Universal Gravity and the Texture of Spacetime: A plausible hypothesis for observations about celestial body dynamics

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November 10, 2013

Abstract: *The science of cosmology and understanding of the origin of the universe has advanced significantly in the past two decades with improvements in research and technology as well as ambitious new missions to explore the expanse of the cosmos. However, the cliché that "the more you answer, the more questions you have" applies in cosmology today with very pivotal, front-and-center observations that are explainable primarily by advancing astronomical theories to include as-yet undetectable forms of energy and matter. The leading explanation among cosmologists for the observation that the universe is expanding at an accelerated rate is the presence of Dark Energy. Observations of celestial dynamics also suggest the presence of Dark Matter. Neither of these constructs has been detected and yet they remain the prevailing explanations for unexpected observations about real celestial motion. This letter advances new gravity thinking by considering a paradigm shift in the characterization of gravity and the texture of spacetime so that explanations for the accelerating expanding universe and the behavior of celestial motion need not include either Dark Energy or Dark Matter. While cosmologists have already defined alternatives, for example with a possible gravitational explanation in lieu of Dark Matter to explain celestial motion over galactic distances (i.e.- MOND, MOG), this letter focuses more on the explanation of why and how. It specifically includes a new idea to explain the expanding universe without requiring Dark Energy as well as a new idea about* ***spacetime texture*** *to explain the perceived effects of Dark Matter without requiring it. The hypotheses in this letter are simple and elegant, with the main intent and benefit to provide the break-through thinking and the impetus for cosmologists and theoretical astrophysicists to focus experimentation as described below to validate the likelihood that* ***spacetime texture analysis*** *could be provide the most logical explanation of "how" for many of the most popular conundrums in our observations of the universe.*

Definitions & Nomenclature

This letter establishes a point of view and theoretical perspective about the impact of gravity on a wide range of scales and includes a number of references to common terms and analogous precepts that have different meanings in different contexts. In order to ensure proper interpretation of the discussion points in this letter, a few definitions are presented as follows:

Massive Objects are referenced in this letter as individual celestial objects that curve spacetime and whose gravity effect is measured by General Relativity (GR) (or for smaller massive objects like moons and planets by Newtonian physics) and whose gravity potential can be visually modeled by Gravity Wells. Massive Objects include black holes, stars, planets, and moons, for example, but for the purposes of this letter exclude structures on galactic dimensions such as galaxies and clusters (which in this letter are considered a conglomeration of Massive Objects). Those conglomerations of Massive Objects (galaxies and clusters) are referred to in this letter as ***Celestial Objects***. For the purposes of this letter, and unless otherwise noted, Celestial Objects exclude ***Large Scale Structures*** (LSSs).

The concept of ***Gravity Wells*** and the ***Rubber Sheet Model*** are well-established conceptual frameworks to describe and visualize the gravity potential of massive bodies in space, but are oftentimes misapplied as general relativistic embedding diagrams[1]. The more massive the object modeled, the deeper the well and greater the deflection / deformity of the rubber sheet. Note that these representations are not descriptions of actual physical mechanics, but a means to focus attention on universal causality (the essence of this letter). See Figure 1.

Figure 1: Gravity Well

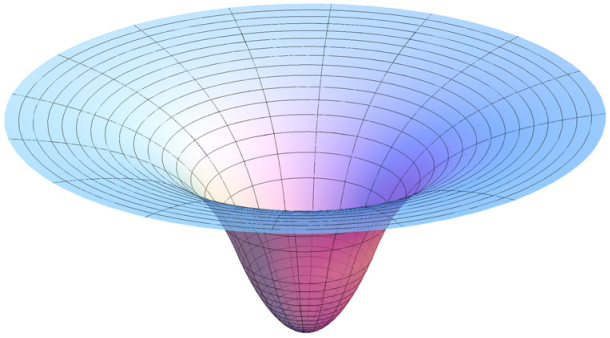
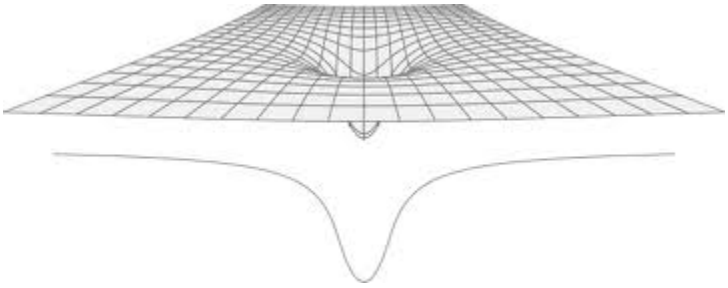


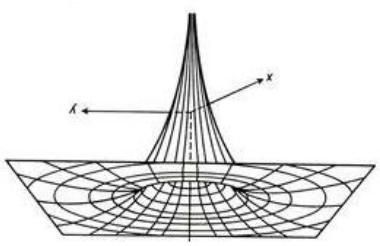
Figure 2: Rubber Sheet Model: Objects depress the rubber sheet according to its mass and density



This letter defines a term called a ***Pressure Cone*** that appears like a pointed protrusion on an inverted Rubber Sheet that, for the purpose of this letter, models the universal singularity of our pre-universe and whose example will be described later in this letter.

[1] , Gravity Wells and the Rubber Sheet model are for explanatory purposes only and distinct from the general relativistic embedding diagrams such as Flamm's paraboloid in describing Einstein's relativistic motion and the curvature of spacetime which cannot be physically revealed (including motion through time) in three dimensions.

Figure 3: Pressure Cone



Elasticity is a common term with different interpretations applied to a wide variety of systems and contexts. Specifically for this letter, and in the context of the Rubber Sheet Model, there is an implied Elasticity of the Rubber Sheet such that a Massive Object with a specified mass would deform the sheet proportional to the mass assuming no other bodies present; that is, the mass exclusively determines the degree of Gravity Well depth and the relative deformation is based on an implied gravitational constant, G. This letter suggests there is an intrinsic and finite elasticity of space and that the texture of space can change in extreme conditions, thus changing the implied gravitational constant, G in calculations of celestial dynamics. Conventional wisdom says that the warping and curvature of space created by Massive Objects will, upon the departure of the Massive Object being observed, completely disappear (following the dissipation of the associated gravitational wave) leaving the previously occupied space perfectly "flat" using the Rubber Sheet model . This letter refutes that assumption with specific examples.

This letter defines the term ***Universe Slope*** by expanding of the analogy of the Rubber Sheet Model and modifying the inherent assumption that the Rubber Sheet is level in its flat unperturbed state, with the direction of gravity perpendicular to the sheet. Instead, this letter proposes that the Rubber Sheet has a slope on a universal scale to be explained later.

The ***Localized Gravity Effect*** is defined here to describe gravitational effects on Massive Objects shown through the conceptual model impacts of the Rubber Sheet that create gravity wells at points on the Rubber Sheet where massive bodies exist. Additionally, ***Micro Gravity Region***s are regions where General Relativistic gravity perfectly models dynamics of Massive Objects and spacetime interactions, and also assumes perfect Elasticity of spacetime.

This letter also defines a ***Regional Gravity Effect*** as the aggregate gravity effect on Celestial Objects over large distances on a galactic scale where there is a conglomeration or cluster of Massive Objects over that large distance (e.g. galaxies and small clusters of galaxies excluding Large Scale Structures). Observations indicate that there is more to GR to explain the Regional Gravity Effect on the motion of Celestial Objects, and specifically on galaxies.

Finally, the ***Universal Gravity Effect*** (or ***Universal Gravity***) is defined here as the effect that gravity has on the universe as a whole in a way not considered before that conceptually explains a gravitational impact on the universe by applying the Rubber Sheet Model on a universal scale and not assuming a level flat surface of the Rubber Sheet, but rather introducing the concept of

Universe Slope and a direction of gravity on a universal scale, i.e. – the ***Universal Gravity Direction***.[2]

Hypotheses and Discussion

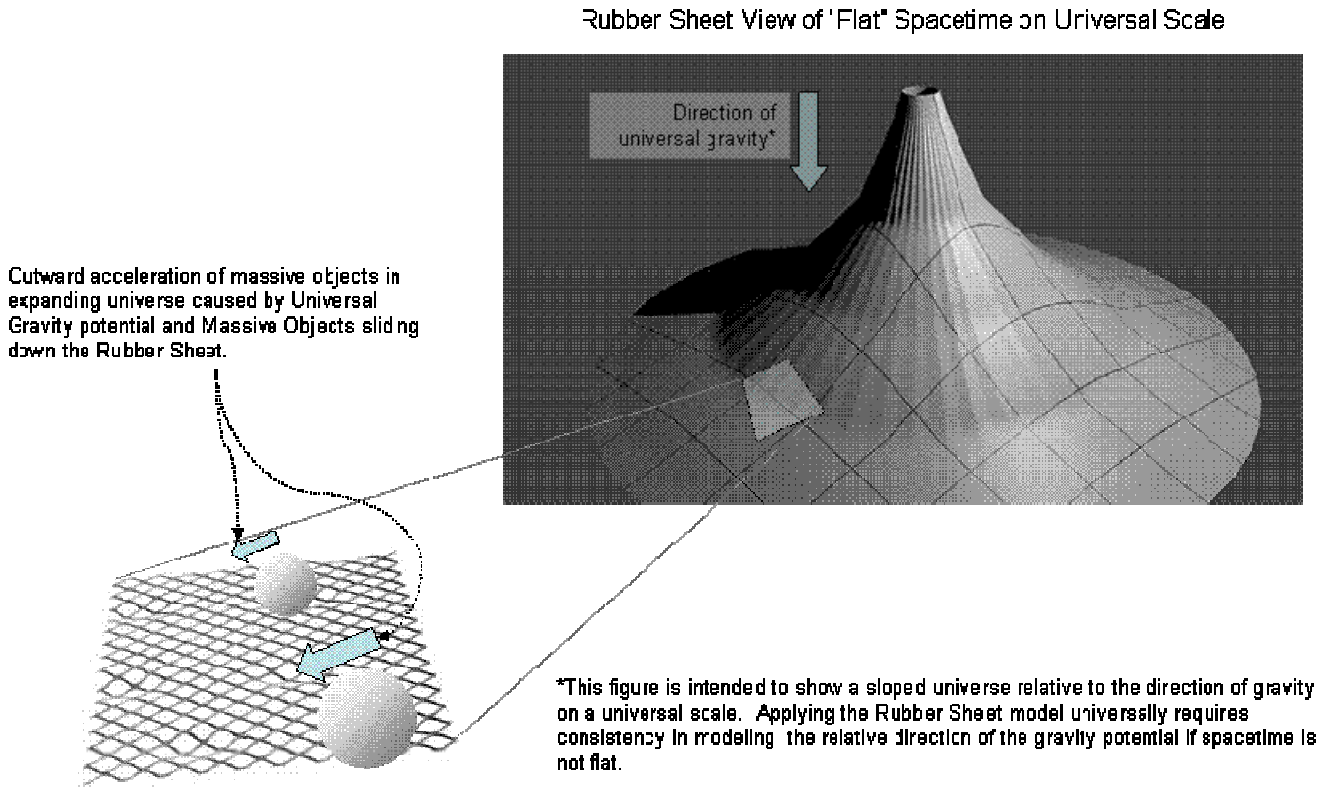
Explaining Our Accelerating Universe without Dark Energy

The first hypothesis of this letter starts by taking the pre-existing idea that the Big Bang event could have been the result of a singularity exploding into the formation of our universe and expanding that idea in a distinct way with the Rubber Sheet Model by describing it as the result of the fabric of spacetime (the Rubber Sheet) being ripped at the point of singularity where the Gravity Well would look like an inverted Pressure Cone whose peak would metaphorically be the head of a pin poking on a the stretched rubber of a balloon. Continuing with the Rubber Sheet Model and balloon analogy, a breach of the Pressure Cone models the Big Bang where the entire spacetime surface would rip apart spewing the mass-energy from the singularity of our pre-universe into the birth of our own universe. The inflation model proposed by Alan Guth in 1980 would represent the expansion of the singularity and formation of matter and all of the forces in our universe (except gravity) in the Plank-time timeframes that the Inflation Model predicts. The statement here that gravity is not "created" at the birth of our universe, but rather was a property of the multiverse that *caused* the birth of our universe, is a key tenant of this letter.

Following the Pressure Cone explosion of our pre-universe, the resulting spacetime surface would resemble a volcano, steeply sloped (not in the physical three dimension reference frame as in Euclidian Geometry, but in the analog of the Rubber Sheet Model) and over time, would evolve into a flatter hill and moving outward from the center reverting back toward flat spacetime. However, spacetime may never achieve perfect flatness, or at least not at the current point in the evolution of the universe, and instead the remnant of the Big Bang event could leave the entire surface of spacetime slightly sloped (and evenly so) up toward the original event, again like the remnant of a volcano as shown in Figure 4 below. This is the Universe Slope.

[2] Note that the creation of a relative orientation of the Rubber Sheet is not to replicate Newtonian Physics as this is still in the General Relativistic realm, but instead, using the Rubber Sheet model to visualize the hypothesis.

Figure 4: Sloping of the Rubber Sheet Model on a Universal Scale



It is important to note that this slope is not the Euclidean slope detected as one of the cosmological parameters from nine-year WMAP results[3], but literally the slope of the "Rubber Sheet," extending the metaphor of the Rubber Sheet Model and Gravity Wells. In other words, the slight slope calculated in the nearly flat universe as determined from the WMAP experiment has nothing to do with the relative direction of gravity in the Rubber Sheet model being close to perpendicular to the Rubber Sheet.

With a sloped Rubber Sheet, the Universal Gravity Effect would be that all matter in the universe would "slide" down the incline of the sloped spacetime surface, causing each celestial body on the spacetime surface to accelerate over time, just as astronomers observe celestial bodies doing so today with the farther bodies accelerating away and moving faster than nearer bodies. Again sticking with the Rubber Sheet Model on a slope, the farther astronomical objects would have on the one hand sped up more because they are farther down the slope, but also accelerate faster if the slope is steeper away from the cone or remnant hill from the Big Bang. What this hypothesis implies, in essence, is that spacetime is not only curved by Massive Objects (the Localized Gravity Effect depicted by Gravity Wells on the Rubber Sheet Model), but also any warping of spacetime (the flat surface of spacetime) caused by cosmological events like the Big Bang can create the perceived effect of the universe expanding as we see it doing so today based on the same gravity that we are familiar with in the Localized Gravity Effect.

[3] , Credit: NASA/WMAP Science Team

As stated previously, just as the Rubber Sheet Model analogy and the implied perpendicular direction to the flat spacetime surface is not literally depicting the deflection and curvature of space representing the gravity potential in the Localized Gravity Effect, neither is it in the case of the Universal Gravity Effect. However, it is important to maintain consistency in the analogy: That is, if there is validity in choosing a relative orientation to describe something using three dimensional space (the gravity direction for a Massive Object on a Rubber Sheet), then there is a validity on a universal scale in referencing an orientation to describe a universal effect using three dimensional space to model it (the gravity direction for any Celestial Object on a Rubber Sheet at universal scale, i.e. – the direction of Universal Gravity).

To be clear, this is not a co-mingling of Newtonian physics to explain the Universal Gravity Effect on the one hand and gravity from General Relativity to explain the Localized Gravity Effect. In the traditional analogy of gravity pushing down on Massive Object in the flat spacetime depicted by the Rubber Sheet, we cannot say anything about why the perpendicular 90 degree direction works so elegantly to describe in a three dimensional model the gravity potential that is created by deforming the Rubber Sheet into a gravity well. We just know this is a special analogy that works quite well. The assumption that must be questioned in the Rubber Sheet model is whether the perpendicular 90 degree direction of gravity in the analogy is relative to the localized Minkowskian space or if it is relative to a universal spacetime Rubber Sheet surface. The position in this letter is the latter assumption is the correct one with the following explanation:

First, there must be consistency with the premise that the Big Bang resembled an event of a large singularity in a pressure cone bursting into our universe from the other side of the spacetime fabric. An implicit assumption in that initial event is that there is already established by definition the description of the event including a universal direction and orientation of the spacetime fabric that can't be ignored simply because we've shrunken to Minkowskian scale for any ad-hoc modeling. (A reminder again, we are still in the world of analogies when discussing anything around the Rubber Sheet model, but even with an analogy, maintaining consistency is important.)

Second, once all of what is now in our current universe burst through the multiverse barrier represented by the universal spacetime fabric shaped into a pressure cone, clearly there would have to be a change – first a change in "pressure" where the tension of the singularity was relieved, so reasonable and logical to expect that the Pressure Cone would diminish and the very deformed shape would begin to abate and revert toward "flat", but still resembling a hill or mountain as described above and in Figure 6, at least for a significant percentage of time in the history of the universe that includes where we are today and into the foreseeable future.

However, there something else that is important besides the effect of the pressure release and the relative direction of the gravity that created the big bang event. Specifically, we now have a point of reference in this new universe – our universe where everything relative to the surface of spacetime (the Rubber Sheet) – is now on the "other side" and this side is the only side we know in our universe. For this model to work, the relative direction of gravity in the Rubber Sheet model would have shifted 180 degrees with respect to the multiverse and the triggering Big-Bang event such that the 180 degree shift would have the perpendicular 90 degree direction of gravity

relative to our new universal spacetime Rubber Sheet surface. If this is the case, then the analogy in Figure 6 explaining the acceleration of everything in the universe away from us – the perceived expanding universe – seems plausible. Accelerating bodies on universal timescales to where we are today in the evolution of the universe could, at the correct angle of slope, justify the speeds of expansion.

There is, however, a logical hurdle to overcome in this idea with regard to the direction of gravity relative to the Rubber Sheet switching 180 degrees from the prior universe to ours. The hypothesis in this letter assumes that gravity is always relative to the spacetime surface of the current universe and that the other-side (or pre-universe) becomes irrelevant. The breach event is where everything changes and that event cannot be known or described precisely, but the before and after should be – namely that in the analogy of the Rubber Sheet model, the direction of gravity relative to the spacetime surface of the existing universe must be established.

There are many examples in our world of scientific understanding where this seemingly contradicting symmetry takes place: In GR theory, the inertial reference frames of two individuals moving away from each other at the speed of light each would think the other person is aging more slowly. Which one is right? Both are correct in their own reference frames. Two observers looking at one another from great distances would claim themselves as bigger and the other who is viewed far away appears small. Which one is right? Both are correct in their own reference frames. A final example resembles the Rubber Sheet itself: Consider the idea of a metal sheet that is magnetized. A ball with opposite charge on one side of the surface would be attracted to that side of the metal sheet just as a ball on the other side of the metal sheet with the identical opposite charge as the metal sheet would also be attracted to the same surface. There is not an apparent contradiction in this example, and for the other examples, the analogy of the Rubber Sheet on universal scales simply assumes that there is a reference frame for the discussion of gravity with regard to the universe that is being discussed.

Therefore, the hypothesis is that the gravity that we know from General Relativity is the same gravity that is responsible for the acceleration of the universe. It is the observation that all celestial bodies are accelerating away *in every direction* that gives rise to the idea of a volcano-shaped, sloped spacetime surface and not by locking the universe into an absolutely flat (Euclidian) surface to explain it when applying the Rubber Sheet Model.

Dark Matter and the Stretched Spacetime Effect

Furthermore, this letter hypothesizes that in our own current universe, very massive objects like black holes could potentially create such a warping of spacetime that even if they were to evaporate over time[4], or in other massive cosmological events like supernova explosions, the resulting space that the mass occupied is no longer elastically rebounded back into the uniform shape of flat space, but forever warped as a stretched area of spacetime resembling a pimpled surface and no longer retaining its original elasticity. This statement implies that there can be a permanent warping of space that depends on the texture of space as well as the mass of the matter that curves it and specifically refers to a space shape remnant due to texture and elastic

[4] , Hawking, S. W. (1974). "Black hole explosions?". *Nature* **248** (5443): 30.

properties of space that live on beyond mass-induced events that created warped space (even after the gravitational waves of associated events eventually dissipate).

Virtually all of cosmology presumes a perfect rebound of space when mass departs such that any gravitational interactions dissipate and reshape space through gravitational waves that ultimate settle out relativistic Reimann spacetime deformities. An analogy would be a boat on the water, creating waves as it passes by a point in the surface of the water, but after a period of time, the waves and turbulence dissipate and the water reverts back to apparent smooth surface (assuming no wind). The permanent warping of space would be more akin to a super-massive object creating such a deep depression in the Rubber Sheet that it fundamentally stretches the sheet beyond the point of rebound. In this case, the analogy is like dropping a piano from two story building onto a trampoline with titanium springs that we can assume would not break under any load. Once the piano was removed, the trampoline mat would be permanently stretched in the center, perhaps reflecting the impression of the piano case. In describing a metaphor for space, the example of a textured surface that has a limit on elasticity wins over the example of water because in the water example, there is no warping, only displacement of the medium. We know from General Relativity (GR) that warping of space occurs, not just displacement around the mass because gravity's effect starts before you come in contact with the mass.

The visible effect of this permanent warping and the many spacetime "impressions" left fossilized in our universe can be explained by the celestial mechanics that have been measured and calculated for galaxies and other massive objects in the cosmos that have necessitated the presence of Dark Matter by supporters of the Standard Model (ΛCDM). The fact that we see behavior of these massive objects (or clusters of objects such as galaxies and galactic clusters) in the presence of matter that we cannot see may be explainable by the dimpling and permanent warping of spacetime when the object that created the warping either is no longer there, or had such large mass to leave permanent warping and stretching.

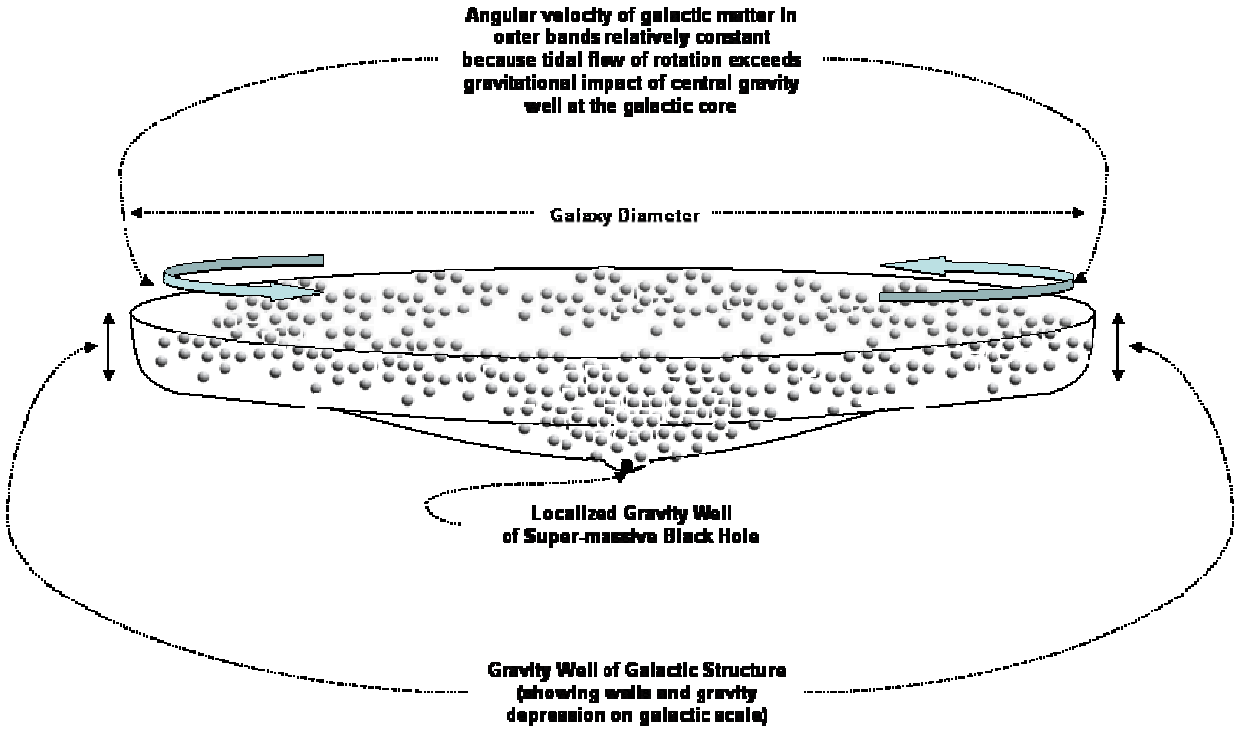
The galaxy rotation problem, for example, which ΛCDM explains by adding Dark Matter, could be explained by considering a relatively large radial expanse of spacetime – on galactic dimensions – covered with relatively dense amounts of visible matter such that the rotating disk of the galaxy (assuming a galaxy) can be modeled by the Rubber Sheet Model as a circular well in the shape of a pan. The rotation of all galactic matter in a galaxy could have created grooves in the spacetime fabric as the galaxy evolved in universal timescales and this in turn could have left the permanent depression of the pan-shaped Gravity Well as shown in Figure 5 below.

Over large distances the cumulative mass and rotation of all the matter in that galactic region creates a Regional Gravity Effect that compresses the Rubber Sheet into a circular depression with a galactic radius such that even the stars in the outer bands of the galaxy are in a shallow Gravity Well relative to outside of the galaxy, where the well has "depression walls" at the galactic radius.

The rotating galactic matter showing constant radial velocity as you move out along the radius from the galactic center would simply be explained by the frictional, tidal flow of the rest of the galactic matter around the center, just as in many other examples of rotational flow. The excessive speed of rotation that imply an escape velocity when calculated by GR, cam be

explained in part by the sloping of the pan depression up from the center as you move out on the galactic radius, with the pan "walls" retaining the outer bands of matter in a caged rotation. (see Figure 5).

Figure 5: Regional Gravity Effect - Gravity Depression over Large Distances



So the stars within would follow the galactic rotation around an observed center in a stretched pan-shape of the spacetime surface with a near constant angular velocity due to the tidal flow of the rotation having a greater impact on the outer bands than the localized gravity effect of the super-massive black hole and associated matter in the deeper Gravity Well at the center of the galaxy.

One of the leading mathematical explanations for the galaxy rotation problem not requiring Dark Matter is from Moffat in his Modified Gravity (MOG) theory[5]. In it he adds a universal vector force to Newton's law of gravity which, by also adding another constant μ to describe the vector field of an interacting mass, explains motion of celestial bodies without requiring Dark Matter. The physical effects and mass-spacetime interactions implied by this math are different than what is described above (MOG includes repulsive forces and angular moments), but the point is that introducing other gravitational explanations for celestial motion using mathematics, while

[5] , J. W. Moffat(1), V. T. Toth(2), (2007), Modified Gravity: Cosmology without dark matter or Einstein's cosmological constant, (1) Perimeter Institute for Theoretical Physics, Waterloo, Ontario N2L 2Y5, Canada, (2) Department of Physics, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada

also maintaining consistency with Newtonian mechanics and GR, proves that other kinematics may be involved in defining gravity universally without requiring Dark Matter. This letter does not reveal the math that would be required to define the effects described above, but they could be modeled. Mathematics can also model the permanent warping of spacetime and also describe textured space.

For example, where there are permanently warped areas of spacetime in our universe, the constant G would change in these locales such that the formulation of mass, motion, and gravity would keep the calculation of mass as intended for only the real, visible mass, and G would be recalculated such that we would see the resulting accelerations and rotations of observed bodies as we see them and measure them today. Moffat shows through his MOG theory that constant velocity curves of rotating galaxies imply G/c is constant ('c' is the speed of light), whereas G and c alone may not be constants.[6] While the Standard Model as the most prominent direct competitor to MOG theory fits today's cosmological observations better than other options, the theory works so well only because it fills in observational gaps with Dark Matter to fit the data instead of looking at the constants that drive the math, and from a physical perspective, would describe the implied texture of spacetime.[7]

Summarized Hypotheses

The two hypotheses above – (1) that the universe may be expanding as a result of a universally sloped spacetime surface, and (2) that space has texture that can create permanent warps both due to prior interactions with massive bodies as well as spacetime impressions from galaxies and other Celestial Objects over galactic dimensions (the Regional Gravity Effect) also implies that ***the universality and permanence in the cosmos (and of the cosmos) is gravity itself***.

The interaction of mass and spacetime as predicted by General Relativity (GR) has been 100% verifiable for Localized Gravity Effects precisely because mass and space interact the same way with each other universally as long as there is perfect elasticity of space. However, this letter suggests that the impact that mass has on space and time is not always the same, and certainly not the same when a Massive Object falls within a region of space that had been warped *prior* by another more Massive Object or where massive clusters of objects *distort the fabric of space differently* than localized Massive Objects that occupy that space currently. Again, the visible effects that cosmologists and astronomers see today are the implied regions of Dark Matter in the universe. If you were to take every measured region in the universe with an implied Dark Matter component and simply considered those regions warped and permanently stretched spacetime regions, then when Massive Objects fall into those regions, they behave as if the original mass that created the warping were still present, or with the galaxy rotation problem, that the rotating matter is swirling within a depressed section of spacetime (in the shape of a pan instead of a paraboloid as in Figure 5 above).

[6] , Moffat, J. W. (2006). "Scalar-Tensor-Vector Gravity Theory". *Journal of Cosmology and Astroparticle Physics* *JCAP* 0603: 004.

[7] , MOG still needs to be verified by future data analysis to confirm the presence of baryonic oscillations, so the jury is still out versus the Standard Model and Dark Matter.

As stated prior, some inflation model cosmologists purport that right after the Big Bang, gravity "came to be" in the first few nano-seconds of the history of the universe and was actually the first force in the universe. Rather, the hypotheses in this letter assume that both the texture and characteristics that describe the fabric of the universe and also gravity (metaphorically speaking with the Rubber Sheet Model) are permanent in the multiverse and, moreover, that the same gravity that is responsible for a singularity – such as a super-massive black hole – is the same gravity that causes all celestial bodies to accelerate down the slope of the spacetime surface after the singularity broke through the fabric of spacetime to create our universe in the event we call the Big Bang.

Proposed Experiments

Certainly, analysis and research conducted at CERN on the behavior of matter to energy transfer (and visa-versa) to further our understanding of the Big Bang event is an important area of exploration, but you do not see the gravity effect at atomic scales to be able to replicate that gravity effect at the moment of the Big Bang. Quantum research on the Higgs Boson and graviton particles may directly correlate to the "Why" of the inherent texture and fabric of spacetime in our universe, but those experiments do not reveal what is happening on cosmological scales. Just as a credentialed architect who builds a skyscraper to regulatory building codes needs to know about metallurgy and the intrinsic properties and behavior of composites and related materials in order to determine viable architectural design options, s/he does not need to know (or care) what the atomic aspects of those underlying materials are. In the same way, this letter suggests experimentation that seeks to explore and verify the properties of the material we call spacetime, without needing to start at the quantum level to entirely explain what happens on cosmological scales.

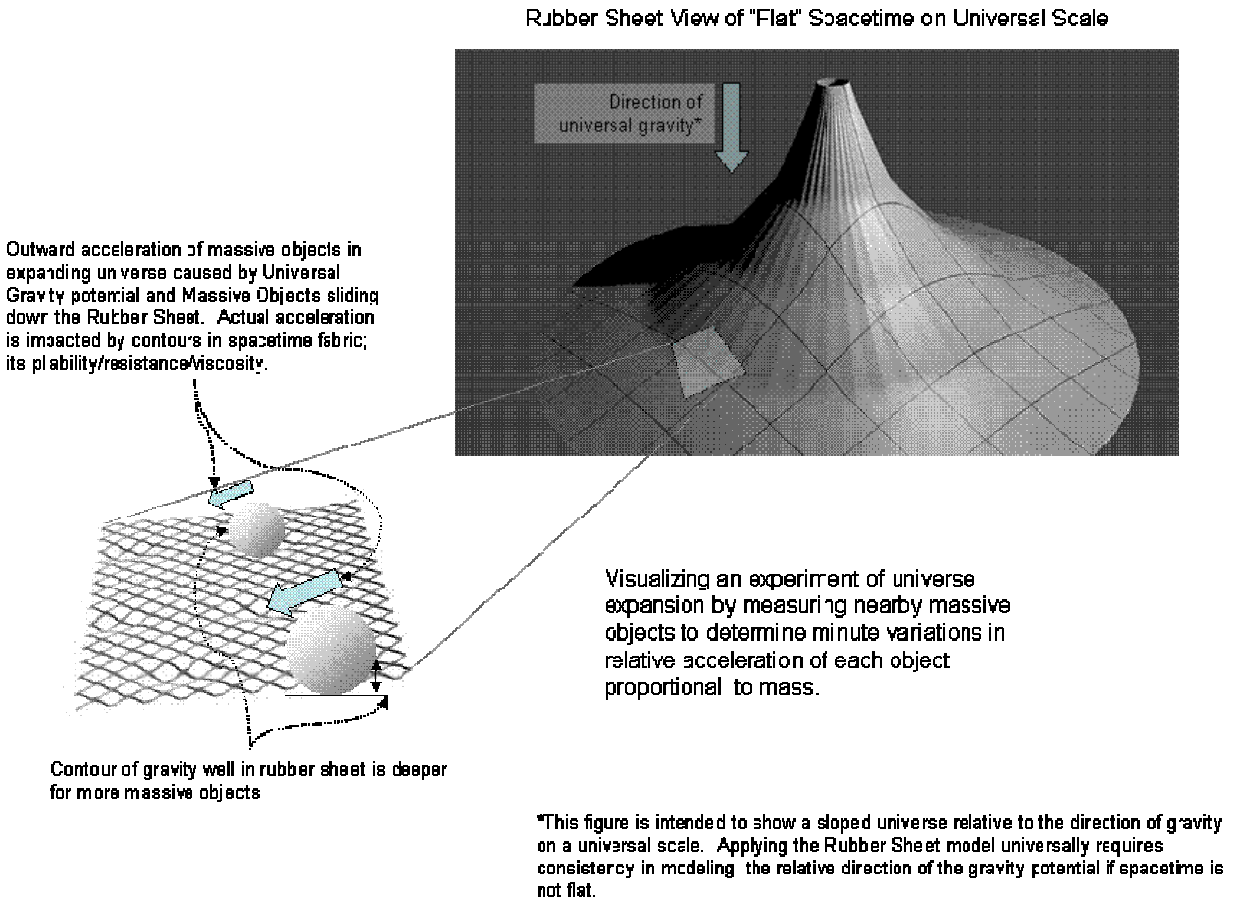
So if experimentation can specifically be focused on the macro fabric of spacetime, then results can give us clues about the ***texture*** of that spacetime fabric, from which we can infer more around the Big Bang event and our expanding universe. Today we are left with current astronomical observations telling us there is Dark Energy and Dark Matter that no one can detect. Instead of dealing with inconsistencies around GR and what we think we know about how gravity should work, let's frame the problem instead by describing the characteristics and attributes of space such as elasticity and viscosity. Metaphorically, are its stretch properties balloon-like or like heavy rubber? Are the resistance properties of the spacetime surface thick or thin, like a gluey fluid or like concrete? Is it pliable, yet super-strong like a spider's web?

Specifically, this letter proposes the following experiments:

1. **Universe Acceleration due to the Slope of Spacetime on Universal Scales-** Cosmologists would have to find a high density, massive Micro Gravity region near a low density, relatively less massive Micro Gravity region to see if there are differences in acceleration measurements of universal expansion for those two relatively co-located Massive Objects (or Celestial Objects).

Compared Micro Gravity regions that are the same distance (radius) from our point in the universe should, in theory, accelerate away from us at the same rate. If we can detect slight differences in acceleration between the two regions, it could be due to different degrees of resistance in the contour changing as each Micro Gravity mass/cluster accelerates down the Rubber Sheet slope OR it could signify the degree of stretch/warping (where indentations that make the more massive Micro Gravity region slower to move through the warped space through the down-sloped spacetime surface; in essence a magnified resistance effect of the spacetime texture). See Figure 6.

Figure 6: Relative Universal Acceleration of Massive Objects



2. **Universe Acceleration for Black Holes –** Similar to the experiment above, researchers could conduct another experiment to show the relative acceleration between the cone expansion gravity impact on the cone slope from the micro gravity dimple stretch from dense "micro" bodies (i.e. – quasars, black-holes). The measurement would compare how fast that micro-body is expanding on universal scales with other less massive micro-bodies to see if their relative universal expansion acceleration is the same. If not, there is an implication of some type of resistance effect for deeper Gravity Wells in the micro-gravity regions of super-massive objects.

3. **Building a computer model of a permanently warped-spacetime surface for Dark Matter regions and model massive body dynamics –** In this experiment, the goal would be to isolate an observed region of the universe where Dark Matter effectively describes celestial dynamics and for that region, create a deformed spacetime surface (without matter), then through computer simulation, have the observed space objects in that region travel through the deformed spacetime area to compare dynamic effects to observations from real data about that massive object.

   In each experiment, the goals are to explain the following:

   - That the universe is expanding at an accelerated rate due to the same micro-body gravity we observe for Massive Objects and without requiring Dark Energy;

   - Celestial-body dynamics without requiring Dark Matter and specifically explainable for dynamics of Massive Objects by a permanently warped spacetime after the influencing mass has departed and for Celestial Objects by the permanent spacetime depressions on the galactic dimensions of the Celestial Objects themselves.

This letter does not go into a detailed explanation of how Large Scale Structures (LSS) are formed using the universal Rubber Sheet analogy, but one idea for others to explore further would be that as large groupings of clusters and super clusters slide down the slope of the universal rubber sheet, there could be a rolling or binding effect that accumulates as it moves along, similar to a snowball rolling down a hill or a snow "log" that grows in its cylindrical diameter as it moves down the slope and accumulates matter in its path.

Summary & Next Steps

What theories such as MOG tell us is that *any* physical explanation for the interactions between masses and space (such as a combination of traditional gravity, repulsive forces, and cross coupling forces) can be modeled mathematically. The sole requirement in a gravity explanation is that GR and Newtonian mechanics are not violated. Constructs like MOG and MOND[8] prove this is possible. In fact, there are an infinite set of mathematical models that could be created to do the same, just like there are an infinite number of scores that can produce music, not just sounds from an instrument. Obviously only one mathematical model that could universally describe gravity without requiring Dark Matter would be the correct one (if indeed Dark Matter is not a real construct in our universe). What this letter suggests, therefore, is for physicists to continue work on developing mathematical models that reflect an imperfect fabric of spacetime that has limits to its elastic properties and can simulate a real degree of "texture". (MOG's universal repulsion component is analogous to a viscous, resistant texture, for example.)

In the final analysis, experiments and additional data sets from ongoing space exploration will verify once and for all if the Dark Matter approach better represents reality than without it.

[8] , MOND – Modified Newtonian Dynamics, Milgrom, M. (1983). "A modification of the Newtonian dynamics as a possible alternative to the hidden mass hypothesis". *Astrophysical Journal* **270**: 365–370.

Given what we know today on all related matters of the cosmos, if any one theory wholly depends on an as-yet undetectable element that is key to that theory, then it leaves us wanting more, especially given that scientific method requires experiments to reveal conclusions from observable results, not just inferences. Dark Matter and Dark Energy are nothing more than a plug to fit observations, and they do this quite well. However, that is not how scientific method is supposed to work. These theories may prove correct and cannot be abandoned. Nevertheless, and absent a verified result with observable inputs, the scientific community owes it to the universal mission of science to be true to its discipline and that means more heavy lifting is required to theorize and test other possibilities and this requires more out-of-the box thinking such as what is proposed in this letter and the associated experiments.