanding Universe. This is amazingly ironic and a fundamental problem for the model.

Two fundamental issues resolved.
The two fundamental arguments against such a uniform expansion that were described earlier are proved ineffectual. The model not only preserves the structure of reality locally, it predicts it. Also, the model is not trivial since it predicts that the effect of gravity and charge should vary with the passage of time and this is a prediction that the Limited Expansion Model does not make. Also, while the evidence of faster clock rates in the past is not directly observable, the cumulative effects should be.

3.14.2 Connection to Quantum Mechanics
If the expansion of Space were to be incremental at the atomic scale of observation, the bit by bit expansion integrating itself onto the existing fabric of reality would result in a probabilistic description of atomic and sub atomic relationships. The physics of Quantum Mechanics is becoming a part of the model as well. A unified field theory is being revealed.

3.14.3 Conclusion – Observable Space
The physics of nature is conforming to a specific dynamic geometry based on expansion.
<table>
<thead>
<tr>
<th>Formula</th>
<th>Equation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S = T^2 )</td>
<td>Eq 3-2, 1</td>
<td>Absolute Volume over measures of Absolute Time</td>
</tr>
<tr>
<td>( D = kT^{2/3} )</td>
<td>Eq 3-2, 4</td>
<td>Absolute Distance over measures of Absolute Time</td>
</tr>
<tr>
<td>( V = (k 2/3)/T^{1/3} )</td>
<td>Eq 3-2, 10</td>
<td>Absolute Velocity over measures of Absolute Time</td>
</tr>
<tr>
<td>( A = (-k2/9 )/T^{4/3} )</td>
<td>Eq 3-2, 11</td>
<td>Absolute Acceleration over measures of Absolute Time</td>
</tr>
<tr>
<td>( k = c T^{1/3} )</td>
<td>Eq 3-2, 7</td>
<td></td>
</tr>
<tr>
<td>( D = T^{2/3} )</td>
<td>Eq 3-2, 9</td>
<td>Eq 3-4, 3</td>
</tr>
<tr>
<td>( V = T^{-1/3} )</td>
<td>Eq 3-2, 12</td>
<td>Eq 3-4, 1</td>
</tr>
<tr>
<td>( A = T^{-4/3} )</td>
<td>Eq 3-2, 13</td>
<td>Eq 3-4, 2</td>
</tr>
<tr>
<td>( E = T^{-2/3} )</td>
<td>Eq 3-2, 14</td>
<td></td>
</tr>
<tr>
<td>( T \Delta = T )</td>
<td>Eq 3-5-2</td>
<td></td>
</tr>
<tr>
<td>( Te/To = \ln(T^{-1}) )</td>
<td>Eq 3-10, 1</td>
<td></td>
</tr>
<tr>
<td>( LBD = LBT )</td>
<td>Eq 3-11, 1</td>
<td></td>
</tr>
<tr>
<td>( T = (To – LBT)/To )</td>
<td>Eq 3-11, 2</td>
<td></td>
</tr>
<tr>
<td>( T_{dilation} \Delta = T^{-1} )</td>
<td>Eq 3-12, 2</td>
<td></td>
</tr>
<tr>
<td>( M ) dimensionally = ( D^3/T^2 )</td>
<td>Eq. 3-13, 2</td>
<td></td>
</tr>
<tr>
<td>( F ) dimensionally = ( D^4/T^4 )</td>
<td>Eq. 3-13, 3</td>
<td></td>
</tr>
<tr>
<td>( E ) dimensionally = ( D^5/T^4 )</td>
<td>Eq. 3-13, 4</td>
<td></td>
</tr>
<tr>
<td>( k ) dimensionally = ( D^3/T^2 )</td>
<td>Eq 3-13, 6</td>
<td></td>
</tr>
</tbody>
</table>
Figure 3-20  $T$ raised by fractional powers based on thirds
Section 4 Expanding the Dimensions of Expansion

Section 4 – Chapter 1 – Six Spatial Perspectives

4.1.1 Necessity for Expanding the Model and a Solution
Despite the wonderfully appealing and simple geometry of the Geometric Expansion Model, and its explanation of some of the basic relationships of nature, it still suffers some fundamental problems. The Cosmological Redshift was not observable, the desired goal for an equivalency between matter and radiant energy was still missing and time dilation was not observable. Even the expansion of the Universe itself would not be observable.

The solution to these issues was to expand the expansion. Our observable Universe is in motion and expanding within another Unobserved Space that is also expanding according to the same geometry that observable space is expanding.

This expansion of the model added complexity, but it resolved the fundamental problems mentioned above. The expanded model also helped explain certain fundamental properties, such as the speed of light and the property of inertia. The ambiguous relationship associated with the energy of a photon over time became resolved. Also, there would now be an observed Cosmological expansion of galaxies. Dark Matter would no longer be necessary to explain the orbital velocities of galaxies. Dark Energy would also no longer be necessary to explain the Cosmological location of galaxies once the effects of observable and unobserved space were incorporated together.

4.1.2 Six Kinds of Spatial Descriptions
Adding additional dimensional relationships increases the spatial perspectives that are needed to visualize or describe the proposed relationships. Physical properties can be described within six kinds of Spaces or perspectives; relative, observable, unobserved, absolute, Unified and Unified local Space. The differentiations between the various spaces or volumes of spacetime are based on the frame of reference or point of view in which observations or measurements are made. The methodology in developing the model is to essentially integrate each spatial perspective into one unified description of the Geometry of a Multidimensional Space.

4.1.3 Relative or Local Space
Relative Space contains all observed measures of events and objects that are “local” using local rulers and local clocks.

Local is a relative term. The determining relationship that establishes whether or not an observation is “local” is the temporal separation between observer and the object, as defined by the time it takes for light to travel between the two, divided by the age of the Universe. The closer this ratio is to 0, the more local the observations are within relative space.

Local measures of intervals of distance and time are invariant over the passage of time, or said another way; local clock rates and rulers do not change their relative measure.

4.1.4 Observable Space or Expanding Observable Space
Expanding Observable Space or what is called Observable space for short, is described or formed by a geometric expansion of the physical measures of distance and time that establish the structure of our observed Universe. An “Eye of God” perspective is needed to observe this expansion since locally everything appears to remain the same.
It was shown previously that the geometry of expanding observable space preserved, or predicted the consistency of measures of distance and time within relative space. Even clocks observed in the past do not appear to be describing shorter intervals of time since the expansion of observable space dilates or expands the shorter intervals of time that existed in the past.

4.1.5 Absolute Space
Absolute Space affords the reference or perspective to measure or visualize the expansion of a Multidimensional space. It is within this absolute space that the “Eye of God” perspective is realized. The structure of Absolute space also establishes the background structure for field relationships. For example, as Observable Space expands, the field effects experienced within gravitational or charge relationships are diminished. The relative separation between gravitational or charge bound objects has not changed, but the absolute distances have. It is by absolute measures that “true” field relationships are described.

4.1.6 Observable Space in Motion Along Unobserved Dimension
Unobserved Space and Observed Space are not separate but united by the structure of expansion. We are not directly aware of unobserved space’s existence. Recalling the ink in water analogy, unobserved space is the water and observable space is the ink. The volume of unobservable spacetime expands according to the same geometry established for observable space.

The motion of observed space along an unobserved dimension is illustrated Figures 4-1 to 4-4.

4.1.7 Unified Space
Unified Space or Absolute Unified Space is the observed structure that results when the effects of Observed Space and Unobserved Space are combined together, as seen from an Eye of God perspective.

4.1.8 Unified Local Space, or Local Unified Space
Local Unified Space is the observed description of structure when local clocks and local rulers are used to describe reality. Since local clocks and local rulers are locally invariant, it is only when events in the past, or are cosmologically scaled that the relationships of Local Unified Space are revealed.
Relative Space corresponds to the region of Spacetime that is local as seen and measured locally using local rulers and local clocks that appear locally to remain constant in their measure.

Observational Space would correspond to the expanding Flatland Universe. (The expanding gray circle). It would be described most simply by an "Eye of God" perspective.

Unobserved Space corresponds to region described by the unobserved "vertical" dimension. Observable space is in motion along an unobserved Dimension.

Absolute Space corresponds to the background structure necessary to describe Observable Space as expanding and the motion of Observable Space along an Unobserved Dimension. It assumes an "Eye of God" perspective.

Unified Space corresponds to the net or cumulative effects on objects in the Flatland Universe due to the relationships imposed by Observable and Unobserved Space. The effects are described as seen from an Eye of God perspective.

Local Unified space corresponds to the local observation of the effects established in Unified Space.

**Figure 4-1** Six Spatial Descriptions in a Flatland Universe
The expanding inner cube represents the expansion of observable space.

The expanding outer cube represents expanding unobserved space.

The expansion of space along the unobserved dimension is geometrically the same as the expansion of observable space.

This combined extra dimensional spacetime will be here in referred to as “Unified Space”.

The expansion of Unified Space and the motion of Observable Space within Unobserved space require a description from an “Absolute Space”.

**Figure 4-2 Expanding the Expansion – Absolute to Unified Space**
This illustration is not meant to imply that Unobserved space is the negative region of observable space. Unobserved space is like our Observable space, and it is a part of Space. The intrinsic orthogonal relationships of the two spaces to each other are being illustrated.

Each spatial dimension has an unobserved dimension orthogonal to it, thereby creating an Unobserved Space that is essentially orthogonal to Observed Space. Both volume measures comprise "Unified Space".

Figure 4-3 Unified Space
The plane containing a “Flatland Universe” is part of unobserved space, represented by the expanding cube. The Unobserved space is expanding the plane containing Flatland.

Expanding Unobserved Space

Expanding plane containing Flatland Universe

Local Observer

This Multidimensional space is structurally interdependent.

The moving plane containing the Flatland Universe is expanding since it is a part of the larger extra dimensional space.

If the expansion in the unobserved “vertical” dimension occurs at the same rate that the expansion occurs in the “horizontal plane” containing Flatland, then orthogonal and proportional relationships within the extra dimensional space are maintained over the passage of time.

Note the difference in the observers. The Absolute or Eye of God observer is outside of the expansion and is a part of the background structure. The relative observer is a part of the expansion and is located within observable space or the expanding flatland universe.

Figure 4-4 Proportional Expansion of Multi-dimensional Space
4.1.10 Notation for Measures of Distance and Time and Perspective

**Relative or Local space and notation – Local Observer – Local perspective**
A local perspective using relative or local measures of distance and time. Distance and time intervals are assumed Constant within the local frame of reference. Lower case letters that have a "small" or regular sized font.
d = distance interval
t = temporal interval

**Observable space and notation**
An “Eye of God” perspective that considers only the Expansion of Observable space. Capitol or Upper case letters

\( \Delta D = \) distance interval
\( \Delta T = \) Temporal interval

**Unobserved Space**
An “Eye of God” perspective that considers only the effects caused by the expansion and motion of Observable Space within Unobserved Space.
*Capitol or Upper case Italic letters –*

\( \Delta D = \) distance interval
\( \Delta T = \) Temporal interval

**Unified Space**
An Eye of God perspective from Absolute Space that combines the effects of Observed and Unobserved Space. Capitol or Uppercase Bold letters

\( \Delta D = \) distance interval
\( \Delta T = \) Temporal interval

**Unified local space**
A local perspective describing the effects based on the relationships of Unified Space. Lowercase letters with a larger font, and bold.

\( \Delta d = \) distance interval
\( \Delta t = \) temporal interval
Section 4 - Chapter 2  Moving in an Unobserved Dimension

4.2.1 Some Intrinsic Properties from Motion through Unobserved Space
The intrinsic properties to be described now are a result of observable space being in motion along an unobserved dimension. What will be described later in Section 4, Chapter 18, is a deceleration that is imposed on observable space that results from the motion of the observable universe while it is also expanding. Including this effect from expanding in this section seemed to detract from the fundamentals being established now.

4.2.2 Flatland Analogy
The motion of a Flatland Universe along an unobserved dimension is illustrative of how intrinsic motion and an intrinsic deceleration would be imposed. Since this motion along the unobserved dimension should also diminish over time, there should also be an intrinsic deceleration imposed.

![Figure 4-5 Intrinsic Motion](image)

The motion, $V_a$, along an unobserved dimension imparts an unobserved or “intrinsic” velocity to all objects in Flatland. Since this velocity diminishes over time there should be an imposed intrinsic deceleration, $A_u$. 
4.2.3 Intrinsic Velocity

If the entire Universe were in motion along an unobserved dimension, than all objects in observable space would have an unseen or intrinsic momentum, and an unseen or intrinsic velocity or kinetic Energy.

**Flatland universe with three points, A B and C moving with an unobserved but real motion (Vu) in a dimension the “residents” of a Flatland universe would not be directly aware of.**

Assuming that the direction of motion of the Flatland universe is orthogonal to the observed dimensions, all points in flatland will inherently have the same intrinsic velocity in the unobserved dimension. That intrinsic velocity is perpendicular to all dimensional measures found in the Flatland Universe. The question is, how will the residents of Flatland detect a motion in a direction where there is no direct observational dimensional measure? If Flatland is accelerating in an unobserved dimension, how would that be detected or experienced?

All points in a Flatland Universe must have the same intrinsic properties induced at the same time. However the velocity or acceleration at A in the unobserved dimension influences observations or physical relationships in Flatland, it also must be the same for points B and C at the same time.

True Simultaneous events exist from an “Eye of God” perspective, not a relative perspective. The beginning of time is a simultaneous event. Points A, B and C all experience the same Vu at the same time. (This description of “simultaneous events” is not a generally accepted description since typically only a local perspective is used.)

Figure 4-6 Motion in an unobserved dimension
Intrinsic Properties

Relative Velocity Changes in Flatland either in Magnitude or direction

An object in a Flatland universe moving in an “unobserved” dimension would have an “unseen” momentum and “unseen” kinetic energy and if the velocity \( V_u \) were slowing down with the passage of time, an “unseen” deceleration. (Note the Expansion of Flatland not shown.)

These unseen properties would manifest these properties as a kind of “intrinsic” property of matter.

Note that when an object changes either its speed or direction in the Flatland universe, there is a change in the speed and direction of the object in the unobserved dimension.

**Au Intrinsic Deceleration**
Since \( V_u \) would be decreasing over time there should also be an intrinsic decelerating.

**Figure 4-7 Intrinsic Properties**
4.2.4 Intrinsic Energy, Speed of Light Conjecture and E = mcc
How fast is the entire observable universe moving in an unobserved dimension?

A mass moving along the “unobserved” dimension with an “unobserved “velocity would also have an intrinsic kinetic energy. It is the property of intrinsic energy that lends itself to what I call the Speed of Light Conjecture,

**Speed of Light Conjecture and E=mcc**

If the velocity of the Universe along the “unobserved” dimension were…

\[ V_u = c \sqrt{2} \]  
*(Equation 4-2, 1)*

(Note italics for relationship established from unobserved space)

Then the Kinetic energy of an object would be…

\[ \text{K.E.} = \frac{1}{2} m V_u^2 = \text{Intrinsic Energy} = E = m c c \]  
*(Equation 4-2, 2)*

What Einstein called the “intrinsic” energy of a rest mass becomes kenematically based. This is an extremely simple derivation of \( E = m c c \).

The Speed of light conjecture also allows a description of the interface between the expansion of observable space and unobserved space. It is the velocity component of the expansion along an unobserved dimension that produces the speed of light. So the speed of light reveals, or is geometrically determined by our velocity along the unobserved dimension. This will be explained in more detail next chapter.

4.2.5 Variations on Speed of Light Conjecture
It is possible to express somewhat different versions of the speed of light Conjecture. The conjecture was based on the simple way the intrinsic rest energy of a mass becomes kenematically based. Other solutions can be possible. The “rest energy” of a mass may be only a proportion of the energy associated with an object as observed in our observable space with the rest of the “missing” energy residing in an “unobserved space”. The physical development of an “unobserved space” is described after the speed of light chapter, Section 4 chapter 3. For now consider the following example. If the velocity along the unobserved dimensions were \( c \), the intrinsic energy of a rest mass would be two times too big. However, if one half of this energy resided in “unobserved space” then the half we see in observed space would correspond to \( E = M c c \).

Another physical explanation would be that the velocity along the unobserved dimension has an orthogonal component from a multidimensional space that translates to \( V_c \), the speed of light times the square root of two.

4.2.6 Intrinsic Acceleration
If the velocity along the unobserved dimension is also decreasing over time then a kind of intrinsic deceleration would also be imposed. This topic will be discussed in more detail in a separate section discussion the role of acceleration and in the section on the extra dimensional acceleration resulting from observable space expanding while it is also in motion along an unobserved dimension. For now it would seem that an inward acceleration everywhere would act as a kind of pressure that helps preserve structure.
4.2.7 Inertia.
Inertia is an interesting property of mass. If one tries to change the motion or induce a motion to an object, there is a resistance or force required to cause the change. Why is there this intrinsic property of mass? What causes this property to exist within mass? The property of inertia is tied to the physical property of momentum in observable space and the velocity along the Unobserved dimension.

A change in the magnitude or direction of the velocity of an object results in the physical manifestation of a “force”. For example, if a mass is moving in one direction and the direction is changed, a force is manifested on to the mass. An example of this would be a ball on a string that is spun in a circle producing a force in the string, the constant changing in the direction of the velocity of the object results in the object experiencing a force. This “force” can be described as a “resistance to change” be it a change in direction or a change in velocity.

Now if the mass were in motion along an unobserved dimension, it would have properties of momentum but the observation of this momentum would not be directly seen in our observable space-time. However any variable motion within our observed space-time would cause a change in velocity along our “unobserved” dimension, resulting in force, or a resistance to change. The property of inertia becomes the result of an intrinsic velocity and a volume like property of mass. Inertia is not an inherent property of mass; it is a generated property.

4.2.8 Special Relativity and Inertia
A brief divergence is probably necessary since Special Relativity alters the effect of mass, an effect that increases as the speeds involved become a meaningful proportion to the speed of light. Ignoring this effect could be considered a major omission. This is not the case; the basic fundamental relationships are being described. How the effect of mass varies with velocity in observable space is another topic, (Objects cannot move faster than the opportunity to change exists). Also, as noted previously, the relationships of special and general relativity are not affected when local measures are used since proportionally they are invariant.

4.2.9 Centrifugal Effect and Inertia
The proposal that all objects have an unseen velocity along an unobserved dimension means that any variation in an objects motion in observable space also causes a change in the motion of the object in unobserved space. This results in a centrifugal effect, which is the physical basis for inertia of an object.

The following illustration is an edge on view of a Flatland universe that is in motion along an “unobserved dimension”. Any motion within Flatland causes a change in the momentum vector along the unobserved dimension and this produces a force, which is experienced as a resistance to a change in motion within the flatland Universe.
In order for an object in the flat land Universe to change its velocity, (either its speed or direction) it will also alter the direction the object in motion along the unobserved dimension. This can be visualized as creating a curved path for the object to be traveling. The greater the change in velocity within the Flatland Universe, $V_0$, the greater the change in direction and the smaller the radius associated with a centrifugal acceleration, which correlates resistance to a change in motion of the object with the effect of inertia.

For the proposed 4 spatial dimensional model, the unobserved dimension is orthogonal to our observed three spatial dimensions so any directional change in three-dimensional space is orthogonal to $V_c$.

(Note, this illustration, which suggests that a centrifugal like acceleration correlates to an inertial effect, is limited to motions that are much less than relativistic speeds. Relativistic speeds increase the effect of mass by the increased energy of the mass and the relationship of energy and mass.)
Section 4 - Chapter 3  What Makes Photons Move?

4.3.1 The Interaction of Observed and Unobserved Space
A key to unifying unobserved and observable space is tied to the physical properties of light. The proposal that observable space is in motion at speeds associated with the speed of light allows an easy explanation for the intrinsic energy of a mass at “rest”. The speed of light ties a relationship that can not only be described in observable space, but also unobserved space. Light reveals the inter-dimensional interaction between observed and unobserved space. Uniting the two spaces in a dynamic inter-dimensional geometry results in a number of simple explanations for common physical phenomenon.

4.3.2 Why Do Photons Move?
What makes the photon move so fast? Maxwell’s equations somewhat address the issue since the interaction of the electrostatic field and magnetic field of the photon are associated with the permittivity and permeability of electrostatic and electromagnetic fields in space which are functionally correlated to the speed of light. http://en.wikipedia.org/wiki/Vacuum_permeability

\[
c_0 = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}.
\]

This relationship works for the wave type characteristics for a photon, but the particle properties of the photon are not so easily explained. How can a photon, which carries no mass, but does have properties of momentum suddenly accelerate to the speed of light in an apparent instant? Also, what is the basis for the field structure that establishes the permittivity and permeability of space in the first place?

Why photons move.
It is the interaction of the photon with the moving and static multidimensional spacetime fields or structures of Space that causes the photon to move.

The speed of light is geometrically integrated into a dynamic multidimensional structure.

Multidimensional Field interaction
The dynamic structure of spacetime is a result of the intersection of the field relationships describing our observable measures of spacetime, with the “absolute” field relationships within unobservable space. Additionally, it is the geometric shape or response of objects caught between these two geometrically described fields that determine physical properties.

To visualize the extra dimensional relationships involved with the motion of photons, the flatland universe example is employed again. As seen in the following figure, an expanding ring results from the intersection of a field relationship with the shape of a cone. If photons were “caught” by the expansion of the ring, the motion of the photons would be geometrically described. Photons are like sailboats with the “keel” fixed in the observable measures of spacetime with the “sail” being pressed by the “wind” of unobservable space.

Electromagnetic Field similarity
A more familiar example of interacting fields producing motion would be a magnetic field passing orthogonally to a wire, inducing the motion of electrons or the creation of what is called current.
4.3.3 Figures Illustrating Interaction of Fields

Flatland universe example of an Extra-dimensional relationship that defines the speed of light

Cone represents the structure of Absolute space-time

Section of Flatland moving in an “unobserved” dimension with a velocity $V_u$.

$V_u$

"Ring" expands across Flatland as Flatland intersects the field relationship described by the "cone". The rate of expansion of the ring determines the speed of light.

The expansion of the “ring” in Flatland is similar to the expansion of a spherical shell of photons from a source in our observable spacetime.

Photons are “moved” by the inter-dimensional intersection of field relationships in space-time.

Figure 4-9 Intersecting fields and the speed of light

(If the expansion of observable space were also considered or integrated in the above flatland drawing, then two cones could be shown, one cone would expand with the expansion of the observable flatland universe, the other cone would expand with the speed of light.)
A Photon is like a sailboat with its “keel” set in observable spacetime.

Here we have a Flatland universe seen edge on with a photon.

And here we see an absolute spacetime that has a kind of structure as indicated by the pattern.

As the photon passes through the structure of Absolute Space, it is “slid” at what appears to be the locally observed speed of light.

“Sailboat” photons

Figure 4-10 “Sailboat” photons
Plane ABCD is along an “unseen dimension”
Plane EF, seen edge on, is perpendicular to plane ABCD.
A relative observer is on the observed Plane EF.
Plane EF, and the relative observer, are moving at velocity Vc, relative to an Absolute perspective.
The relative Observer “sees” light along the intersection of plane ABCD and the observers’ plane, seen on edge.

If \( Vu = c \sqrt{2} \) so that \( E = mcc = \frac{1}{2}m(VA)^2 \), (which reduces the relationship to kinematics)

Then the “True” or “Absolute” speed of light is described by this triangular relationship

\[
C^2 = Vu^2 + c^2 = (c \sqrt{2})^2 + c^2 = c^2(1+ 2)
\]

\( C = c\sqrt{3} \)  \textbf{Equation 4-3, 1}

\textbf{Figure 4-11 Geometry of the Motion of light}
4.3.4 Expansion Allows Change
The model provides a very simple explanation for the observed speed of light limit to the velocity of an object. It is our motion along the unobserved dimension that establishes the speed of light in the first place. Without this expansion, there would be no opportunity for photons to change their physical location. A space that is not expanding does not allow change to occur.

Section 4 - Chapter 4 – More on the Cosmological Redshift

4.4.1 Cosmological Redshift Continued
The effects of the expansion of observable space produced no cosmological red shift. The photon also lost energy faster than matter, which also contains the ambiguity with respect to the reality that something moving at the speed of light cannot change but somehow the photon does.

What was observed was that the speed of light varied by $T^{-1/3}$ which also correlated to the ambiguity. If the photon had a longer wavelength directly related to its speed, without changing the energy content at the time the photon was generated, then the issue would resolve itself. This would be a "breaking" of the association of the photons wavelength and its energy content, but this variation on the rules would allow matter and energy to be equivalent over time. Out of curiosity I thought of abandoning the $E = f = c/\lambda$, and just look for a means of increasing the wavelength and decreasing the energy content of a photon in the past.

4.4.2 Forming the Wavelength and $V_u$
When an electron drops from one energy level to another, a given amount of energy is imparted to the released photon. The collapse of a volume of spacetime corresponds to a loss of mass from the atom. The greater the loss, the greater the energy imparted and the shorter the wavelength.

It is proposed that the above process does not define the wavelength entirely. The wavelength is also defined by the velocity of the object along the unobserved dimension. The wavelength is also changed proportionally to $V_u$. Since the velocity along the unobserved dimension varies over time, or was greater in the past, the wavelength imparted to the departing photon would be greater.

The wavelength of the photon released at the time is not defined entirely by the energy content at the time of creation, but also by the velocity along the unobserved dimension.

Wavelength of photon and Unobserved Velocity
The following Flatland illustration shows that the motion of observable space along the unobserved dimension forms the wavelength of a photon. As an electron “falls” from one energy state to another, it transcribes a distance measure over an interval of time. As this process occurs, the motion along the unobserved dimension imparts the wavelength characteristic to the photon. The faster the motion along the unobserved dimension, the longer the wavelength induced. Since the motion along the unobserved dimension is also proposed to adhere to the same set of expanding geometric field equations, the velocity along the unobserved dimension correspondingly decreases over the passage of absolute time. Objects that emit a photon when the universe was moving faster in the past, will have a longer wavelength compared to present measures.
Vu1 and Vu2 = Motion of “flatland”, (analogous to observable space) along unobserved dimension which helps determine the wavelength of the emitted photon corresponding to when the photon was produced. The faster velocity in the past creates a longer wavelength.

Figure 4-12 The Cosmological red shift partially corresponds to the Wavelength induced by the Velocity in the unobserved dimension
The physical or geometric relationship explaining how a photon has a wavelength imparted as a
physical characteristic also explains how a photon can apparently accelerate from a speed of 0 to
light speed at the speed of light. Before there was the somewhat evasive answer that the reason the
photon could accelerate so fast was that a photon has no mass, which allows it to accelerate to the
speed of light and this answer still left hanging a physical explanation as to how this process could
occur at the speed of light. The photon, (or volume of spacetime), is in essence already moving at
light speed, and the duration of the step off from unobserved space into observable space records
this process and is part of what establishes the photon's wavelength.

**Cosmological Redshift from Vu**

\[ \lambda_{\text{old photon}} = \frac{T}{V_u} \]  \hspace{1cm} Eq 4-4, 1?  (see “deal breaker” for “?” explanation)

**4.4.3 Cosmological Redshift and Energy**

Tying the formation of the wavelength of the photon to a physical process is appealing. If the energy
content was less in the past by \( \frac{T^{1/3}}{3} \), then the Energy issue in which the energy of the photon varied
differently from the energy content of matter would be resolved.

\[ E_{\text{photon}} = \frac{T^{-1}}{3} \]  \hspace{1cm} Eq 3-8,1

\[ E_{\text{photon}} \times \text{less energy due to longer wavelength} = \frac{T^{-1}}{3} \times \frac{T^{1/3}}{3} = \frac{T^{-2/3}}{3} = E_{\text{photon with longer initial wavelength}} \]  \hspace{1cm} Eq 4-4, 2?

Also since the wavelength is established in the past, this longer length would be stretched by the
expansion of space. Now the wavelength would be unchanging relative to the fabric of space, and the
photon produced in the past would be longer, a cosmological red shift would be produced. Also, the
energy relationship matches the expression derived for observable space. (Eq 3-2,14), which is
another encouraging aspect of the relationship. Unfortunately the wavelength does not.

\[ \lambda_{\text{old photon}} = \frac{T}{V_u} \]  \hspace{1cm} possible observed cosmolgical red shift  Eq 4-4, 1?

**4.4.4 The Deal Breaker**

The disconcerting aspect of this relationship is that it doesn’t make sense from a physical
perspective. One would think that if the atom were moving faster in the past the photon would have
more energy, or at least stay the same, since the photon has no mass. Why should the photon have
less energy? If the energy imparted to the photon is greater in the past when it is released from the
atom, how could it be less in the past? Also, destroying the relationship of \( E = f = c/\lambda \) seems to
be too contradictory to a model which proposes to proportionally maintain basic relationships. The
ambiguity is the reason for the question mark in Equation 4-4-?. The model is incomplete but, the
direction and type of energy variation over time that is necessary for the model to be consistent is
indicated. We know what we are looking for.
Section 4 - Chapter 5- Diminishing intrinsic Properties

4.5.1 Diminishing Intrinsic Properties
If our observable space is in motion within an Unobserved Space that is also expanding according to the same geometry that Observable space is expanding, then the Velocity of Observable Space must diminish with the passage of time. The diminishing velocity along the Unobserved Dimension must also diminish the intrinsic properties of inertia, intrinsic energy of a mass at rest, the speed of light and the formative process that defines the wavelength of a photon. There are also additional changes associated with dynamic systems that depend on a balance between inertial and spatial forces.

These intrinsic properties must conform to the dynamic relationships described by the Ratio of Times formulas since the same geometric expansion is assumed for both spaces.

4.5.2 Basic Formulas for Expanding Unobserved Space
Since the same geometric expansion is proposed for expansion along the unobserved dimension, the same basic formulas are similarly derived. The volume of Unobserved Spacetime varies to the square of the Absolute time elapsed.

\[ SU \sim T^2 \] Expanding "Unobserved" Volume Eq 4-5, 1

SU is unobserved space. Since this is a geometrically defined relationship the “==” notation can be used instead of the proportionality symbol.

4.5.3 Notation “U” or Italic
Adding a "U" term to indicate it is a relationship within unobserved space is a bit tedious and visually confusing. Since the forms of the equations within observable space and unobserved space are so similar, using a convention of “regular” text for observable space formulas and italic text for unobserved formulas will simplify the expressions.

\[ S == T^2 \] Expanding “Unobserved” Volume

4.5.4 Unifying k and \( k \)
It will be assumed that the rate of expansion of Observable space and Unobserved space share the same expansion factor \( k \). This is not required but it is the simplest model and it integrates or ties in the structure of space into a more consistent model.

\[ k = k \] Eq 4-5, 2
4.5.5 Ratio of Time formulas - Unobserved Space

Ratio of Time formulas - Unobserved Space

\[ S = T^2 \quad \text{Eq 4-5, 1} \]
\[ k = k \quad \text{Eq 4-5, 2} \]
\[ D = kT^{2/3} \quad \text{Eq 4-5, 3} \]
\[ V = (k^{2/3})/T^{1/3} \quad \text{Eq 4-5, 4} \]
\[ A = (-k^{2/3}) / T^{4/3} \quad \text{Eq 4-5, 5} \]

\[ D = T^{2/3} \quad \text{Eq 4-5, 6} \]
\[ V = T^{-1/3} \quad \text{Eq 4-5, 7} \]
\[ A = T^{-4/3} \quad \text{Eq 4-5, 8} \]
\[ E = T^{-2/3} \quad \text{Eq 4-5, 9} \]

4.5.6 A List of Intrinsic Properties that Vary Over Time
Since the inertial response of an object is determined by its velocity along the unobserved dimension, then the inertial mass of the object is going to vary by the velocity along the unobserved dimension. The following list defines the variation in the intrinsic properties due to the relationship along the unobserved dimension.

\[ M_i = T^{-1/3} \quad \text{Intrinsic inertia of Mass} \quad \text{Eq 4-5, 10} \]
\[ C = T^{-1/3} \quad \text{Speed of light} \quad \text{Eq 4-5, 11} \]
\[ E_i = T^{-2/3} \quad \text{Intrinsic Energy of Rest Mass} \quad \text{Eq 4-5, 12} \]
\[ A_i = T^{-4/3} \quad \text{Intrinsic Deceleration} \quad \text{Eq 4-5, 13} \]

The fourth term associated with acceleration is included since it was briefly mentioned as an intrinsic property in Figure 4-5

4.5.7 Worrisome Loss of Inertia and Consequences
Directly attributing the property of inertia to the velocity along the unobserved dimension is worrisome since this velocity is proposed to geometrically decrease with the passage of time, which therefore requires the property of inertia to diminish over time. The very perfect structure that the expansion of observable space preserved in orbiting systems bound by gravity and charge would now be destroyed. As inertial mass decreases, the effect of the forces of gravity and charge would draw their orbiting masses inwards. Orbiting systems collapse, rotating galaxies compress, atoms contract. I must say that it was with some reluctance that the proposed extra dimensional expansion was added to the model. It should also be noted that such collapse of dynamic structure occurs slowly, over cosmological intervals of time, that changes observed locally would be extremely difficult to detect.

One somewhat reassuring aspect of this is that as astronomical relationships defined by gravity collapse, so to would the orbital relationships defined by charge. Matter would essentially shrink the same proportional amount and local measures of astronomical relationships would appear to remain the same.
Predictions due to loss of inertia
If inertia is lost over time then there should be evidence of the result of such loss. Over time orbiting bodies would contract. Since the rate of loss slow, observations over long intervals of historical time, or over an accumulated period of time, would be necessary.

The following effects should be observed due to a loss of inertial mass. If there is no observed evidence of the proposed effects, the model fails.

1. Orbiting systems would slowly contract over time.
2. Solar systems would contract over time.
3. Galaxies would contract over time.
4. Galaxies would appear to be experiencing an extra force maintaining their dynamic structure.
5. The orbital configuration of electrons around Atoms would contract over time.
6. If solar systems and rulers made of atoms contract, and they would contract at essentially the same proportional amount, then this makes local measures of such changes difficult to measure. Comparisons would have to be made over cosmological distances.
7. Clock rates based of orbital systems would appear to be slower in the past since the contraction of orbital systems would cause the orbital rates to speed up due to conservation of angular momentum. As a spinning skater drawn in her arms, the spin rate increases.
8. The electrostatic field electrons would be orbiting in would be denser over time, which, if the wavelength of light is associated with the physical drop of an electron from one energy level to another, then the wavelength of light emitted from an electron dropping from one energy level to another would be “bluer” in the present than the past. A cosmological Red shift would be predicted.
9. Possible variation in the Fine Structure Constant, due to electrons being closer to the nucleus and from the acceleration inwards associated with contracting orbits.

4.5.8 Varying Speed of Light
An advantage of the extra dimensional expansion model is that the variation in the speed of light is tied to the structure of the expansion of space. This helped avoid a potential flaw in the proposed model. If voids were causing the slowing of a photon, one would expect some kind of variation of position of the photon as it travels through space. A blurring of distant images would be expected. By tying the speed of light to the structure of space itself, the loss of velocity of objects with mass is differentiated from that associated with the decreasing velocity of light.

4.5.9 Loss of Intrinsic Energy and Stars
The loss of intrinsic energy associated with a mass at rest has a rather profound effect when the energy production of stars is considered. The further away in the past a star is observed, the greater the amount of energy produced when two atoms of hydrogen fuse together. Stars in the past should get brighter the further in to the past they are observed. Since the brightness of cosmological objects are used to estimate distance, this is going to effect the estimated distances to those objects. This would be in addition to the increased effect of gravity associated with observable space.

4.5.10 Loss of Intrinsic Deceleration
The possible role of an intrinsic deceleration and its decrease with the passage of time will be discussed in later. (Most likely in the verification section) For now it appears that an omnipresent acceleration inward would seem to act as a kind of pressure. This pressure may act as a stabilizing component for preserving structure. If this is so, then the decrease in its measure would tend to indicate that structure becomes less stable over time.
Section 4 - Chapter 6 - Spatial and Inertial Mass and Force

4.6.1 Spatial and Inertial Mass and Force
This section continues the ramifications of allowing inertial mass to change over time with respect to two kinds of forces, spatial and inertial.

4.6.2 Non-Equivalency of Inertial Mass and Spatial Mass
It is generally assumed that the mass associated with gravitational or charge based forces is the same as the mass associated with inertial forces. This is a big assumption, especially when one considers the vastly different causes for the creation of a force.

Inertial mass produces a force when there is a change in the direction or magnitude of the objects velocity.

Gravitational mass produces a force by the relationship the object has with the field structure of spacetime around it interacting with the field structure imposed by another mass on the structure of spacetime around it.

Similarly, an electrostatic mass produces the same kind of interacting field structure or relationship producing a spatial – field based force.

As seen within observable space, an inertial force requires a change in velocity while a spatial force exists as a result of a spatial interaction between a mass and the shape of spacetime around the mass. (An object in “free fall” experiences no force at all despite a change in velocity since the force exerted by gravity is exactly countered by the inertial effect of an ever-increasing velocity.)

Since gravitational mass and electrostatic mass are both described by spatial field like relationships, it makes sense to refer to the property of mass that is involved in spatial based interactions as a Spatial Mass.

The assumption of equivalency for spatial mass and inertial mass is no longer true. Inertial mass decreases over time since the Inertial characteristics of mass includes the influence of the velocity of observable space along the unobserved dimension over the passage of time while the spatial relationships of matter and spacetime are kept proportionally the same within both unobserved space and observed space due to an interlocked geometric expansion of Space. A spatial mass would not diminish its measure or effect on the structure of spacetime with the decreasing velocity along the unobserved dimension since it is its “volume” like or field properties that determine its effect on the structure of spacetime, not its inertial properties. The volume or field based properties of matter increases at the same proportional rate as the spacetime the matter is contained in.
Here we see that the spatial field relationship between two objects remains proportionally the same between T1 and T2 within a proportional expansion of spacetime.

Spatial Field properties of two objects at T1 and T2. Proportionally the spatial field relationships stay the same with a proportional expansion of spacetime that includes the expansion of the objects in it.

Figure 4-13   Fields Proportionally Expand
4.6.3 Relationships of Spatial Mass and Inertial Mass

One consequence of breaking off the inertial property of mass from matter is that an additional insight as to nature of mass is revealed.

In this case, Gravitational Force is the result of the interacting spatial fields generated by the physical "impression" or change in the field structure of spacetime that the mass imparts on the field structure of spacetime. This "impression" of one field to another is a spatial property, meaning that there is a volume property to matter that is directly correlated to the Atomic "weight" of the atoms involved. Actually, rather than using the term Atomic Weight, it would be better to associate the property with an atomic volumetric property, and it is a conversion factor that correlates the volume to a weight in a gravitational field. For example, a Proton's charge would have a volumetric property. This property would be a fixed to, and expand with the structure of expanding observable space.

Since the volume of an object proportionally expands with the spacetime it is imbedded in, the field-based relationships are proportionally maintained. If the gravitational mass doubles in volume, the observable space around the mass similarly doubles, the proportional change is identical and no observable change would result.

**Spatial Mass in general, or gravitational with “g”mass, use a “c” for charge**

\[
\begin{align*}
ms &= Ms = 1 & \text{Eq 4-6, 1} \\
mg &= mc = Ms = 1 & \text{Eq 4-6, 2}
\end{align*}
\]

- mg = gravitational mass constant in relative space
- mc = effect of charge constant in relative space
- Mg = Gravitational Mass within expanding observable space

**Inertial Mass**

The inertial mass of an object is defined by the scalar intrinsic relationship of mass, \( m_i \), times its velocity along the unobserved dimension. Since this unobserved velocity varies according to the relationships established by the geometric expansion of spacetime, the predicted decrease in unobserved velocity corresponds to a decrease in inertial mass with the passage of historical time.

**Actual inertial mass variation over Historical time.**

\[
MI = Vu = T^{1/3} \quad \text{Eq 4-5, 10}
\]

- MI = Intrinsic Inertial Mass
- m = scalar term associated with the particle(s)
- Vu = Velocity along unobserved dimension

\[
MI1 = m \times T^{1/3} \quad \text{Eq 4-5, 11}
\]

It is only because the rate of change in inertial mass is so slow that the assumption that inertial mass and spatial mass is the same works for most situations.

**4.6.4 Spatial and Inertial Forces**

Gravitational and Inertial mass are no longer the same in this model. Gravitational mass and its' association with force is kept the same with the expansion of Space. Inertial mass and its' association with force is diminished with the loss of velocity along the unobserved dimension. Since there is now a difference between inertial and gravitational mass with respect to how they vary with the passage of Historical time, there is a different description for the relationships associated with spatial and inertial forces.
**Spatial Forces**

It was proposed earlier in the development of the expansion of observable space that the accelerative field associated with an expanding spacetime field for spatial forces was...

\[ F_g = F_c = T^{-4/3} \quad F = T^{(-4/3)} \quad \text{Eq 3-6, 1} \]

Force of gravity and Force due to charge are predicted to change over cosmological intervals of time. It is important to note that these relationships were derived on volume properties of spacetime.

- \( F_g \) = Force of Gravity
- \( F_c \) = Force of Charge
- \( F_s \) = Spatial Force

Electromagnetic and gravitational forces are the result of their spatial properties they are field based interactions within Space and can be generally called Spatial Forces.

It is not the inertial mass that is involved with gravitational relationships, but the volume or spatial properties associated with the mass. Since the objects and spacetime proportionally expand the same amount, the relative spatial relationship of the objects to the surrounding spacetime field stays proportionally the same.

**Inertial Forces**

The impact of allowing inertial mass to change alters the relationship associated with forces with the passage of time. For example, consider \( F = ma \).

Expansion of Observable space with loss of inertial mass. This time mass does not divide out

\[ \frac{F_I}{M_i} = \frac{M_i \times A}{T^{1/3} \times T^{-4/3}} = T^{5/3} \quad \text{Eq 4-6, 3} \]

**4.6.5 Balance Lost- Collapsing Orbits**

Spatial Forces do not change at the same rate that Inertial Forces change

\[ \frac{F_I}{T^{5/3}} \neq \frac{T^{4/3}}{T^{4/3}} = F_g = F_c \quad \text{Eq 4-6, 4} \]

The balance between centrifugal and gravitational forces is no longer preserved for constant radius orbits, which means that orbits must collapse in order to restore the balance between centrifugal and gravitational forces.
4.7 Conservation of Motion, Rotational and Linear Intervals

The change in inertial mass does not change the velocity of a moving object that is not accelerated, as observed in relative space. For example, if an object were moving at a given velocity and the inertial mass were simply reduced without any net preferential direction in dispersion of mass, such as two equal streams of matter emitted orthogonally to the direction of motion of the moving mass, the object would still have the same velocity. This conservation of motion relationship is also true within Observable space due to the effect of Unobserved Space's loss of inertial mass.

Since velocity as observed within observable space is unaffected by the variation in its inertial mass, the interval of time described by an object moving across an interval of distance would still be the same. This results in augmenting or transforming the concept of conservation of momentum with the concept of conservation of motion.

Conservation of rotational motion and linear motion within observational and relative space

In systems in which there is no exchange of momentum to other objects, or a change in outside forces are applied, what is being described over the passage of time is a conservation of rotational and linear measures of motion within observational space and relative space.

Change in Distance or angular measure per time = constant

or expressed as an absolute ratio

\[ \text{MOTION} = \text{constant} \quad \text{Eq 4-7, 1} \]

Splitting hairs with Conservation of Momentum

If the object is un-accelerated and mass does not change, the measure of change of distance per time does not change in relative space and the proportional measure of motion within observable maintain their proportional value. The distance or angle measure change per time relationship is conserved, which is a transformed version of Newton's first law. Which poses the question as to why complicate the issue and introduce a new expression for the Conservation of Momentum Principal? The intent is to clarify the relationship where inertial mass is lost over time. Technically there would be a loss of Momentum since mass is lost, but now in this model there would be a perseverance of the Conservation of Motion.

Conservation of Motion in due to Unobserved Space

The variation in mass due to the change in velocity of observable space along the unobserved dimension has no effect on the velocity (so long as no forces are applied to the mass).

\[ \text{MOTION} = M_1 \times \frac{V}{T} = 1 \times \frac{D}{T} = \text{constant} \quad \text{Eq 4-7, 2} \]

Angular momentum and rotational intervals

Applying the same physical relationships of linear motion to rotational motion, the following relationships describing rotational intervals are established. Since mass is not changing within observed space, or its variance is not altering the intervals of distance and intervals of time involved in Unified space, we get the following relationships as observed in relative space, or locally.

Rotational intervals in relative space

\[ v_a \times r_a = v_b \times r_b \quad \text{Eq 4-7, 3} \]

\( v \) refers to the tangential velocity, which is perpendicular to the radius \( r \), defining the orbit of motion. This is conservation of angular momentum with the influence of mass being removed or held to a constant. (A non-relativistic expression). There is no transference of
momentum to another object nor are any additional outside forces involved or added to the system being considered.

Rotational intervals due to effects of Unobserved Space

\[ \text{ROTATIONAL MOTION} = V_a x R_a = V_b x R_b \]  
Eq 4-7, 4

The same conservation of rotational and linear intervals relationship is valid in relative space, and observable space.

\[ \text{ROTATIONAL MOTION} = V_a x R_a = V_b x R_b \]  
Eq 4-7, 5

Section 4 - Chapter 8 - “Orbits” with Decreasing Inertial Mass

4.8.1 Orbits Represent Systems Balanced by Inertial and Spatial Forces

While the primary application of the proposed relationships will deal with orbital relationships, what are being described generally are any dynamic system that is balanced between spatial forces and inertial forces. For example, atomic clocks and stars are in a balance between inertial and spatial forces and as such would be conformant to the general effects described below. The term “orbit” is to represent any system that is described by an interaction between inertial and spatial forces.

4.8.2 “Orbital” Relationships Change

The prediction of the proposed model that inertial mass decreases according to an extra dimensional, geometrically defined relationship alters gravitationally or spatially bound orbiting relationships. This is because spatially defined relationships maintained their proportional effects on measures of distance and time but inertial based relationships do not.

For example, it was shown earlier that within expanding observational space that two objects bound by gravity (or any spatially defined relationship), would be dynamically stable with local and absolute measures staying proportionally the same. Even orbits observed in the past would appear to keep their apparent expected measure since spatial expansion and time dilation balanced the smaller and faster clock rates in the past. This balance was dependent upon the equivalence of inertial and spatial mass.

This balance was lost once inertial and spatial masses were no longer equivalent. As inertial mass is lost, gravitational or spatial forces would cause an inward draw of the orbiting objects, be it electrons in atoms or orbiting celestial objects.

Rulers and clocks in the past would now appear to differ from those in the present.

4.8.3 Shrinking Celestial Orbits and Shrinking Rulers

Initially it may seem that this decrease in orbital relationships would be locally observable or even provide a basis to invalidate the model. The observed balance between centrifugal and gravitational forces is evidenced in our solar system with no obvious motion of the planets. Offsetting the slow collapse of orbiting objects in observable space is the fact that orbital relationships also define the size of atoms, which therefore describes the size of the local rulers used to measure the size of the orbits. If orbits of celestial objects decrease in size while the size of your ruler also proportionally reduces in size, the result is no locally measurable variation in size.

However, evidence of these changes are observed, as will be described later, but the evidence involves looking back in time (or far away), or to consider the effects with the passage of time. For now what will be done is to develop the measures of distance and time that describe Orbital relationships.
4.8.4 Balancing Orbital Relationships
Orbital relationships are defined by a balance between inertial or centrifugal forces on one side of the balance, and spatially based forces defined by field effects on the other side.

If the inertial mass were to change as proposed due to the change in intrinsic Mass, the centrifugal force associated with the orbiting object(s) would diminish while the force associated with the effect of gravity or charge does not. This causes the rotating objects to be drawn closer together. As this happens, the velocity of the rotating objects increase due to the conservation of motion; a shorter rotational radius requires a higher rotational velocity. The higher velocity increases the centrifugal force till there is again the equivalency between centrifugal and gravitational forces.

Unobserved Space effects
The perspective used to describe orbital relationships caused by the loss of balance between spatial and inertial forces are within unobserved Space. The expansion effects from Observed space are, for now, ignored. Ignoring the effects of observable space is somewhat justified since there is no change in the relationship between inertial and spatial forces within observable space. The integration of the effects due to observable space will be described later as occurring within Unified Space. Visually this corresponds to an “Eye of God” perspective describing an orbital relationship that loses inertial mass while only looking at the effect of unobserved space. (Note the use of italics to establish effects associated with Unobserved Space or the unobserved dimension).

Stable orbital relationships are based on a balance between inertial and gravitational forces…

\[ CF = GF \quad \text{Eq 4-8, 1} \]

\[
\frac{Mi1a \times V1^2/R1}{G \times mga \times mgb /R1^2} = \frac{Mi2a \times V2^2/R2}{G \times mga \times mgb /R2^2} \quad \text{Eq 4-8, 2}
\]

\(Mi1a\) = The measurable value for inertial mass “a” at historical location T1.
\(Mi2a\) = The measurable value for inertial mass “a” at historical location T2
\(mga, mgb, \) gravitational mass a and b, maintain their measure
\(V\) and \(R\) are the observed measure of velocity and distance or orbital radius in Unobserved Space as seen from an Eye of God perspective.

4.8.5 Orbital Velocity and Radius
From conservation of rotational intervals we have…

\[ V1 \times R1 = V2 \times R2, \text{ or } V1/V2 = R2/R1; \quad V = R^1 \quad \text{Eq 4-8, 3} \]

\[ CF = GF \quad \text{becomes} \]

\[ Mi \times \frac{V^2}{R2} = \frac{1}{R2^2} \]

\[ Mi \times \frac{V^2}{R} = \frac{1}{R} \quad \text{which is } V \]

\[ Mi = R = V^1 \quad \text{Eq 4-8, 4} \]

The inertial mass varies over time by the change in velocity of observable space along the unobserved dimension yield the variation in orbital radius and velocity over absolute time.

\[ Mi = R_{\text{orbit}} = V_{\text{orbit}}^1 = T^{1/3} \quad \text{Eq 4-8, 5} \]

The orbital velocity and radial measures of orbiting systems change over time.
4.8.6 Orbital Periods and Clock Rates

\[ T_{\Delta\text{orbit}} = \frac{D}{V} = \frac{T^{1/3}}{T^{1/3}} = T^{2/3} \quad \text{Eq 4-8, 6} \]

Orbital period and clock rates

Any dynamic system that oscillates as a result of a balance between Spatial and Inertial Forces establish a period or an interval of time. While the term “orbit” is used, any dynamic system defined by a simple balance between spatial and inertial forces is represented. (Simple means there are no other compounding factors involved.)

\[ T_{\Delta\text{orbit}} = T^{2/3} \quad \text{Eq 4-8, 6} \]

4.8.7 Local and Cosmological Measures

The above variation in the relationships defining the size and period associated with dynamic systems is from the Eye of God perspective looking at only the effects due to unobserved space. These variations in measures of distance and time, using local inertial clocks and local rulers to measure local events would not be measured. For example if the distance from the Earth to the Sun decreases to 1/2 over time, and the ruler used to measure the change similarly decreases to 1/2 its measure over time, proportionally all local measures stay the same. If temporal measures of an atomic clock, which uses dynamic resonance, is used to measure intervals of time associated with orbiting planets, the speeding up of the intervals of time would keep in sync.

Cosmological measures

However, observations made of events in the distant past should show evidence of these effects. For example, From the Eye of God perspective, a ruler in the past would be bigger than one used in the present, so objects observed in the past should appear bigger than they do in the present.

Also, clock rates should be observed to “tick” slower in the past so clocks observed in the past should appear to tick slower than they do today.

These are predicted properties that should be observed if the model is correct. What is somewhat reassuring, the Limited Expansion model also corresponds to, and depends on observational evidence of similar effects for support of its model.

4.8.8 Formulas for Orbital Relationships of Unobserved Space – Loss of inertial mass

When the effect of the loss of inertial mass is considered, without including the effects from the expansion of observable space, the following variations in measures of intervals of distance, time and velocity are realized.

\[ \begin{align*}
R_{\text{orbit}} &= \frac{T^{1/3}}{1} \quad \text{orbital radius larger in past} \quad \text{Eq 4-8, 5} \\
V_{\text{orbit}} &= \frac{T^{1/3}}{T} \quad \text{velocity slower in past} \quad \text{Eq 4-8, 5} \\
A_{\text{orbit}} &= \frac{T}{T} \quad \text{acceleration} = \frac{V^2}{R} \quad \text{Eq 4-8, 6} \\
T_{\Delta\text{orbit}} &= \frac{T^{2/3}}{T} \quad \text{orbital periods longer in past} \quad \text{Eq 4-8, 10} \\
M_i &= \frac{T^{1/3}}{1} \quad \text{Inertial mass greater in past} \quad \text{Eq 4-5, 10} \\
M_g &= 1 \quad \text{Gravitational mass constant} \quad \text{Eq 4-6, 2} \\
M_s &= 1 \quad \text{Spatial mass constant} \quad \text{Eq 4-6, 2}
\end{align*} \]
Section 4 - Chapter 9 - Cosmological Redshift

4.9.1 Cosmological Redshift Continued in Unobserved Space.
The energy content of a photon produced by an electron “dropping” from one energy level to another is dependent upon the intensity of the electrostatic fields the electron must drop through. The intensity varies to the inverse square of the distance to the nucleus. (Ignoring the center of mass variation between the nucleus and electron relationship involved for conceptual simplicity).

As an electron moves closer, or “falls” towards the nucleus, due to the loss of inertial mass of the electron, the electrostatic field the electron orbits through becomes more intense. This increases the energy content associated with each of the orbital energy levels available to the electron within the atom. This more intense orbital field allows the creation or absorption of a higher energy photon when the electron falls or rises between orbital fields. A photon with more energy has a shorter wavelength, or it is “bluer”. There is no addition or creation of energy to the system since the energy imparted within the more intense electrostatic field is due to the electron “falling” within the electrostatic field.

The loss of inertial mass would result in photons that are “bluer” today than they were in the past. Since we assume our local measure of the wavelength of a photon is unchanged, the wavelength of a photon from the past is observed to be longer or “redder” than a similarly produced local photon.

4.9.2 The Cosmological Redshift and Electrostatic Fields
One way to visualize the variation of the energy content between orbital levels with the passage of time is to imagine that Coulomb’s constant is increasing over time. This would produce the same effect of electrons being drawn inwards to the nucleus since the electrostatic field simply becoming more intense. The increase in Coulomb’s constant necessary to draw the electrons to the correct orbital distances would produce the necessary electrostatic field density around the atom.

This analogy may be confusing since Coulomb’s constant and the Gravitational Constant are not changing, it is more like the effect of Coulomb’s constant is changing and the effect of the gravitational constant is changing, but it is from this perspective it was initially easier for me to physically understand and describe what was happening

4.9.3 Energy Variation Over Cosmological Time
What will be done now is to determine the energy variation associated with the change in electron orbit over time. This energy variation can then be used to establish the variation in the wavelength over time.

Potential Energy of Spatial Field of electrons with orbital distance
\[ U = -C \times qa \times qb / r \]

Where Coulomb's constant is constant, as well as the value of charge, we get

\[ U \approx -1 / R \]

which, transforms to

\[ U = R^{-1} \]

In section 2.7 it was shown that the radius of orbiting objects would vary by.

\[ R_2/R_1 = \sqrt[3]{1} = R^{-1} \]

so,

\[ U = T^{1/3} = E_{past \ atom/now \ atom \ -photon} \]

Eq 4-9, 1

Notation Caution
Note the expression is for the observed energy content of an old photon observed in the present.
The further in the past a photon is produced, the less energy is imparted to the photon due to the less intense electrostatic field surrounding the electron orbital shells. (Ignoring for now the effects predicted from observable space)

### 4.9.4 Cosmological Redshift, \( \lambda_{\text{comological}} \)

Translating the relationship \( E = \frac{hc}{\lambda} \) for the wavelength variation due to the effects of unobserved space finally produces an observable Cosmological Redshift ratio. (Observable space effects were self-canceling).

\[
\lambda_{\text{comological}} = \frac{\lambda_{\text{now atom/past atom-photon}}}{T^{1/3}} = \frac{C}{E_{\text{now atom/past atom-photon}}} = \frac{T^{2/3}}{T^{1/3}} = T^{2/3} \quad \text{Eq 4-9, 2}
\]

This relationship matches the variation in the wavelength with the stretch of observable space, \( D = T^{2/3} \) (The inverse relationship is right since the size established in the past would be expanded)

And this change in the observed wavelength of the “past” photon to the “now” or local photon would not violate the desired requirement that the wavelength of the photon actually changes its length only relative to the fabric of observable space since the change in wavelength is the result of the difference in the wavelength established in the past and is then compared to the wavelength established in the present. Even the proposed formation process that established the wavelength due to the velocity along the unobserved dimension works since it is the speed of light that also establishes the wavelength.

The spectra of a photon produced in the past would have a greater wavelength than a photon produced in the present, and the Energy content in the past would also be less.

Equation 4-4.1 \( ? \) and Equation 4-4, 2\( ? \), formally designated with “?” now have a physical justification.

### Section 4 - Chapter 10 – Equivalency Between Matter and Energy Restored

The ambiguity that resulted from the non-equivalency of matter and radiant energy with the passage of time is now resolved. The rate that a photon loses energy with the passage of time is exactly the same rate that the “intrinsic” energy of a rest mass loses energy. This is because the higher velocity along the unobserved dimension increases the inertial mass of an object in the past.

Previously...

\[
E_{\text{photon}} = \frac{C}{\lambda} = \frac{T^{(-1/3)}}{T^{(2/3)}} = T^{-1} \quad \text{Eq 3-8-1}
\]

Now that the inertial property of mass is also time dependent the equivalency is restored.

\[
E = M \cdot c^2 = \frac{T^{(-1/3)}}{T^{(2/3)}} = T^{-1} \quad \text{Eq 4-10, 1}
\]

Equivalency is restored! A gram of matter loses energy at the same rate that a gram of radiant energy loses energy.
Section 4 - Chapter 11  Shrinking Rulers and Faster Clocks

4.11.1 Shrinking rulers
If the orbital size of atoms shrinks due to the loss of inertial mass, then rulers, which are constructed with atoms, should also shrink. This means that when a local ruler in the present is used to measure the wavelength of a photon produced in the past, the wavelength would be measured locally bigger when compared to an absolute ruler that does not change over time.

(The effects of unobserved space are only being considered now. The expansion of the atom within observable space produced no observable variation in the size of objects observed in the past due to the stretch of space).

Since the radius of the atom was predicted to vary by...

\[ R^1 = T^{1/3} \]

rulers composed of atoms should also vary at the same rate.

\[ r_{ruler} = T^{1/3} \text{ Eq 4-11, 1} \]

Objects observed in the past, would appear bigger using a smaller local ruler. Again this is just based on the relationships of Unobserved space. The effects of observable space are not included.

4.11.2 Faster Clocks and Time Dilation Restored
As orbits in unobserved space contract, their period would speed up. For clock rates that are established by a balance or resonance between inertial and spatial forces this would result in

\[ T_{\Delta \text{orbit}} = T^{2/3} \text{ Eq 4-11, 2} \]

orbital periods longer in past

If one was using a local clock to measure intervals of time in the past, they would appear to be longer or dilated.

This is restoring the relationship of time dilation. It is also in direct proportion to the stretch of space. which is maintaining the models consistency with the expectation that the stretch of space correlates to the dilation effects of that stretch.
4.12.1 Radial acceleration
The change in radial orbit due to the loss of inertial mass is of some interest to determine since it corresponds to an inward acceleration not expected in limited expansion models. As shown below it is a very small effect.

\[ R^{-1} = \frac{T}{1/3} \]

\[ \frac{R2}{R1} = (\frac{T1}{T2})^{1/3} \]

\[ R2 = (R1 \times T1^{1/3}) \times T1^{1/3} \]

\[ \frac{dR2}{dT^2} = (R1 \times T1^{1/3}) \times 4/9 \times T1^{-7/3} \]

At present, \( T0 \), where \( R2 = R1 = Ro \)

\[ \frac{dRo}{dT^2} = (Ro \times T0^{1/3}) \times 4/9 \times T0^{-7/3} = Ro \times 4/9 \times T0^{-2} \quad \text{Eq 4-12, 1} \]

4.12.2 Effect Very Small
In a \( 10 \times 10^3 \) year old universe, at a radius of 50,000 light years (a galaxy sized radius), the radial acceleration is about \( 4.7 \times 10^{-18} \) meters second\(^{-2} \). This is much smaller than the acceleration associated with Dark Matter within galaxies, (about \( 10^8 \) times too small), but it is important when considering the shape and form of galaxies established over time and when considering clusters of galaxies over time. The variation over time also affects the wavelength of an emitted photon over time, but this would be a very minor effect.
### Unobserved Space, Basic Formulas

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S = T^2$</td>
<td>Eq 4-5, 1</td>
</tr>
<tr>
<td>$k = k$</td>
<td>Eq 4-5, 2</td>
</tr>
<tr>
<td>$D = kT^2/3$</td>
<td>Eq 4-5, 3</td>
</tr>
<tr>
<td>$V = (k T^{2/3}) / T^{1/3}$</td>
<td>Eq 4-5, 4</td>
</tr>
<tr>
<td>$A = (-k^{2/9}) / T^{4/3}$</td>
<td>Eq 4-5, 5</td>
</tr>
<tr>
<td>$D = T^{2/3}$</td>
<td>Eq 4-5, 6</td>
</tr>
<tr>
<td>$V = T^{1/3}$</td>
<td>Eq 4-5, 7</td>
</tr>
<tr>
<td>$A = T^{4/3}$</td>
<td>Eq 4-5, 8</td>
</tr>
<tr>
<td>$E = T^{2/3}$</td>
<td>Eq 4-5, 9</td>
</tr>
</tbody>
</table>

### Intrinsic Properties that Change

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M_i = T^{-1/3}$</td>
<td>Eq 4-5, 10</td>
</tr>
<tr>
<td>$C = T^{-1/3}$</td>
<td>Eq 4-5, 11</td>
</tr>
<tr>
<td>$E = T^{-2/3}$</td>
<td>Eq 4-5, 12</td>
</tr>
<tr>
<td>$A_i = T^{-4/3}$</td>
<td>Eq 4-5, 13</td>
</tr>
</tbody>
</table>

### Spatial mass constant

$ms = Ms = 1$  
Eq 4-6, 1

### Collapsing Orbits

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
</table>
| $Fl = T^{5/3} 
eq T^{-4/3} = Fg = Fc$ | Eq 4-6, 4 |
| MOTION = constant | Eq 4-7, 1 |
| ROTATIONAL MOTION = $V_a x R_a = V_b x R_b$ | Eq 4-7, 4 |

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Mi = R_{orbit} = V_{\text{orbit}} = T^{1/3}$</td>
<td>Eq 4-8, 5</td>
</tr>
<tr>
<td>$T_{\Delta \text{orbit}} = T^{2/3}$</td>
<td>Eq 4-8, 6</td>
</tr>
<tr>
<td>$\Lambda_{\text{cosmological}} = T^{-2/3}$</td>
<td>Eq 4-9, 6</td>
</tr>
<tr>
<td>$E_{\text{photon past atom/ photon now atom}} = T^{1/3}$</td>
<td>Eq 4-9, 1</td>
</tr>
<tr>
<td>$dR_o/dT^2 = R_o x 4/9 x T_o^{-2}$</td>
<td>Eq 4-12, 1</td>
</tr>
</tbody>
</table>

### Energy of Matter and Photon

$E = M cc = T^{1}$  
Eq 4-10, 1

$E_{\text{photon}} = c / \lambda = T^{-1}$  
Eq 3-8-1

### Shrinking Rulers and Faster Clocks

$R_{\text{ruler}} = T^{1/3}$  
Eq 4-11, 1

$T_{\Delta \text{orbit}} = T^{2/3}$  
Eq 4-11, 2
Section 4 - Chapter 14  Perspectives in Unified Space

4.14.1 Unified Space
The integration of the Effects of Observable Space and Unobserved space are characterized as occurring in Unified Space. The primary focus here will be on how orbital or simple dynamic relationships are observed depending upon the perspective used.

4.14.2 Three perspectives in Unified Space
There are three perspectives used here to describe nature.

1. Absolute or an “Eye of God” perspective.
2. Local – Local perspective.
3. Local-Cosmological perspective.

4.14.3 Absolute Unified Space – Absolute perspective
From the Eye of God perspective the effects of the Expansion of Space and Unobserved Space add together. Clock rates slow down due to the expansion of observable space and speed up due to the loss of inertial mass due to the effects of Unobserved Space. Rulers expand due to the expansion of observable space, and contract due to the loss of inertial mass. Both effects on the behavior of matter are added together. Overall, as seen from the Eye of God perspective the effects of observable space are more powerful than the effects of Unobserved Space.

4.14.4 Local Unified Space – Local Observer with Local Perspective
Within Local Unified Space are descriptions or measures made by local clocks and local rulers for local events in the present. Since local measures keep their proportional measures locally, measures of distance and time appear to be invariant.

4.14.5 Local- Cosmological - Unified Space; Local Observer with Historical or Cosmological Perspective
A local observer looking at objects at cosmological distances is observing relationships as they were in the past. Since the variation in distance and time intervals within Observable space are self-canceling when observing events at cosmological distances, only the effects of Unobserved Space would be observed from the local perspective. Since the effects of Unobserved Space causes clocks to speed up and rulers to contract, orbital relationships observed in the past when measured using these locally smaller rulers and locally faster clocks would measure cosmological events observed in the as being dilated. Orbital periods in the past would appear to take longer, and the image observed would appear to be stretched or larger than if there was no expansion.

Total elapsed time would be actually be greater since the variation of clock rates of observable space are faster than the variation of clock rates in unobserved space. Also, this would have to be an inferred effect. For example, If the age of a star were estimated by how long it takes to burn a certain amount of fuel more time would have elapsed than would be assumed one would think, based on the assumption that local clock rates did not vary.

4.14.6 Notation
The following notation, as stated earlier will be used to describe relationship within the various spatial perspectives.

<table>
<thead>
<tr>
<th>Relative space,</th>
<th>Lower case letters</th>
<th>d,v,a,t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Observable Space,</td>
<td>Capitol letters.</td>
<td>D,V,A,T</td>
</tr>
<tr>
<td>Absolute Unobserved Space</td>
<td><em>Italic Capitol letters</em></td>
<td>D,V,A,T</td>
</tr>
<tr>
<td>Unified Cosmological Absolute</td>
<td>Capitol Bold letters</td>
<td>D,V,A,T</td>
</tr>
<tr>
<td>Unified Cosmological Local</td>
<td>large bold lower case</td>
<td>d,v,a,t</td>
</tr>
</tbody>
</table>
Section 4 - Chapter 15   Orbital Relationships in Unified Space

4.15.1 Unified Space
The expansion of observable space, combined with the loss of inertial mass associated with unobserved space occur together according to a specific geometry. The combined effects on orbital relationships are described as occurring within unified space. Unified Space is an Eye of God perspective on the results of the Expansion of observable space and the loss of inertial mass due to the relationship to unobserved space.

4.15.2 Orbital = Dynamic
The use of the term orbital relationship can be understood to also represent any simple dynamic system, which balances a spatial force against an inertial force.

4.15.3 Absolute Distance Measures of Orbital Relationships in Unified Space
As seen from an Eye of God perspective, the expansion of observable space is defined by
\[ R = T^{2/3} \]
The loss of inertial mass due to the relationship with unobserved space, decreases the orbital radius of atoms and gravitationally defined objects is described by
\[ R = T^{-1/3} \]
with the net effect on orbital defined distance measures in Unified Space being
\[ (R \times R_{\text{orbit}}) = T^{2/3} \times T^{-1/3} = R_{\text{orbit}} = T^{1/3} \quad \text{Eq 4-15, 1} \]

4.15.4 Absolute Velocity of orbiting objects in Unified Space
As seen from the Eye of God perspective, the velocity of orbit defined objects in observable space decreases with the passage of time.
\[ V_{\text{orbit}} = T^{-1/3} \]
The loss of inertial mass causes the orbital velocity of an orbiting object to increase with the passage of time,
\[ V_{\text{orbit}} = T^{1/3} \]
The net effect in unified space, as seen from the Eye of God perspective, is for the two effects to cancel so that the observed velocity is unchanged.
\[ V_{\text{orbit}} \times V_{\text{orbit}} = T^{-1/3} \times T^{1/3} = V_{\text{orbit}} = 1 \quad \text{Eq 4-15, 2} \]

4.15.5 Absolute Acceleration within Orbiting Objects in Unified Space
\[ A = V^2 / R; \quad A_{\text{orbit}} = (V_{\text{orbit}})^2 / R_{\text{orbit}} = T^{-1/3} \quad \text{Eq 4-15, 3} \]

4.15.6 Absolute Orbital Intervals of Time in Unified Space
As seen from the Eye of God perspective, the net effect on the orbital periods is …
\[ T = D/V; \quad \Delta T = R/V = T^{1/3} / 1 \quad \Delta T_{\text{orbit}} = T^{1/3} \quad \text{Eq 4-15, 4} \]

4.15.7 Absolute Spatial and Inertial Mass
\[ M_i = T^{-1/3} \quad \text{Eq 4-15, 5 (from 4-5, 10)} \]
Inertial mass greater in the past
\[ M_s = 1 \quad \text{Eq 4-15, 6 (from 4-6, 1)} \]
Spatial mass constant with respect to spatial forces of gravity and charge
4.15.8 Acceleration and Check for Dimensional Consistency
Just a quick check on the Formulas. Another way to visualize the effect of Observable space on the change in orbital relationships due to the loss of inertial mass is to consider the variation in acceleration caused by the change in density of the Spatial Field relationships of observable space being imposed on the orbital relationships established in Unobserved Space. Its effect would be as if the gravitational constant (or Coulombs constant) varied.

**Orbital Acceleration Unobserved Space x Increased effect of gravity (or in general, Spatial acceleration) = Unified Acceleration.**

\[ \text{Aunified} = A_{\text{orbit}} \times A_{\text{Observeable space}} = T \times T^{-4/3} = T^{-1/3} \]

Which is the same as derived earlier from the application of the relationships to distance and time in orbital relationships for Unified Space. As seen from the Eye of God perspective the size of a ruler composed of atoms would be smaller in the past. Clocks determined by orbital periods or processes determined by a balance between inertial and spatial forces, would tick faster in the past.

4.15.9 Energy Check of Orbital Relationships in Unified Space
Another check of the formulas is to check for consistency with respect Energy of systems over time. There should be a consistent description of energy content over time for systems that balance inertial and spatial relationships within orbital systems. All relationships should vary by \( T^{-1/3} \)

**Energy check - Orbital relationships**
Potential Energy for spatial Field varies by \( Ms \times \frac{1}{R} \).
\[ \text{PE spatial field orbit} = Ms \times \frac{1}{R} = T^{-1/3} \]

K.E for inertial object varies by \( m v^2 \)
\[ \text{K.E. inertial object} = m v^2 = Mi \times V^2 = T^{-1/3} \]

Energy imparted to Photon produced by orbital level drop or difference in P.E.
\[ E \text{ of Photon-orbit} = \text{PE spatial field orbit} = Ms \times \frac{1}{R} = T^{-1/3} \]

A quick check on maintaining proportional energy relationships in Unified Space are preserved.
4.16.1 Cosmological Redshift in Unified Space, Absolute Perspective

The Cosmological redshift in Unified Space is an Eye of God perspective on the spectra emitted or absorbed by atoms over the passage of time. The Eye of God perspective of a photon produced in the past would see the photon receive more energy imparted to the photon due to the denser electrostatic field associated with denser field conditions associated with observable space, and less energy imparted to the photon due to the less dense electrostatic field associated with the orbital configuration of the electrons around the nucleus due to the effects of unobserved space. The Eye of God perspective would then observe the photon lose energy while traveling through an expanding spacetime field. The initial wavelength of the photon would keep its relative measure, or stretch with the expansion of observable space.

**Cosmological Energy of Photons in Absolute Unified Space**

Adding the effects of Unobserved and Observable space results in the net effect on a photon. The effects of Observable space produced.

Observable Space
\[ E_{\text{photon}} = T^{-1} \]  \hspace{1cm} Eq 3-8-1

Now the effect of Unobserved Space needs to be added. Since the electrostatic field the photon was generated in was less intense in the past, the Energy content of the photon would be less as well.

Unobserved Space
\[ U = T^{1/3} = \frac{E_{\text{old/new-photon}}}{E_{\text{old/generated}}/E_{\text{new photon redshift}}} \]  \hspace{1cm} Eq 4-9, 1

\[ E_{\text{old/generated}}/E_{\text{new photon redshift}} = T^{-1} \times T^{1/3} = T^{2/3} \]  \hspace{1cm} Eq 4-16, 1

The energy content of the photon produced in the past within observable space is reduced by the effects of unobserved space.

**Cosmological Wavelength of Photon in Absolute Unified Space**

The effects of observable space with respect to the wavelength of light resulted in a wavelength that was smaller in the past, but its measure was canceled by the expansion of observable space. The only observable effect would be from the effects of Unobserved space. Previously this was derived to be...

\[ \lambda_{\text{cosmological}} = T^{2/3} \]  \hspace{1cm} Eq 4-9, 2

which becomes in Unified Space...

\[ \lambda_{\text{cosmological}} = T^{-2/3} \]  \hspace{1cm} Eq 4-16, 2 or also designated as

\[ \lambda_{\text{old/generated}}/\lambda_{\text{new photon}} = T^{-2/3} \]  \hspace{1cm} Eq 4-16, 3

So from the Eye of God perspective the wavelength that is observed in the present has the longer wavelength that was imposed on it when it was created due to effects of unobserved space. The effects of observable space were canceled out. The traveling photon always maintained its original length on the fabric of the expanding observable space; it is just that when it is observed in the present the wavelength corresponds what would be expected from the stretch of space.
4.16.2 Spectral Energy and Wavelength Issues Resolved in Unified Space

One of the issues was the inequality between matter and radiant energy. A traveling photon lost energy at a faster rate than matter did

\[ E_{\text{matter}} = T^{-2/3} \neq T^{-1} = E_{\text{photon}} \quad \text{Eq 3-8, 2} \]

What is interesting now is that a photon produced in the past, as seen from the Eye of God perspective, starts off a longer wavelength and less energy due to the variation in inertial mass associated with \( V_u \) and the less dense electrostatic field the electron drop occurred. The proportional effects combined with the proportional effects from observable space are exactly what are necessary to preserve the equivalence between matter and light and for the wavelength of light to match the stretch of space always in the present.

\[ \lambda_{\text{cosmological}} = T^{-(2/3)} \quad \text{Eq 4-16, 2} ; \quad D = T^{(2/3)} \quad \text{Eq 3-2-9} \]
\[ \text{Old generated/new red shift} = T^{(2/3)} \quad \text{Eq 4-16, 1} ; \quad E = T^{(-2/3)} \quad \text{Eq 3-2-14} \]

Also, as established in Chapter 4.10, the Equivalency between matter and photons was preserved over time.

\[ E_{\text{photon}} = C / \lambda = T^{(-1/3)} / T^{(2/3)} = T^{-1} \quad \text{Eq 3-8-1} \]

and …

\[ E = M c c = T^{(-1/3)} / T^{(2/3)} = T^{-1} \quad \text{Eq 4-10, 1} \]

Results in Unified Absolute Space become…

\[ E_{\text{photon}} = E_{\text{matter}} = T^{-1} \quad \text{Eq 4-16, 3,4} \]

Section 4 - Chapter 17 Using Local Rulers and Local Clocks, Local Cosmological

4.17.1 Using Local Rulers and Clocks for Cosmological Objects

Local rulers are shrinking, which gives the appearance that distant rulers have expanded. Local clocks are speeding up, which gives the appearance that distant clocks have sped up.

(Again as a reminder, the rulers are actually expanding and clock rates are slowing down since the rate of change from observable space is greater than the effects of unobserved space, but observation of these effects of observable space were self-canceling due to dilation effects).

\[ \mathbf{r}_{\text{ruler}} = T^{1/3} \quad \text{Eq 4-11, 1} \]

Local clock with locally expected variation

\[ \Delta t = T^{1/3} \quad \text{Eq 4-11, 2} \]
4.17.2 Apparent Observed Image Size of Distant Ruler

The image size of an object, like a distant ruler observed perpendicular to the line of site is proportional to the size of the object and inversely proportional to the distance to the object, assuming the relative size of the object is small in comparison to the distance. Double the distance and the image size is ½ as big, but in this case there is also the effects of the expansion of Space.

What is of interest now is the variation in size due to the effects of the expansion of unobserved Space since the effects of observable space were self-canceling.

Observed angle size = Size of object now x proportionally larger in the past / Distance

The size of the distant ruler is defined by the orbit size of the atoms.

In local Unified Space local rulers are used to measure angles subtended. Since the Unified perspective above for the Observed Angle Size was based on present measures, and local measures are present measures, we have, using the proposed notation for local measures.

\[ \text{O.a.s} = \frac{d}{l} \times T^{-1/3} \quad \text{Eq 4-17, 1} \]

4.17.3 Apparent Spatial Dilation

If an object’s size is determined only by its orbital size of its atoms, (and other effects, such as the inward acceleration varying by the inverse square of the time elapsed is small, or an inward acceleration, Aic, which has yet to be discussed which would alter the size of galaxies), then there is an apparent spatial dilation that results from using a smaller present ruler to measure a larger past ruler. Ruler looks larger in past since local ruler has shrunk.

\[ r_{\text{apparent spatial dilation by ruler}} = T^{-1/3} \quad \text{Eq 4-17, 2} \]

\[ r = T^{-1/3} \quad (\text{From Eq 4-11, 1}) \]
4.17.4 Apparent Temporal Dilation
Just as the shrinking of local rulers altered the measurement of past sizes the speeding up of our local clocks results in the appearance that past clocks are ticking slower. (Again this is ignoring the effects of observable space which were actually a stronger reverse effect on clocks, but dilation effects canceled this observation across cosmological distances).

\[ \Delta t = \frac{T}{3} \]  
Eq 4-11, 2 A clock observed in the past would appear to be “ticking slower”

\[ \Delta t = \frac{T^{-1/3}}{} \]  
Eq 4-17, 3 same for local Unified Space

4.17.5 Dilation Effect Does Not Match Stretch of Observable Space
The larger apparent size of an object observed in the past, and the longer orbital period of a dynamic system in the past does not match the expected effects from the stretch and dilation effects of space, which varied by the 2/3rds power. This means that when the Limited Expansion model is used to measure a dilation effect observed in a dynamic system, such as a Variable star, it will expect the dilation effect to correspond to the stretch of space, which varies by \( T^{2/3} \), not \( T^{1/3} \).

4.17.6 Alters Distance Estimates Using Cepheid Variable Stars
The period of a Cepheid variable star is used to determine its absolute or inherent brightness; the longer the period the greater the absolute or inherent brightness of the star. The period of the star is currently determined using the Limited Expansion Model after accounting for a dilation effect. For example, a variable process observed when the Universe was \( 1/8 \)th its present age would be expected to be dilated to 4 times longer in the LEM, but only 2 times longer in the GEM. The LEM would overcorrect the effect of dilation, resulting in assuming a smaller natural period to the variable star. A smaller period would be correlated to assuming the star was smaller star than it really is. Since the brightness is used to determine distance, assuming a smaller star with a given brightness would result in assuming the star is closer than it really is.

**Effects measure of Ho, the Rate the Universe is expanding and the Age of the Universe To**
The measure of Ho is the recessional velocity per distance, so if the measure of distance is assumed smaller than it is, the measure of Ho will be assumed greater than it really is. The age of the Universe would similarly be assumed younger than it really is.

The assumption that a variable star is like a clock, with a balance between inertial and spatial forces is a bit of a stretch, but for now it can be seen that the GEM will require some changes to the method of determining the distance to cosmological objects.

4.17.7 Local Rulers and Clocks for Measuring the Cosmological Redshift.
Previously, when the wavelength for the cosmological red shift ratio in Unified Space was determined, it was based on using a local ruler and a local clock established in the present as the basis for comparison. This means that no ruler or clock adjustment needs to be additionally applied to measures of the wavelength or energy content of photons observed from the past.

\[ \lambda_{\text{local/comological red shift}} = \frac{T}{3} \]  
Eq 4-17, 4

Fortunately the local observable clock rate speeds in exactly the correct proportion to maintain the energy relationship. The inversely proportional relationship between the wavelength and the energy of the photon is preserved.
**local/cosmological red shift** = \( T^{(2/3)} \) \[ Eq \, 4-17, 5 \]

Note notation of lower case letters to designate a relationship defined in local Unified Space. Since the lower case \( \lambda \) is already used for wavelength by convention, it is made larger, which is still somewhat ambiguous, so an extended designator of "local/cosmological" is used.

Since the relationships defining the observed energy content and wavelength of an old photon that has traveled through an expanding spacetime field is the same as was derived from the in absolute Unified space, the simpler notation could be used.

### 4.17.8 Local Experiential Time – “Orbital” Systems

As biological beings made of atoms, we experience the passage of time based on the orbital rates of electrons in orbit in atoms. The assumption that our clock rate is constant over time would result in two errors. Clocks observed in the past would appear to be out of synchronization from clocks observed locally and the cumulative measure of intervals of time would be off. ("orbital" = dynamic system balanced between inertial and spatial forces)

**Time Measured Locally**

Earlier it was shown that intervals of orbital time as they occur in Unified Space vary by...

\[ \Delta T_{\text{orbit}} = T^{1/3} \] \[ Eq \, 4-15, 4 \]

In the past, intervals of time associated with orbits, such as found with electrons around atoms, would be smaller and chemical rates and thus the clock rates of biological beings would be faster in the past than the present. The sum of all these orbital periods over time results in the total amount of time experienced by chemical based beings like us. Since clock rates were faster in the past, the total experiential time elapsed is greater than that associated with measures based on absolute time for an “Absolute being”.

### 4.17.9 Experiential Time Intervals Compared

Shorter intervals of time in the past compared to the present means that more time intervals elapsed per the same measure of absolute time established in the present. It is an inverse relationship of one to the other.

The following graph illustrates the variation in clock rates per an absolute interval of time. The measures of time have been unitized, meaning that the Absolute location in time is represented as fractions with the current age of the Universe set a equal to 1 and the intervals of time used are also set at one unit. For comparison the intervals of time are plotted for three relationships. The top curve is that based on the relationship developed earlier for observable space only. The middle curve is the proposed rate for chemical reactions and the bottom curve is for intervals or clock rates that are constant over time.
4.17.10 Cumulative Measures of Unified Local/Cosmological Experiential Time - \( t_e \)

The integral of the area under the clock rate yields the sum of the intervals under the curve considered. What is of interest is the experienced elapsed measure of time from the present to some point in the past.

\[
Cumulative \, time \, elapsed = \sum t_e = \int_{T_1}^{To} T_1^{-1/3} \, dT = To \left( \frac{3}{2} T_1^{2/3} \right)
\]

Equation 1-21

\( t_e = To \left( \frac{3}{2} - \frac{3}{2} T_1^{2/3} \right) \) Eq 4-17, 6

The following graph illustrates the sum of the intervals of time for 3 function defined clock rates. The top line illustrates the amount of time that elapsed if the effects of observable space were only considered. Note that the Universe becomes infinitely aged.

The middle line represents the amount of time elapsed looking from the present to some proportional location defined by the Ratio of Time using a chemical clock or experiential. An experiential clock is
any relationship that is defined by a balance between electrostatic and inertial forces. The lower line is the amount of time elapsed if clock rates were constant.

Note that when the effects of observable space are only considered, the age of the Universe is infinitely aged. The local experiential clock, $t_e$, is 1.5 times greater than the age of the Universe, as described in Absolute measures.

### Figure 4-16 Experiential Time verses Absolute Time Ratio

#### 4.17.11 Application of $t_e$, and Evolution and Stars

Experiential time, (small $t$), is the local measure of the total elapsed time for any process that balances spatial and inertial forces. The application for chemical reactions helps describe how much time biological evolution has occurred on Earth. While we measure the Cosmos in absolute terms using our local rulers in the present, this assumption based on a fixed measure would under estimate the duration of any process that occurs over cosmological time periods.

**Stars**
The rate stars evolve is not just based on the balance between spatial and inertial forces, and evolve even faster due to the dynamics of stellar evolution, as will be discussed in the Verification Section of this work.
Section 4 - Chapter 18 –
Intrinsic Centrifugal Acceleration = Aic,

4.18.1 Physical Basis for Aic
If Observable space is in motion along an unobserved dimension, and it is expanding, then every point in observable space is changing its direction while it is in motion along the unobserved dimension. When an object is in motion in a particular direction, and that direction of motion is changed, the object will experience a directional force or acceleration in opposition to the change in direction. This centrifugal based acceleration is realized as a resistance to expansion.

4.18.2 An Intrinsic Centrifugal Acceleration Verifies the Model
The physical existence and prediction that there should be an intrinsic centrifugal like inward acceleration that resists the expansion of Observable space is one of the strongest verifications of the proposal that the entire universe is in motion at speed of light speeds, while it is also expanding. If this physical condition exists, then there are physical ramifications that should result that should be and are observable. It is this process that eliminates the necessity for Dark Matter.

There are other benefits due to the effect of Aic. For example,
1. The expansion of Observable space resulted in a geometric expansion in which all points in space maintained their relative measure with the passage of time. There would be no measurable expansion of observable space. Now with this deceleration, Aic, the location of galaxies and quasars would closely correspond to expectations of an expanding Universe.
2. The Universe begins with matter initially distributed. All the matter in the entire universe is no longer forced to be assumed to be located at a “point” when the Universe begins.
3. It answers the question as to why there are no very high red shift quasars even though they should; there are galaxies observed with higher red shift ratios, why not the brighter, easier to find quasars?
4. The model also resolves the issue about the lack of time dilation in the variation in the energy output of quasars.

The more detailed physical application of the model will be reserved for the next section

4.18.3 Deriving Formula for Aic
The following diagrams illustrate the derivation of Aic.
Expansion while Moving

Edge on view of points $\bullet$ in a Flatland Universe being spatially expanded, and therefore moving orthogonally to the velocity long an unobserved vertical direction.

The expansion the points, (or objects) relative to an absolute space or geometric structure includes a motion that is not only along the unobserved dimension, but orthogonal to it. Objects and points are also moving outwards.

Figure 4-17 Expanding while moving in Unobserved Dimension
The following figure shows the velocity along the unobserved dimension, $V_u$, as the square root of $2 \times$ the speed of light, which is a part of the unifying conjecture. This velocity is orthogonal to the velocity defined by the rate of expansion. (This is orthogonal in 4 spatial dimensions)

$v_{\text{expansion}}$

Object while moving along unobserved dimension is also deflected by the expansion of observable space.

$v_u = \sqrt{2} \times c$

**Figure 4-18 Acceleration by change in direction**
The value of $Aic$ is proportional to the rate of expansion, $Ve$ divided by a local interval of time.

$$Aic = Vu^2 / R = Ve / \Delta t$$  \text{Equation 4-18, 1}

Since this an acceleration that is imposed directly on points in observable space from unobserved space this would be an effect as imposed in Unified Space.

$$Aic = Ve / \Delta t$$  \text{Equation 4-18, 2}
4.18.4 Vector Projections from a 4 Dimensional Space. 1/2 Factor for Aic.

There is a gnawing sense that extra dimensional relationships are not described as simply as the flatland universe examples that have been used to develop the model so far which is motivation for further discussion.

Since it would be expected that the imposed deceleration resisting the expansion of Observable space is uniformly imposed, the magnitude in every direction would be the same in observable space. Also, since acceleration is a vector relationship, (described by a magnitude and a direction), the distribution of the imposed acceleration from a 4th dimensional relationship would be evenly distributed in each of the three spatial dimension of observable space from the unobserved dimension along which observable space is in motion. This unobserved dimension is still orthogonal to each of the spatial dimensions of observable space. The magnitude of the deceleration of observed space along an unobserved dimension is what was derived previously since the velocity \( V_u \) and acceleration \( A_u \) were all based on measures along the unobserved dimension.

The assumption that the imposed acceleration resisting expansion is evenly distributed requires the same deceleration in each of our 3 spatial dimensions and the one unobserved dimension.

The question is, how does an acceleration that is imposed from an unobserved dimension impress or distribute its effects in our 3 spatial dimensions?

The following example illustrates a vector imposed in a two dimensional space that is equally distributed in two dimensions.

If the vertical dimension represents an unobserved dimension and the horizontal dimension represents an observed dimension, and the vector imposed is evenly distributed in each dimension, or is a shared effect that is evenly shared in each dimension, then the vector effect observed in the observed horizontal dimension would be

\[
\text{Vector observed} = \text{Vector unobserved} = \text{net vector} = \sqrt{2} \times \text{Vector observed}
\]

The diagonal vector represents a vector in two dimensional space. When the two dimensional “initial” vector is symmetrically mapped down to two individual perpendicular dimensions, the divided vector is less.

If the observed vector has a unit measure, the original vector has a length of \( \sqrt{2} \).

**Figure 4-20 Vector in two dimensions observed in one**
4.18.5 Experienced Aic Reduces Aic by 1/2
If the acceleration imposed was along the diagonal in 4 spatial dimensions, then the realized vector projection along each of the 3 spatial dimensions in observable space would be 1/2 as strong. This could help yield a measure of Aic to explain the rotation curves of galaxies.

\[ Aic^{1/2} = \frac{1}{2} Aic \quad \text{Eq 4-18, 3} \]
4.18.6 Theoretical Value of Aic
4.18.6.1 Ve, The Velocity of Expansion

Velocity of Expansion across entire observable distance or size of Observable Space

Since relative measures of distance and time are constant over time, (review diagram of light clocks end to end across space, or the matrix like distribution of galaxies on the structure of Space, Figure 3-17), and local measures are used to establish present intervals, the local recessional velocity or Ve can be determined using the current measures across the observed universe. This velocity can be determined across the age and the size of the observable universe.

The theoretical value for Aic requires knowing the Velocity of Expansion. The velocity of expansion of observable space is described by...

\[
V = \frac{(k \ 2/3)}{T^{1/3}} \quad \text{Absolute Velocity over measures of Absolute Time}
\]

and

\[
k = c \ T^{1/3}
\]

The apparent recessional velocity from the beginning of the Universe to the edge of the Universe (which is our present location) would be...

\[
Ve \begin{align*}
\text{beginning to present} &= V \text{recessional velocity across observable universe} = \\
&= \frac{(k \ 2/3)}{T^{1/3}} = \frac{(2/3 \ c \ To^{1/3})}{T^{1/3}} = \frac{2}{3} \ c
\end{align*}
\]

\text{Eq 4-18, 4}

\[
Ve \quad \text{recessional velocity across observable universe}
\]

\[
\text{Beginning of Observable Universe}
\]

\[
\text{Present}
\]

\[
\text{Do} = cTo
\]

\text{Figure 4-22 Recessional Velocity over Distance}

4.18.6.2 Ve and Ho

The local measure of Ve over Do = Ho

\[
Ve/ \text{Do} = \frac{2}{3} \ c / cTo = \frac{2}{3} \times \frac{1}{To} = Ho, \ \text{Equation 4-18, 5}
\]

the local rate of expansion over the size of the observable Universe.
4.18.6.3 Ho, Hot to Aic

The expression for Ho can be is also be expressed as a velocity of expansion over the Age of the Universe, yielding an acceleration like term in that the dimensional Units are distance per time squared. Points in space are expanding away from each other per an interval of time separating the points

\[ \text{Hot} = \frac{Ve}{To} = \frac{2}{3} c \times \frac{1}{To} = \frac{Ve}{\Delta t} \quad \text{Equation 4-18, 6} \]

This is the same expression defining Aic, Aic

\[ \text{Aic} = \frac{Ve}{\Delta t} = \frac{2}{3} c / To \]

Actually, being consistent with notation convention using “o” for present origin, but ignoring the add-on of “o” on to c for conventional clarity…

\[ \text{Aico} = \frac{2}{3} c / To \quad \text{Equation 4-18, 7} \]

4.17.6.4 Historical Measures of Aic.

Aic in the past would be greater since the speed of light was greater in the past and the age of the universe was smaller..

\[ c = T^{-1/3} \quad \text{and} \quad T1 \text{ represents a past location in time} \]

\[ \text{Aic1} = \frac{2}{3} c o \times \frac{T^{-1/3}}{T1} \quad \text{Equation 4-18, 8} \]

Which becomes…

\[ \text{Aic1} = \frac{2}{3} c \times \frac{To^{1/3} \times T1^{-4/3}}{T1} \quad \text{Equation 4-18, 9} \]

Correcting the sign to indicate a deceleration and incorporating the constant k yields

\[ \text{Aic} = \left( -\frac{k2}{3} \right) T^{-4/3} \quad \text{Equation 4-18, 10} \]

Or

\[ \text{Aic} “1/2” = \left( -\frac{k}{3} \right) T^{-4/3} \quad \text{Equation 4-18, 10} \]

Comparing deceleration rates A and Aic

Again, comparing to the expansion of observable space there is a variation of a constant 1/3.

\[ A = \left( -\frac{k2}{9} \right) T^{-4/3} \]

\[ \text{Aic1} = -k \times \frac{2}{3} \times \frac{T1^{-4/3}}{T1} \]

Considering the relationships as a ratio…

\[ \text{Aico “1/2” /Ao} = \frac{3}{2} \quad \text{Equation 4-18, 11} \]

The deceleration imposed on galaxies is 3/2 greater than the expansion of points in space.

4.18.6.5 Ao and Aico “1/2” For a 10 x10^9 year old Universe

\[ \text{Aico “1/2” “10”} = 3.17 \times 10^{-10} \text{ meters per s}^2 \quad \text{Equation 4-18, 12} \]

\[ \text{Ao “10”} = 2.11 \times 10^{-10} \text{ meters per s}^2 \quad \text{Equation 4-18, 13} \]
4.18.7 Inertia and Aic
4.18.7.1 Inertial Effects on Physical Response to Aic
In honesty, I initially assumed that the inertial effects of galaxies made no difference in the actual motion of galaxies in space. Aic only determined the location of galaxies in observable space overtime. I so loved the symmetry of the equations matching in terms of their powers of exponents for distance, velocity and acceleration, that in order to justify the assumption I felt that galactic structures did not have a dimensional component to respond to the acceleration imposed by unobserved space. The desire for the model to predict an acceleration that would move galaxies in a relationship that matched the relationships that correlated to the motion of points attached to the fabric of space was a strong “trap”.

However this initial desire is wrong. Galaxies should respond to the acceleration imposed by Aic and the effect of this acceleration on galaxies would vary not only by the variation in Aic over time, but the variation in the inertial mass of the galaxies over time. The increased inertial mass of the galaxies in the past would slow the response of the galaxies to the imposed acceleration Aic. A galaxy that had two times as much inertial mass in the past would respond to the imposed Aic with 1/2 as much physical acceleration when describing the physical motion as an acceleration of distance moved per time squared. The increased measure of Aic in the past, and its effect on the motion of galaxies would therefore be muted by the increased inertial mass of galaxies in the past.

This physical interpretation is much more in line with the model and its’ assertion that inertial mass is the result of the volume like properties (a baryonic property), and the momentum established by the velocity along the unobserved dimension.

The acceleration physically describing the motion or physical location of the galaxy in space will be indicated by the inclusion of the terms “inertial motion”. It is the change in the physical response or movement of the galaxy to the acceleration after incorporating the variation in the inertial mass of the galaxy over time. The variation in the spatial acceleration defining the actual motion of the galaxy is to be compared to the present. The proportional increase in the inertial mass proportionally reduces the effect of Aic on moving galaxies. This acceleration associated with the variation in the motion of galaxies over time will be indicated by adding the term “inertial motion” to Aic.

\[ M_i = T^{1/3} \quad \text{Inertial mass of galaxy} \quad \text{Eq 4-15} \]

\[ \frac{Aic}{1/2} \text{ inertial motion} = \frac{Aic}{1/2} / M_i \quad \text{Equation 4-18, 14} \]

\[ Aic \frac{1/2}{1/2} \text{ inertial motion} = 1/3 \co \times T_0^{1/3} \times T^{-4/3} / (T_1/T_0)^{1/3} = 1/3 \co \times T_0^{4/3} \times T^{-1/3} = -k/3 \times T^{-4/3} \times T_1^{1/3} = -c (T_0^{1/3} /3T_0^{1/3}) \times T^{-1} = -c/(3T) \quad \text{Equation 4-18, 15} \]

Since the inertial mass of the present was used as a reference inertial mass, the values should correspond in the present. . The present magnitude of the effect of Aic/Inertia Mass is:

\[ Aic_0 \frac{1/2}{1/2} \text{inertial motion} = 1/3 \co /T_0 = Aic^{1/2} \text{galaxy spatial motion} = -k/3 \times T_0^{-4/3} \times T_0^{1/3} = - c/3T_0 \quad \text{Equation 4-18, 16} \]

Which is still the same 2/9 verses 1/3 variation determined earlier without considering the effect of inertial variation over time, which would be expected since the inertial mass variation is equal to 1 for the present.
4.18.7.2 Notation Subscript “i”, Dropping the “1/2 Inertial Motion”
Writing “1/2” inertial motion” is a bit laborious. Replacing the expression with just a subscript “i” will indicate it relates to the inertial effected motion expected to be observed in Galaxies. Hopefully this short hand will not be construed to mean the effect of Aic “1/2” inertial motion is only observed in galaxies. Also it is hoped that the concept of reducing the effect of Aic by the variation in inertial mass is not lost as a moderator of the effect of Aic.

\[ \text{Ai} = \text{i/O} \text{ Equation 4-18, 17} \]

4.18.7.3 Integrating for Velocity and Distance, the “ln” Functions
If a galaxy’s motion over time is changed by “Aic “1/2” galaxy spatial motion”, its location and velocity over time can be determined by integrating the relationships of motion over time. For example, if the current rate of motion of galaxies are observed, and given the assumed influence of Aic “inertial motion” over time, it would be possible to determine the velocity of the galaxies over time by integrating the effect of the acceleration over time starting with the given observed velocity.

The “ln” functions
Integrating Ai over time results the use of natural log relationships, with constants of integration.

\[
\int \frac{1}{x} dx = \ln(x) + C \\
\int \ln(x) dx = x \cdot (\ln(x) - 1) + C
\]

Defining position and velocity from “Aic “1/2” Galaxy Spatial Motion” in Space

\[ \text{Ai} = \frac{-c}{3T} \text{ Equation 4-18, 18} \]
Integrating over time yields

\[ \text{Vi} = \frac{-c}{3} \cdot \ln(T) + \text{Constant “a”} \text{ Equation 4-18, 19} \]
Integrating over time yields

\[ \text{Di} = (-cTo) \cdot \left( \frac{T}{3} \right) \cdot (\ln(T) - 1) + (cTo) \cdot (T \times “a”) \] + constant “b” \text{ Eq 4-17, 20} \]

“a” = velocity of galaxies determined by boundary conditions \text{ Eq 4-18, 21} \\
“b” = separation between galaxies determined by boundary conditions \text{ Eq 4-18, 22} \\
c/(3x) ; (-c/3)\ln(x) + 2c/3 ; \left\{-\frac{x}{3}(\ln(x) - 1) + \frac{2x}{3}\right\} (cTo) ; \left(\frac{x}{3}\right) (1 + (\ln(x) - 1)) \times (\ln(x) - 1) \]

4.18.7.4 Comparing Formulas for Galactic Motion with Inertial Effects Considered
The equations for the separation of points over time need to be compared to the relationship defining the location of galaxies over time. If the two relationships are close, than the fundamental Cosmological Issue described earlier, when just the expansion of Observable Space was considered, would be resolved. The location of galaxies in observable space would move in relation to the Fabric of Space.
4.18.7.5 Accelerations Compared
The following graph compares the variation in the acceleration associated with points in space with
the acceleration experienced by galaxies, ignoring for now the additional deceleration imposed by
objects moving through an expanding spacetime field.

\[ A = \frac{2}{9} \left( \frac{c}{T_0} \right) T^{-4/3} \]

Red line - top most line first then lowest line
Describes the acceleration between points in the
fabric of space initially “connected” at the beginning
of time that separate with the expansion of Space

A “1/2” inertial motion = \( \frac{1}{3} \left( \frac{c}{T} \right) \)
Describes the acceleration/motion observed
between two galaxies initially “connected” at
the beginning of time and how the relationship
changes over time

This comparison of accelerations does not include the
additional deceleration that is incurred when an object
is moving through an expanding spacetime field

**Figure 4-23** Variation of \( A \), and \( A^{1/2} \) inertial motion per proportional
location in time
**4.18.7.6 Would Galaxies Be in the Right Place with the Passage of Time?**

It is interesting to note that the accelerations are very similar but sufficiently different to raise concerns as to the ability of the model to conform to observation, the current deceleration Galaxies are experiencing from \( \ddot{A}c \) is 3/2 greater than the acceleration describing the expansion of points attached to the fabric of space. Since it is the motion of galaxies over time which is used to determine the expansion of the fabric of space, there is some question as to the ability of the two relationships to correspond.

The Geometric Expansion of Observable space produced no measurable variation in the locations of galaxies over time. Each step back in time corresponded to an equal step back in distance, Galaxies would be evenly distributed, there would be no locally observed relationship of \( D = T^{(2/3)} \), which corresponds to the “2/3rds Model”. Would this new deceleration yield a relationship corresponding to observation?

**4.18.8 The 2/3rds Model**

**4.18.8.1 The 2/3rds Model - Location of Galaxies Based on Deceleration**

The 2/3rds Model refers to a specific deceleration rate describing the geometric expansion of Space using the Geometric Expansion model. The “2/3”rds comes from the exponent describing the distance between points in space with the passage of time, and it also corresponds to the Age of the Universe where \( T_0 = 2/3 \times 1/H_0 \). This age of the Universe relationship is illustrated in the following Figure where the current rate of expansion, \( H_0 \) is plotted and if extended to 0 ordinate, it can be seen that \( T_0 = 2/(3H_0) \).

\[
D = T^{2/3} \quad \text{Eq 3-2, 4}
\]

![Graph of Equation](image)

**Figure 4-24 The “2/3”rds Model**

**4.18.8.2 “The 2/3rds Model”, General Relativity and the Geometric Expansion of Space**

This “2/3rds” Model is also exactly the same relationship predicted for the location of galaxies over time when General Relativity is used in its simplest application. By simplest application what is being
specified is that gravity interaction alone is determining the deceleration rate associated with the Expansion of Space; there is no dark matter and no dark energy.

To (mainstream, gravity interaction between galaxies alone) = 2/3 \( \frac{1}{Ho} \)

(Source [http://map.gsfc.nasa.gov/universe/uni_age.html](http://map.gsfc.nasa.gov/universe/uni_age.html))

This similarity of the GEM with General Relativity is somewhat reassuring in that both models should somewhat correspond to each other. However, as noted before, the Geometric Expansion of Observable space produced no locally observed measure of this variation, it is only when the “Eye of God” perspective is used that the relationships are seen to be equivalent.

4.18.9 Fundamental Cosmological Issue, The Even Distribution of Galaxies
As mentioned previously the General Expansion Model does produce a 2/3rds model distribution, it is only as seen from the Eye of God perspective using an absolute ruler. If an observer in the present looks to the past, galaxies keep their proportional location over time. There is no change in the density of galaxies over time. The consistency or the “lining up of galaxies in a straight row” over time was illustrate in the previous section Figure 3 -17

This observed lining up of the galaxies over time is a result of space itself expanding the path of light as it travels to an observer in the present. Were it not for some gravitational and dynamic interactions between moving galaxies that are close to each other, the density distribution of galaxies over time is always the same across perspectives of time, if the expansion of observable space is only considered. In order for galaxies to not fall on an observed straight line path across time, then something else would have to reshape the distribution path to something closer to the 2/3rds model. Would the “ln” functions correspond to the “2/3rds model?”

4.18.10 Vio, Veo, and the Constant of Integration “a”
4.18.10.1 Evaluating the Velocity Vio and or Veo for the Constant of Integration “a”
The measure of Ai was determined to be byproduct of the expansion of observable space while in motion along the unobserved dimension. As mentioned earlier, it is the double integration of Ai over time that would result in the location of galaxies over time. Integration is a process that extrapolates relationships, and in order to have any specific distance to time functions, the constants of integration have to be determined based on boundary conditions. A specific value would be known at a particular point in time.

The First Constant of integration was “a”, which raises the question, what is the value of “a”? It will be assumed that the value of “a”, can be determined from the present velocity of galaxies, Vio, and that Vio is equal to the present rate of the Expansion of points attached to the fabric of space, Veo.

\[ Vio = Veo = \frac{2c}{3}. \text{ Eq 4-18, 23} \]

also Veo was determined to be \( \frac{2c}{3} \) in 4.18.7.1.

There are a few reasons for assuming the velocities of Veo and Vio are the same.

One reason for assuming the two velocities are the same is based on the kinematic cost of expansion. Any motion of a galaxy relative to the fabric of space would diminish and eventually the motion of galaxies should ease into matching the expansion rate Expansion of Space. After expanding for over \( 10 \times 10^9 \) years any initial variation between the velocity of galaxies and the velocity of the expansion of space should be reduced substantially.

Also, while the accelerations are different, they are remarkably similar with the differences appearing to be self-canceling. The “extra” acceleration of observable space when the Universe was young seems to be very similar to the “extra” acceleration galaxies have after \( T=.1 \)
Finally, the primary reason for the same velocity is that when the velocity of expansion, Ve was theoretically determined, it was done across the Universe, and since local measures kept their proportional temporal and spatial location within observable space, the rate of expansion across the Universe also yielded the rate of expansion locally. (Review expanding light clocks in space, Figures, 3-14 and 3-15.) Since the local rate of expansion is what is used or measured, this relationship corresponds to the 2/3 c value for the expansion across the observable Universe.

4.18.10.2 Velocities Compared
The next graph illustrates how closely the two velocities match each other, based on the assumption that “a” =2c/3. The match is good, over time. The “difference” illustrated in the graph would actually be less if the kinematic cost of expansion was also applied as an effect from T =.1 to 1. The assumption that “a” = 2c/3 seems somewhat justified.

\[ V = \frac{c}{2/3} T^{-1/3} \text{ Observable Space} \quad \text{Eq 3-2.11} \]

Red line – top most line till about T greater than .1

Describes the velocity between points in the fabric of space over time that are initially connected at the beginning of time that separate with the expansion of space

\[ V_i = (-c/3) \times \ln(T) + “a” \text{ Galaxy} \quad \text{Eq 4-18. 19} \]

Describes the observed velocity between galaxies initially connected at the beginning of time.

When the present velocity of galaxies in the Universe is 2/3c, the current measure of their velocity corresponds to the same present rate of expansion for observable Space

Figure 4-25 Variation in Ve and Vi per T with “a” = 2c/3
4.18.11 Distances Compared
The next graph compares the distance measures, $D_i$ and $D$ with $a - 2c/3$. The relationships are remarkably close. Considering the kinematic cost of expansion would result in an even closer correspondence.

\[ D = (cTo)^{2/3} \] - Upper red line, 2/3 rds Model
Distance between points in Expanding Space
Eq 3-2, 4

\[ D_i = (cTo)(-T/3)(\ln(T)-1) + (cTo)(2T/3) \]
Eq 4-18, 20
Distance between galaxies over time with initially no separation with an constant of integration for velocity $= c2/3$ under the influence of Aic “1/2”.
Lower blue line

Figure 4-26 Comparison of Distance functions, points and galaxies

4.18.12 “ln” Model Corresponds to “2/3 rds” Model, Cosmological Distribution and Aic
This is a convincing verification that the “ln” functions result in a galaxy distribution that is very similar to what would be expected from the “2/3rds” model. The Extra Dimensional Centrifugal Acceleration now resolves the distribution or density of galaxies with respect to historical location. Galaxies would be closer together in the past. The historical location of galaxies conforms closely to the “2/3 rds” model with a couple of caveats. The Age of the Universe associated with the 2/3 rds model is different and there is an “offset” introduced.
**4.18.13 Geometric Age of Universe, Tt**

The following graph is a reinterpreted version of Figure 4-23, but instead of extending the Age of The Universe by 1/3, the actual historical location is plotted with in the True Geometric Age of the Universe, Tt. It also illustrates the difference between a straight line distribution of points in a Geometrically expanding space, represented by the red or upper line, and the historical location of galaxies (the blue or lower line) based on the assumption that the present value for Vi is the same as Ve, (Ve = 2c/3), that Aic 1/2 and the inertial variation with time is considered.

The more exact inertial relationship or “ln” function was not used in establishing the graph, and the 2/3rds relationship was used to describe the location of galaxies in Figure 4-27. The graph is just easier to draw. Those so inclined to challenges can redraw the graph with the more accurate relationship of the ln function (include the “cost of expansion” for an even more accurate relationship, which also forces the ln and 2/3rd model relationships to more closely match than what was shown in Figure 4-25 and 4-26)

The “exact” offset using the “ln” function can be found by Solving 4-17, 20 at T =0 = Offset = 1/3 To

“b” Offset “2/3rds” = .296 Do (Closely) Eq 4-18, 24

“b” Offset “ln” = 1/3 Do (more closely) Eq 4-18, 25

**4.18.14. The “offset model”**

**4.18.14.1 The “offset model”**

The result of imposing the acceleration of motion on galaxies given the present rate of expansion results in galaxies beginning their existence, or location in the Universe at about T = .33. This is an “offset” from the point in time in which the universe begins its expansion, hence the “offset” model.

The red line illustrates that at the beginning of time all geometric points will converge. The location of galaxies over time yields the result that the galaxies or quasars enter the Universe with an initial separation of about .33 To.

( The coefficients for the relationship was based on solving for the same slope at the present (To =1) then find the intercept to the x axis, and then scale corrected to still yield a cTo x 1 factor or so that the same total time elapsed or range of To is included.)
4.18.14.2 True To, Tt;  \( Tt = 1/Ho \)
The model also indicates that true age of the Universe would be \( 1/Ho \), or \( Tt \). since this is how long it would take for all the points in spacetime to move from a “point” or the beginning of time, to the present separation between points with the proposed geometric expansion of space where all intervals of distance and time keep their proportional value. The location of galaxies would not be determined by being carried by the fabric of space, but by the effect of \( \Lambda \)ic and the variation in inertial mass.

\[ Tt = 1/Ho \]  \( \text{Eq 4-18, 26} \)

4.18.14.3 Tg  Start of Galaxies  \( \text{Eq 4-18, 27} \)
This also adjusts what would be associated with the start of Galaxies, \( Tg \). For example a galaxy or quasar entering the Universe at \( .33 \) would be 0 years old at \( 33 \). The experiential age would increase the time “experienced” by the galaxy.

\[ Tg = \text{Start of galaxies} \geq 1/3 \text{ To} \]  \( \text{Eq 4-18, 27} \)

\[ t_e = T_o(3/2 - 3/2 \ T^{2/3}) \]  \( \text{Eq 4-17, 6} \),
Starting at \( .33 \) the experienced time for a galaxy is \( t_{eg} = .779\ )  \( \text{Eq 4-18, 28} \)

Figure 4-27  Observed Distance between points and galaxies
4.18.14.4 Tt and Cosmological Redshift Ratio
The disassociation of the galaxy location with respect to the fabric of observable space alters the assumed location of galaxies with respect to the observed cosmological redshift ratio. Instead of $T_0 = 2/3 \times 1/H_0$, we have $T_t = 1/H_0$. Different age to the Universe; different age for Galaxies. Also, since the Cosmological redshift is correlated to the proportional location in time and history, this will place galaxies at a different proportional location when the true age of the Universe is used. This is most apparent when quasars first enter the Universe at .33T. In the 2/3rds model, the corresponding cosmological redshift ratio would be infinite, but in this case the corresponding redshift ratio would be for a proportional historical location of $1/3T$.

4.18.14.5 Redshift Ratio When Quasars or Matter First Enters Universe

\[ \lambda_{\text{local/comological red shift}} = T^{(-2/3)} \] Eq 4-17, 4

\[ T = 1/3; T^{(-1)} = 2.08 = \lambda_{\text{local/comological red shift initial matter}} ; \quad z = 1 \] Eq 4-18, 29

This presents some issues that need to be addressed since there are cosmological objects with redshift ratios greater than 2.

4.18.15 The Evolving Offset Model
4.18.15.1 Resolving the Redshift Quasar issue
The resolution to the redshift variation of quasars will be explained more completely in the verification section of this work. Hopefully the following brief explanation will suffice for now since some explanation has to be offered to keep the model viable.

The proposed solution to resolve the observed redshift ratio issue is to assume that when quasars enter the Universe they do not do so all at once, but there is a delay over time. Some enter the Universe significantly after $T = .33$.

Additional it is proposed that these later entrants also have an initial velocity relative to the fabric of space. This randomly oriented motion relative to the fabric of space will be called “peculiar” motion, being consistent with terminology used by astronomers.

Additionally it is proposed that the later these “straggler” quasars enter the universe they do so with increasing “peculiar” velocity.

The details describing the range of time quasars enter the Universe will be explained in more detail in the Verification Section of this work. The specific goal will be to make sure that the observed quantity of quasars also corresponds to the observed red shift ratios associated with the quasars.

This assumption as to how quasars enter the Universe is an “after the fact” solution, and as such should always be considered a model that is somewhat “weak”. However, besides preserving the model, a number of other issues tend to be resolved, thereby justifying the assumption.

The following figure illustrates the example…
Quasars are also shown that have entered after \( T = 0.33 \) that are further away from our location. They also have real or “peculiar” motion relative to the fabric of Observable Space and the velocity is random in its direction in space.

These late and moving away quasars are observed once enough time has elapsed to see them in the past. Some of these quasars will have had enough time to evolve into galaxies, hence the reason a few rare galaxies are observed with very high redshifts. This also explains why there are some galaxies with redshifts higher than all quasars and why there are no very high redshifted quasars observed.

Figure 4.28 Quasars with delayed entry are observed over time.
4.18.15.2 Review of Quasar and Galaxy Location Justifies Model
From the preceding development, galaxies and quasars end up conforming to the “2/3 rds” model fairly well. The prediction that young galaxies or quasars first appear at .33T (with an additional spatial distribution that results from quasars entering over time), helps account for the range of red shift ratios these quasars are observed to have. While there are a few more issues that need to be addressed, especially with respect to the actual accuracy of the model and specific range of values describing when and with what velocity quasars enter the universe is required, the fundamental problem that the proposed geometric expansion of space resulted in a Universe with no variation in the rate of expansion is now resolved.

4.18.15.3 Benefits of Universe “Offset” Model
While this discussion should probably be reserved for the verification section it is interesting to note that a number of issues with respect to quasars and galaxies are resolved by the proposed “offset” model. I feel somewhat required to at least describe these advantages since the proposed “offset” model is so substantially different from the limited expansion model in which everything it the Universe is supposed to start a “point”.

4.18.15.4 Babies Younger Than Their Adolescent Twins
This problem is observed since there are galaxies observed with red shift ratios greater than the most redshifted quasars. (UDFy-38135539 at a redshift of z = 8.6, http://en.wikipedia.org/wiki/Redshift). If quasars are baby galaxies, how can there be galaxies that are younger than quasars?

The appearance of quasars after the initial burst of quasars at locations that are further back in time then the initial entry point of .33T, and which are in motion away from our observation, explains the observation of rare high redshifted galaxies.

If this galaxy is far enough away, with enough of a peculiar motion away from us, then by the time we are observing it, it has evolved beyond the quasar stage.

4.18.15.5 Babies Playing with Their Own Adolescent Twins
Another benefit of the model is that it explains how quasars can be seen interacting with galaxies, which is like babies playing with their adult twins. (Halton Arp is famous for his observations of these interactions and posed it as grounds for considering a reinterpretation of the redshift ratio associated with quasars http://en.wikipedia.org/wiki/Halton_Arp).

Now a late appearing quasar can enter the Universe after the initial rush of quasars entered the Universe, which allows the initial rush of quasars to evolve to be a galaxy. Adding “peculiar motion” to the late coming quasar increases the likelihood of a newer quasar interacting with an older galaxy.

4.18.15.6 Why Don’t We See More Very High Redshift Quasars?
If quasars are associated with young galaxies, and quasars are much brighter than galaxies, why don’t we see quasars with redshift ratios higher than the highest redshift galaxies? This is a fundamental problem for the LEM.

(Highest quasar has a z = 7.1 or redshift ratio of 8.1, http://en.wikipedia.org/wiki/ULAS_J1120%2B0641
and the highest red shift galaxy has a z = 8.6 or red shift ratio of 9.6. http://en.wikipedia.org/wiki/UDFy-38135539

It is impossible to see a quasar before it has appeared in the Universe. Only those few quasars that are moving away from us will have had time to evolve to being a galaxy, and from this more distant location, the spectra from the now emerging galaxy will be additionally redshifted. This will be addressed in more detail in Verification Section 5.
4.18.15.7 The Lack of Time Dilation Associated with Quasars
There is another issue that the proposed model resolves which has to do with the lack of dilation effects associated with the variation in the energy output of quasars.

A discussion of this issue will be reserved for the Verification section of this work. But for now it can be noted that the younger the quasar, the more quickly energy variation should occur. Also, the expected time dilation rate is different; \( T^{-2/3} \) versus \( T^{-1/3} \). The primary goal up to now was to describe the Geometric Expansion of Space and develop the basic formulas pertaining to the model.

Section 4 Chapter 19 Summary and List of Equations
4.19.1 Summary of Benefits and List of Equations for Unified Space

The motion of our expanding observable space within an expanding unobserved space resulted in the following properties or relationships.

1. An Intrinsic velocity resulted in the property of inertia
2. The motion of photons of photons became physically explained as well as a process for establishing the wavelength of light.
3. The intrinsic energy of a mass at rest, \( E = mc^2 \), became a simple kinematic derivation.
4. The ambiguity between the equivalency between matter and energy has been resolved.
5. The ambiguity of a photon apparently changing its wavelength while traveling at the speed of light has been resolved. The difference is simply due the difference between the wavelengths created in the past when compared to the wavelengths created in the present.
6. Spatial and inertial mass are two distinct properties of matter.
7. The expansion of observable space produced no locally observable dilation effects. The effects of Unobserved space resulted in a variation in local clock rates and ruler size, which corresponds to a dilation of space effect, but at a power of \( T^{1/3} \), which is different from the expected \( T^{2/3} \) expected from the LEM.
8. An intrinsic resistance to the expansion of space in the form of an inward acceleration is proposed. When this acceleration is applied to the rotational rates of Galaxies, no Dark Matter will be required.
9. A number of issues associated with the expansion of observable space have been resolved. A cosmological redshift is predicted, and a time dilation was produced. There was also a real variation in the location of galaxies with the passage of time that more or less correlated to the expected location of galaxies if the expansion of space were to conform to the simplest application of general relativity.
10. An “offset” or initial size to the Universe is predicted into which the matter that will become galaxies is injected.
11. This offset also explains a number of other astronomical issues that will be further discussed in Section 5.
### Absolute Unified perspective on Light

<table>
<thead>
<tr>
<th>Term</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E ) old generated/new photon</td>
<td>( T^{-2/3} )</td>
</tr>
<tr>
<td>( \lambda ) cosmological</td>
<td>( T^{-2/3} )</td>
</tr>
<tr>
<td>( E_{\text{photon}} = E_{\text{matter}} = )</td>
<td>( T^{-1} )</td>
</tr>
</tbody>
</table>

### Local Unified perspective

<table>
<thead>
<tr>
<th>Term</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \lambda ) local/comological</td>
<td>( T^{(-2/3)} )</td>
</tr>
<tr>
<td>( e ) local/comological red shift</td>
<td>( T^{(-2/3)} )</td>
</tr>
<tr>
<td>( r ) apparent spatial dilation</td>
<td>( T^{-1/3} )</td>
</tr>
<tr>
<td>( o.a.s = ) Optical angle size</td>
<td>( d/l \times T^{-1/3} )</td>
</tr>
<tr>
<td>( \Delta t ) apparent temporal dilation</td>
<td>( T^{-1/3} )</td>
</tr>
<tr>
<td>( t_e )</td>
<td>( T_0(3/2 - 3/2 T^{-2/3}) )</td>
</tr>
</tbody>
</table>

### Intrinsic Centrifugal Acceleration, Aic

<table>
<thead>
<tr>
<th>Term</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_e/ D_o = 2/3 \times 1/T_0 = H_0 )</td>
<td></td>
</tr>
<tr>
<td>( H_o = V_e/T_0 = 2/3 \times c \times 1/T_0 = V_e/\Delta t )</td>
<td></td>
</tr>
<tr>
<td>Acceleration resisting expansion of objects</td>
<td></td>
</tr>
<tr>
<td>( A_{ico} = 2/3 \times c /T_0 )</td>
<td></td>
</tr>
<tr>
<td>( A_{ic} ) “1/2” = ( (-k/3) \times T^{-4/3} )</td>
<td></td>
</tr>
<tr>
<td>( A_{ico} ) “1/2” /( A_o = 3/2 )</td>
<td></td>
</tr>
<tr>
<td>( A_{ico} ) “1/2” “10” = ( 3.17 \times 10^{-10} ) m/s^2</td>
<td></td>
</tr>
<tr>
<td>( A_{o} ) “10” = ( 2.11 \times 10^{-10} ) m/s^2</td>
<td></td>
</tr>
<tr>
<td>Inertial Motion of Galaxies</td>
<td></td>
</tr>
<tr>
<td>( A_i = (-c/3T) )</td>
<td></td>
</tr>
<tr>
<td>( V_i = (-c/3) \times \ln(T) + “a” )</td>
<td></td>
</tr>
<tr>
<td>( D_i = (-cT)(T/3)((\ln(T) - 1)) + (cT)(T \times “a”)) + “b”</td>
<td></td>
</tr>
<tr>
<td>“a” = ( V_{io} = V_{eo} = 2c/3. )</td>
<td></td>
</tr>
<tr>
<td>“b” “\ln” = ( 1/3 ) Do</td>
<td></td>
</tr>
<tr>
<td>( T_{o \text{ True}} = T_t = 1/H_0 )</td>
<td></td>
</tr>
<tr>
<td>( T_{g} ) Start of galaxies ( \leq 2/3 ) T_t</td>
<td></td>
</tr>
<tr>
<td>( \lambda ) local/comological red shift initial matter = ( 2.08 ); ( z = 1 )</td>
<td></td>
</tr>
</tbody>
</table>