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DARK ENERGY FROM DARK MATTER: NEWTON VS EINSTEIN, WHO'S REALLY RIGHT?

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ABSTRACT: *This article explores solutions to the hierarchy problem and the cosmological constant problem with gravity and the fundamental forces, including properties and interactions of dark matter, dark energy, parallel dimensions, and cold thermodynamics, while developing advanced models for gravity to help declare a winner between Newton and Einstein. Aside from the difference in geometry and mathematical formulas, and aside from a Newtonian separation of space and time, with no gravitational waves, no gravitons, no speed of light limits for gravity, and no relativity metrics based on matter, Newtonian gravity is simply based on observation of an apple, leaving the question of how it works to the reader, while Einsteinian gravity has an elegant warping of space-time based on a natural consequence of mass's influence on space, but who's really right here?*

KEYWORDS: Gravity, Dark Matter, Dark Energy, Hydrogen, Proton, Anti-Gravity

INTRODUCTION

The graviton is merely a theoretical particle that mediates the force of gravitation, but has yet to be discovered and has an outstanding mathematical problem with renormalization; therefore models beyond quantum field theory, such as the standard model and string theory, have become popular. Although mass is generally considered to be the influence for gravity, the mechanism is often left to hypotheses like the graviton.

The Gravity Probe-B confirmed two predictions of Einstein's theory of relativity, [1] including frame-dragging, the spin of how a large body distorts the space-time around it, and gravitational lensing, where light around a large body is bent, but again the reader is left to generalize that mass somehow results in gravity. Trent Perrotto of NASA did some great coverage of this in his articles. [2]

Let's take a leap and assume we are beyond waiting to discover some illusive quantum partial to understand gravity, but simply need to describe the properties of an atom in a way that answers some basic questions 1) does mass generate a gravitational field, 2) does mass warp space-time geometry, or oppose an anti-gravitational field density in space, or 3) is there some combination of both with relative gravitational field densities that are yet to be determined?

Although #1 is the general perception of gravity and is in line with Newton's observations, #2 is the simplest expression of gravity, yet it is also the most difficult to comprehend, and is more in line with Einstein's predictions of a warp of space-time geometry, and #3 would suggest they are both somehow right for the most part.

The fabric of space will eventually be determined to be something, say dark matter, dark energy, strings, loops, waves, molecules, etc., consisting of predominately weak negative gravitation, so mass is primarily positive to gravity and the fabric of space is predominately negative to gravity, but wouldn't they both simply attract and overlap with each other?

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With equal field densities, they would stay at bay, but that's not the case, because mass has density and comparable space is relative to distance.

The Potsdam Gravity Potato (2005-2011) illustrated that gravity is not so much a warp of space-time as it is attributed to surface features on the planet and unusual high and low surface densities, also suggesting the fabric of space has an influence. [3]

The Wilkinson Microwave Anisotropy Probe (WMAP 2001-2012) was monitoring the cosmic microwave background fluctuations of the early universe for several years. [4] The European Space agency's Planck Probe (2009-2013) has completed its census of the universe with greater accuracy and is now showing more matter and less energy, by as much as 4% of what was expected, which puts dark matter at 26.8%, ordinary matter at 4.9%, with a 4% drop in the amount of dark energy detected. [5]

This hidden mass and energy can only be detected based on their positive (dark matter) and negative (dark energy) gravitational effects. However, the popular consensus is gravity is just an attraction force.

Even so, we are talking about two overleaping geometric systems, both mass and space, but it's not just space-time that is getting warped, it's the fabric of space (dark matter) that is getting displaced. So the property of an atom that makes the most sense with these scenarios is to use the angular momentum of the electrons, quarks and nucleus, which is what actually influences gravity:

- Neutron (no electron) predominantly displaces space and the fabric of space (dark matter) and is a major influence over gravity.
- Proton (ortho nuclear spin), or when combined with neutrons, results in a predominately positive gravitational field (strong, but is relative to density).
- Proton (para nuclear spin), along with the fabric of space (dark matter), is predominately a negative gravitational field (weak, but is relative to density).

The photon and dark matter field strengths fluctuate based on nuclear spin, orbital angular momentum, electron spin, atomic structure, electron ground to excited states, and the molecular binding of molecules, while neutrons have more of a constant field density.

Even the shape, size and spin of a proton can be somewhat daunting to physicists, which can best be described as "spherical-ish", consisting of two up quarks that are positively charged and one down quark that is negatively changed. Matthew Francis has a great explanation for the shape of the proton in his blog, [6] where the spin of the quarks combine in parallel and in opposite directions, resulting in more of a "peanut" or "bagel" shaped proton.

The paper entitled "Gravity, Special Relativity and the Strong Force" [7] published in 2012 proposes that quarks are actually ultra-relativistic neutrinos, with the strong force being gravity. This is very interesting, but even with the quark as the primary mechanism for gravity; the neutron has to behave differently than the proton, with two down quarks and one up quark, requiring a more precise universal gravitational constant at the very least.

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Aside from the field densities of gravity and the displacement of the fabric of space, neutrons would primarily "compress" the geometric system of space in a way that warps space-time. This would work inverse to the way atmospheric pressure drops and atmospheric gas density decreases with distance from the center of the planet.

Therefore, bodies keep their atmospheres with gravitational attraction (and repulsion), resulting in higher density and pressure, while space is a near perfect vacuum with low density and pressure, resulting in two "overall" opposing forces, mediated by gravity, density and pressure, with the consequence of a gravitational weight.

Other influences on gravity includes the spin of the planet resulting in lower gravitational weight at the equator, the electromagnetic field of the planet, moon or star, the tide bulge of our moon, the momentum and electromagnetic stress-energy tensors, and perhaps even the gravitational void at the center of the planet, moon or star.

So it is possible that Newton and Einstein could both be right for the most part, at least with our current understanding of the dynamics of gravity. Although the math is excellent, Monash University has demonstrated that is doesn't always agree with at least with low speed trajectories [8] and possibly magnetic fields.

The physics simply doesn't cover every scenario though, so saying either one is right is more like saying Newtonian generalizations are often good enough for some things. Brian Koberlein has a great point why Einstein will never be wrong though, suggesting a better model would need to actually do more than what relativity has to offer, [9] with perhaps quicker calculations too.

In any case, no matter how you look at it, there are two distinct and overlapping geometric systems (neutrons-protons 1st – 3rd dimensions) and (protons-dark matter 4th dimension) that are influencing gravity, which opens up a lot of possibilities for things like taking larger payloads to space, artificial gravity, and even anti-gravity, but further research is needed with gravity and dark matter in particular, along with the containment of dark matter.

The Cold Thermodynamics of Gravity

Gravity and electromagnetism appear to be two sides of the same coin. They share similar mechanisms, mediated primarily by quarks and electrons, where electromagnetism is 10^{35} times stronger than gravity and acts on charges, while gravity acts on mass. They are both fundamental forces, one of which we know how to shield against, the other we don't.

This relationship plays into the hierarchy problem, where the weak force is 10^{24} times stronger than gravity, but that takes us full circle and back into renormalization issues, unless we recognize there is more to gravity than we presently understand. Saibal Ray did an excellent paper to explore this problem from various perspectives. [10]

Physicists have been trying to relate gravity to electromagnetism for centuries, but are not necessary working with all the right variables…

Take the case of composite dark matter, as covered in the paper "Exploring Composite Dark Matter with SIDM and CDM" [11] published in 2017, part of a collection of papers and articles titled the "Grand Unification of Dark Matters: The Dark Universe Revealed". [12]

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The below rudimentary truth table illustrates how electromagnetism and gravity might relate based on quarks, electrons and positrons.

Atom	Quarks Up	Quarks Down	Up Charge	Down Charge	Net Nucleus Charge	Gravity Pull	Gravity Push	Max Electrons	Max Positrons	Net Lepton Charge	Gravity Pull	Gravity Push	Net Charge
Dark Protons	3	0	2	0	2	2	0	0 to 4	0	0 to -4	0 to 1	0 to 1	2 to -2
Protons	2	1	1 1/3	- 1/3	1	1 1/3	1/3	0 to 2	0	0 to -2	0 to 1/2	0 to 1/2	1 to -1
Neutrons	1	2	2/3	- 2/3	0	2/3	2/3	0	0	0	0	0	0
Dark Neutrons	0	3	0	1	-1	0	1	0	0 to 1	0 to 1	0 to 1/2	0	-1 to 0

For each elementary particle, the charge associated with their angular momentum is used to determine the relative gravitational force, where each atom participates in both an attraction and repulsion force, with the potential for a positive and negative gravity for each.

The gravitational relationship with electrons is cumulative based on odd/even rotations with a half-integer spin. With quarks, it's just the standard 2/3 Up and 1/3 Down.

For nuclear spin, the magnetic movement is much smaller, but these truth tables would need to be done per element. With free protons (molecular hydrogen), the ortho and para nuclear spins are expected to have the most significant influences with "negative" gravitations (dark energy from composite dark matter) at lower temperatures. This would make for a very interesting experiment for someone to take on; suggesting the change in rotation would influence gravity, so aside from ortho and para hydrogen separation, it should just be a matter of determining their gravitational weights or seeing which one rises faster.

Composite Dark Matter gasses at absolute zero, to sub-absolute zero, which has been demonstrated for the first time with quantum gas in a laboratory, [13] could easily explain dark energy too, with gas that is "defying" gravity.

Morton Travel did a great job of explaining the "spin" of subatomic particles in his article. [14]

Protons are expected to be the major force in attraction and the neutrons are expected to be the primary force in repulsion for "compressing", "displacing", "bending", "curving" or "warping" of space-time, but all rotating particles participate.

Aside from exploring this more and tweaking the math to see if it all still works, that leaves the basic question of what is gravity?

The neutrino and anti-neutrino have potential. In space, they are primarily produced by the Sun, but are generally thought to pass through normal matter unimpeded. Even so, more types of neutrinos may turn up to explain and mediate gravity.

Perhaps dark gravitons and dark anti-gravitons will eventually turn up, that is theorized to be a massless spin-2 particle; where "dark" would make for a good nomenclature standard for any theoretical partial. These could be just another type of neutrino, even though they are now known to have a discrete mass.

Gravity is often described as a fundamental force, similar to electromagnetism, whose energy (quanta) is of a particular kind of field using a gauge boson as a force carrier. With gauge theory, interactions (forces) between elementary particles and each other occur by the exchange of gauge bosons, usually as virtual particles, but these are generally short-lived theoretical particles for mathematics, and not actually observable, so Matt Strassler helps explain it in terms of "field densities" rather than "virtual particles", or as "disturbances" of gauge bosons rather than "exchanges". [15]

The interesting aspect of particle physics, with the standard model and quantum field theory in particular, is that mass may have nothing to do with gravity, other than relay packs of information (energy) that causes atoms to respond, so once all of this signaling is understood (properties and relationships), it could potentially be simulated to make matter and energy do all kinds of things, but back to the 21st century, these frameworks would make for some interesting modelling tools to do simulations on supercomputers, and of course use for mathematics, although it would take some sold research to truly understand all of this signaling before the end of the century, but who knows how soon the next biggest breakthrough could accelerate everything.

Back to the physical universe (well as real as it gets anyway), dark matter could be described as almost virtual, because we can't perceive it with our physical eyes and it's not clear if scientific instrumentation has even gotten a glimpse of it for any length of time, except perhaps the deltas.

In any case, gravity is up to forty orders of magnitude weaker than all the other forces in the universe. Therefore, you would need to increase the force of gravity by 10^40 just to get two protons to overcome their own electromagnetic repulsion or otherwise increase gravity by bringing together a mass of 10^40 protons.

It would take one trillion times that mass of protons for a spontaneous reaction about the size of a small sun. Although this works out well for us on a macro scale, it will eventually have some interesting explanations, like a "net" effect with the elementary force of gravity, rather than a one-sided attraction like what is generally accepted, in addition to other theories, such as multiple dimensions. In a sense, dark matter does create a pseudo or shadow 5th dimension, but everything is still happing in the four dimensions that we can all relate to.

Another way to look at it is quantum field theory is only interested in energy differences, while general relativity is an absolute value for vacuum energy density needed to warp space-time, but when calculating that value, it is forty to well over one hundred magnitudes stronger than it should be, otherwise known as the cosmological constant problem, so another real question is does vacuum energy gravitate, or does it have an anti-gravitational effect like dark energy, which is not mutually exclusive of the anti-gravitational effect that dark matter and perhaps at least some ordinary matter must have?

The greater challenge is we are only talking about one form of compose dark matter here, perhaps the one that interacts with our reality the most. There could be several forms of composite dark matter, with upwards to eleven dimensions (11D), [16] all with different phases and levels of interactions, making their detection somewhat similar, but not necessarily using the same technology.

Beyond that includes other forms of dark matter that could act more like neutrinos, having no interaction with ordinary matter, although it is not clear if any of these gravitate.

Beyond that we are truly getting into parallel universes, all sharing the same space, with no interactions whatsoever, which is way beyond our technology to even begin to detect.

Our perspective of the universe is often based on what we can observe and imagine; which is merely a fraction of what we will ultimately discover about the universe, but one thing is for certain, understanding all of the dynamics of gravity is the key to recognizing who's research, theories and models of the universe are on track, and will truly open the door to space and interstellar exploration amongst other things, in part because negative energy could be much closer than you expect.

Essay originally written for the Gravity Research Foundation 2017 Awards for Essays on Gravitation, but it wasn't ready for the deadline; maybe next year!

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