Confirm Discovery of Fifth Force of Nature

Recent findings indicating the possible discovery of a previously unknown subatomic particle may be evidence of a fifth fundamental force of nature, according to a paper published in the journal Physical Review Letters by theoretical physicists at the University of California, Irvine. [16]

Radioactive decay anomaly could imply a new fundamental force, theorists say. [15]

Researchers at the University of Southampton have proposed a new fundamental particle which could explain why no one has managed to detect 'dark matter', the elusive missing 85 per cent of the Universe's mass. [14]

Fast Radio Bursts (FRBs) are extreme bursts of radio emission that last for a few milliseconds. They were discovered in 2013, and, in 2014, the number papers on FRBs skyrocketed. The origin of these transients is still uncertain — we can't even agree if they are extraterrestrial! Astrobites has already covered two possible origins: stellar flares and neutron star mergers. Today's paper suggests an even more exotic source: dark matter annihilation of neutron stars. [13]

If dark matter comes in both matter and antimatter varieties, it might accumulate inside dense stars to create black holes. [12]

For a long time, there were two main theories related to how our universe would end. These were the Big Freeze and the Big Crunch. In short, the Big Crunch claimed that the universe would eventually stop expanding and collapse in on itself. This collapse would result in…well…a big crunch (for lack of a better term). Think "the Big Bang", except just the opposite. That's essentially what the Big Crunch is. On the other hand, the Big Freeze claimed that the universe would continue expanding forever, until the cosmos becomes a frozen wasteland. This theory asserts that stars will get farther and farther apart, burn out, and (since there are no more stars bring born) the universe will grown entirely cold and eternally black. [11]

Newly published research reveals that dark matter is being swallowed up by dark energy, offering novel insight into the nature of dark matter and dark energy and what the future of our Universe might be. [10]

The gravitational force attracting the matter, causing concentration of the matter in a small space and leaving much space with low matter concentration: dark matter and energy.

There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

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Author: George Rajna

Physicists confirm possible discovery of fifth force of nature

Recent findings indicating the possible discovery of a previously unknown subatomic particle may be evidence of a fifth fundamental force of nature, according to a paper published in the journal Physical Review Letters by theoretical physicists at the University of California, Irvine.

"If true, it's revolutionary," said Jonathan Feng, professor of physics & astronomy. "For decades, we've known of four fundamental forces: gravitation, electromagnetism, and the strong and weak nuclear forces. If confirmed by further experiments, this discovery of a possible fifth force would completely change our understanding of the universe, with consequences for the unification of forces and dark matter."

The UCI researchers came upon a mid-2015 study by experimental nuclear physicists at the Hungarian Academy of Sciences who were searching for "dark photons," particles that would signify unseen dark matter, which physicists say makes up about 85 percent of the universe's mass. The Hungarians' work uncovered a radioactive decay anomaly that points to the existence of a light particle just 30 times heavier than an electron.

"The experimentalists weren't able to claim that it was a new force," Feng said. "They simply saw an excess of events that indicated a new particle, but it was not clear to them whether it was a matter particle or a force-carrying particle."

The UCI group studied the Hungarian researchers' data as well as all other previous experiments in this area and showed that the evidence strongly disfavors both matter particles and dark photons. They proposed a new theory, however, that synthesizes all existing data and determined that the discovery could indicate a fifth fundamental force. Their initial analysis was published in late April on the public arXiv online server, and a follow-up paper amplifying the conclusions of the first work was released Friday on the same website.

The UCI work demonstrates that instead of being a dark photon, the particle may be a "protophobic X boson." While the normal electric force acts on electrons and protons, this newfound boson interacts only with electrons and neutrons - and at an extremely limited range. Analysis co-author Timothy Tait, professor of physics & astronomy, said, "There's no other boson that we've observed that has this same characteristic. Sometimes we also just call it the 'X boson,' where 'X' means unknown."

Feng noted that further experiments are crucial. "The particle is not very heavy, and laboratories have had the energies required to make it since the '50s and '60s," he said. "But the reason it's been hard to find is that its interactions are very feeble. That said, because the new particle is so light, there are many experimental groups working in small labs around the world that can follow up the initial claims, now that they know where to look."

Like many scientific breakthroughs, this one opens entirely new fields of inquiry.

One direction that intrigues Feng is the possibility that this potential fifth force might be joined to the electromagnetic and strong and weak nuclear forces as "manifestations of one grander, more fundamental force."

Citing physicists' understanding of the standard model, Feng speculated that there may also be a separate dark sector with its own matter and forces. "It's possible that these two sectors talk to each other and interact with one another through somewhat veiled but fundamental interactions," he said. "This dark sector force may manifest itself as this protophobic force we're seeing as a result of the Hungarian experiment. In a broader sense, it fits in with our original research to understand the nature of dark matter." [16]

Has a Hungarian physics lab found a fifth force of nature?

Physicists at the Institute for Nuclear Research in Debrecen, Hungary, say this apparatus — an electron-positron spectrometer — has found evidence for a new particle.

A laboratory experiment in Hungary has spotted an anomaly in radioactive decay that could be the signature of a previously unknown fifth fundamental force of nature, physicists say – if the finding holds up.

Attila Krasznahorkay at the Hungarian Academy of Sciences's Institute for Nuclear Research in Debrecen, Hungary, and his colleagues reported their surprising result in 2015 on the arXiv preprint server, and this January in the journal Physical Review Letters1. But the report – which posited the existence of a new, light boson only 34 times heavier than the electron – was largely overlooked.

Dark matter may feel a "dark force" that the rest of the Universe does not

Then, on 25 April, a group of US theoretical physicists brought the finding to wider attention by publishing its own analysis of the result on arXiv2. The theorists showed that the data didn't conflict with any previous experiments – and concluded that it could be evidence for a fifth fundamental force. "We brought it out from relative obscurity," says Jonathan Feng, at the University of California, Irvine, the lead author of the arXiv report.

Four days later, two of Feng's colleagues discussed the finding at a workshop at the SLAC National Accelerator Laboratory in Menlo Park, California. Researchers there were sceptical but excited about the idea, says Bogdan Wojtsekhowski, a physicist at the Thomas Jefferson National Accelerator Facility in Newport News, Virginia. "Many participants in the workshop are thinking about different ways to check it," he says. Groups in Europe and the United States say that they should be able to confirm or rebut the Hungarian experimental results within about a year.

Search for new forces

Gravity, electromagnetism and the strong and weak nuclear forces are the four fundamental forces known to physics — but researchers have made many as-yet unsubstantiated claims of a fifth. Over the past decade, the search for new forces has ramped up because of the inability of the standard model of particle physics to explain dark matter — an invisible substance thought to make up more than 80% of the Universe's mass. Theorists have proposed various exotic-matter particles and force-carriers, including "dark photons", by analogy to conventional photons that carry the electromagnetic force.

Freefall space cubes are test for gravitational wave spotter

Krasznahorkay says his group was searching for evidence of just such a dark photon – but Feng's team think they found something different. The Hungarian team fired protons at thin targets of lithium-7, which created unstable beryllium-8 nuclei that then decayed and spat out pairs of electrons and positrons. According to the standard model, physicists should see that the number of observed pairs drops as the angle separating the trajectory of the electron and positron increases. But the team reported that at about 140º, the number of such emissions jumps — creating a 'bump' when the number of pairs are plotted against the angle — before dropping off again at higher angles.

Bump in confidence

Krasznahorkay says that the bump is strong evidence that a minute fraction of the unstable beryllium-8 nuclei shed their excess energy in the form of a new particle, which then decays into an electron–positron pair. He and his colleagues calculate the particle's mass to be about 17 megaelectronvolts (MeV).

"We are very confident about our experimental results," says Krasznahorkay. He says that the team has repeated its test several times in the past three years, and that it has eliminated every conceivable source of error. Assuming it has done so, then the odds of seeing such an extreme anomaly if there were nothing unusual going on are about 1 in 200 billion, the team says.

Force of nature gave life its asymmetry

Feng and colleagues say that the 17-MeV particle is not a dark photon. After analysing the anomaly and looking for properties consistent with previous experimental results, they concluded that the particle could instead be a "protophobic X boson". Such a particle would carry an extremely short-range force that acts over distances only several times the width of an atomic nucleus. And where a dark photon (like a conventional photon) would couple to electrons and protons, the new boson would couple to electrons and neutrons. Feng says that his group is currently investigating other kinds of particles that could explain the anomaly. But the protophobic boson is "the most straightforward possibility", he says.

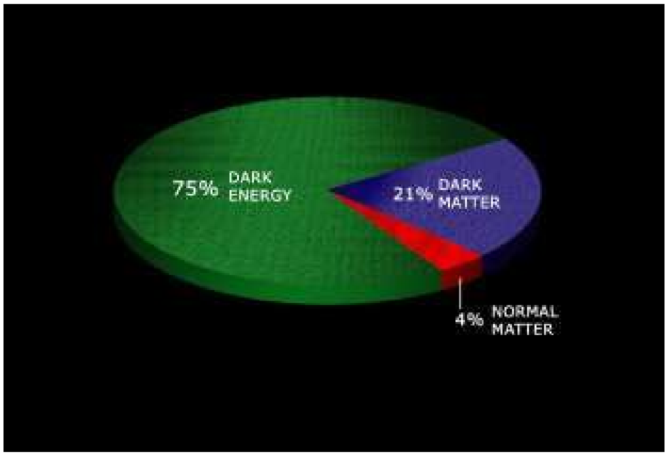
Unconventional coupling

Jesse Thaler, a theoretical physicist at the Massachusetts Institute of Technology (MIT) in Cambridge, says that the unconventional coupling proposed by Feng's team makes him sceptical that the new particle exists. "It certainly isn't the first thing I would have written down if I were allowed to augment the standard model at will," he says. But he adds that he is "paying attention" to the proposal. "Perhaps we are seeing our first glimpse into physics beyond the visible Universe," he says.

Researchers should not have to wait long to find out whether a 17-MeV particle really does exist. The DarkLight experiment at the Jefferson Laboratory is designed to search for dark photons with masses of 10–100 MeV, by firing electrons at a hydrogen gas target. Now, says collaboration spokesperson Richard Milner of MIT, it will target the 17-MeV region as a priority, and within about a year, could either find the proposed particle or set stringent limits on its coupling with normal matter. [15]

Could a New Proposed Particle Help Detect Dark Matter?

Dark Matter is thought to exist because of its gravitational effects on stars and galaxies, gravitational lensing (the bending of light rays) around these, and through its imprint on the cosmic microwave background (the afterglow of the big bang).



Despite compelling indirect evidence and considerable experimental effort, no one has managed to detect dark matter directly. Particle physics gives us clues to what dark matter might be, and the standard view is that dark matter particles have a very large mass for fundamental particles, comparable to that of heavy atoms. Lighter dark matter particles are considered less likely for astrophysical reasons, although exceptions are known, and this research highlights a previously unknown window where they could exist and, with very general arguments from particle physics, derives some surprising results.

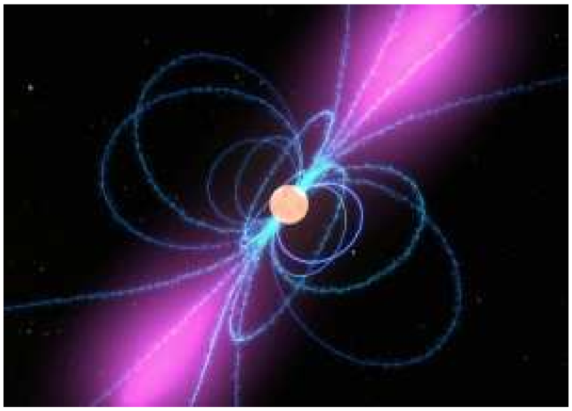
The proposed particle has a mass of 100eV/c^2, only about 0.02 per cent that of an electron. While it does not interact with light, as required for dark matter, it does interact surprisingly strongly with normal matter. Indeed, in stark contrast to other candidates, it may not even penetrate Earth's atmosphere. Earth-bound detection is therefore not likely, so the researchers plan to incorporate searches into a space experiment planned by the Macroscopic quantum resonators (MAQRO) consortium, with whom they are already involved. A nanoparticle, suspended in space and exposed directly to the flow of dark matter, will be pushed downstream and sensitive monitoring of this particle's position will reveal information about the nature of this dark matter particle, if it exists.

Dr James Bateman, from Physics and Astronomy at the University of Southampton and co-author of the study, says: "This work brings together some very different areas of physics: theoretical particle physics, observational x-ray astronomy, and experimental quantum optics. Our candidate particle sounds crazy, but currently there seem to be no experiments or observations which could rule it out. Dark matter is one of the most important unsolved problems in modern physics, and we hope that our suggestion will inspire others to develop detailed particle theory and even experimental tests."

Dr Alexander Merle, co-author from the Max Planck Institute in Munich, Germany, adds: "At the moment, experiments on dark matter do not point into a clear direction and, given that also the Large Hadron Collider at CERN has not found any signs of new physics yet, it may be time that we shift our paradigm towards alternative candidates for dark matter. More and more particle physicists seem to think this way, and our proposal seems to be a serious competitor on the market."

Dark matter may be a problem to be understood by crossing fields and looking for hidden possibilities. Dr Bateman adds: "Also from this point of view, the paper comprises a milestone on the history of our department: for the first time there has been a publication involving authors from all three groups in Physics and Astronomy, which shows how valuable it can be to cross boundaries and to look beyond one's own field." [14]

A Possible Link between Fast Radio Bursts and the Missing Pulsar Problem



Missing Pulsars in the Galactic Center

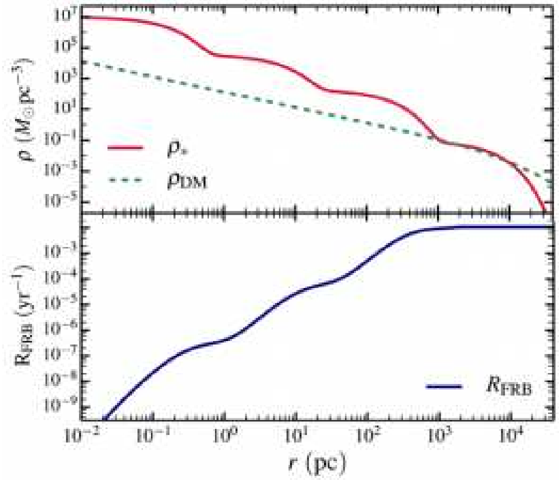
The key behind this work is tying together the mysterious origin of the FRBs with another open investigation of astronomy: the case of the missing pulsars. We believe that pulsars are neutron stars formed when the core of a massive star collapses during a supernova. Although there are many massive stars in the center of our galaxy, we have found no pulsars within the central 10 parsecs. (Oddly, scientists have discovered a magnetar, or what is thought to be a very young pulsar. This helps make the case that we do have the capability to find pulsars, but they seem to be missing.)

There has already been a suggested solution to the "missing pulsar problem", which involves another mystery character: dark matter. Dark matter is the mysterious stuff that constitutes roughly 30% of universe but that we know almost nothing about. Our best guess is that dark matter is a new type of particle, but its mass and properties are highly uncertain. Given the "correct" set of physical properties, dark matter may be able to "eat" neutron stars from the inside out. Dark matter particles may scatter off the surface of neutron stars, heat up and sink to the cores. In the core, the dark matter particles can accumulate to push the neutron star above its critical mass. This would create a black hole which would swallow the neutron star.

You don't need a lot of dark matter to trigger black hole creation— only about an asteroid-sized amount; however, because dark matter is unlikely to interact with nucleons, the density of dark matter must be extremely high. And where is dark matter density the highest? In the centers of galaxies, where pulsars appear to be missing!

Are Fast Radio Bursts Collapsing Neutron Stars?

High dark matter density helps pulsars collapse.



High dark matter density may help neutron stars collapse. The top panel shows the toy galaxy's dark matter density (DM) and stellar density (*) as a function of distance from the center of the galaxy. The bottom panel shows the cumulative FRB rates which are concentrated near the center of the galaxy. The inner part of the galaxy (with the largest DM) has the greatest RFRB.

So what role do Fast Radio Bursts play in all of this? Today's paper suggests that FRBs are the astrophysical burp caused by the black hole gobbling up the neutron star. The authors show that the energy released and the millisecond timescale of the FRBs roughly match what is expected from a collapsing neutron star.

Additionally, the authors estimate how often FRBs should occur if they were caused by collapsing neutron stars. To do this, they construct a model galaxy with the large dark matter density necessary for black hole formation. They estimate how many neutron stars form yearly in the model galaxy and give a very rough estimate of how many FRBs we should see. Fig. 1 shows the model galaxy's dark matter distribution and estimated FRB rate. They find that there is about one FRB every one hundred years in a single galaxy if their theory is correct. Extrapolating to the night sky, they estimate that about 5,000 FRBs should occur every day. This is about half the FRB rate that we currently see in observations.

Implications of Neutron Star Collapse

If this theory is correct, the authors lay down some basic hypotheses about dark matter, the missing pulsar problem and fast radio bursts:

Dark matter has well specified properties: Currently, the properties of dark matter are highly uncertain. This theory provides tight constraints on dark matter's interaction rate with baryonic matter. Dark matter needs to accumulate quickly enough in the neutron star to not radiate away due to Hawking radiation before eating the neutron star. It also needs to accumulate slowly enough that pulsars can exist in regions far away from the galactic center.

The missing pulsar problem should be astrophysically real: Neutron stars and pulsars should really be missing from the center of our galaxy, and there should not be an observational explanation for why we have not seen them. Additionally, in the place of these missing pulsars should be solar-mass black holes which have eaten up all the neutron stars.

The basic properties of FRBs should hold: FRBs should still be fast, occur only once and exist predominantly in the radio. This study also finds that FRBs should be clumped near the centers of galaxies, where the dark matter concentration is high enough to facilitate neutron star collapse.

Dark matter preying upon neutron stars and belching the remnants our way is certainly an exciting theory, but, for now, the source of FRBs remains a mystery. We'll have to wait and see what new insights and observations 2015 will provide to us about these elusive events.

Dark Matter Black Holes Could Be Destroying Stars at the Milky Way's Center

If dark matter comes in both matter and antimatter varieties, it might accumulate inside dense stars to create black holes Dark matter may have turned spinning stars into black holes near the center of our galaxy, researchers say. There, scientists expected to see plenty of the dense, rotating stars called pulsars, which are fairly common throughout the Milky Way. Despite numerous searches, however, only one has been found, giving rise to the so-called "missing pulsar problem." A possible explanation, according to a new study, is that dark matter has built up inside these stars, causing the pulsars to collapse into black holes. (These black holes would be smaller than the supermassive black hole that is thought to lurk at the very heart of the galaxy.)

The universe appears to be teeming with invisible dark matter, which can neither be seen nor touched, but nonetheless exerts a gravitational pull on regular matter.
Scientists have several ideas for what dark matter might be made of, but none have been proved. A leading option suggests that dark matter is composed of particles called weakly interacting massive particles (WIMPs), which are traditionally thought to be both matter and antimatter in one. The nature of antimatter is important for the story. When matter and antimatter meet they destroy one another in powerful explosions—so when two regular WIMPs collide, they would annihilate one another.

But it is also possible that dark matter comes in two varieties—matter and antimatter versions, just like regular matter. If this idea—called asymmetric dark matter—is true, then two dark matter particles would not destroy one another nor would two dark antimatter particles, but if one of each type met, the two would explode. In this scenario both types of dark matter should have been created in abundance during the big bang (just as both regular matter and regular antimatter are thought to have been created) but most of these particles would have destroyed one another, and those that that remain now would be just the small excess of one type that managed to avoid being annihilated.

If dark matter is asymmetric, it would behave differently from the vanilla version of WIMPs. For example, the dense centers of stars should gravitationally attract nearby dark matter. If dark matter is made of regular WIMPS, when two WIMPs meet at the center of a star they would destroy one another, because they are their own antimatter counterparts. But in the asymmetric dark matter picture, all the existing dark matter left today is made of just one of its two types—either matter or antimatter. If two of these like particles met, they would not annihilate, so dark matter would simply build up over time inside the star. Eventually, the star's core would become too heavy to support itself, thereby collapsing into a black hole. This is what may have happened to the pulsars at the Milky Way's center, according to a study published November 3 in Physical Review Letters.

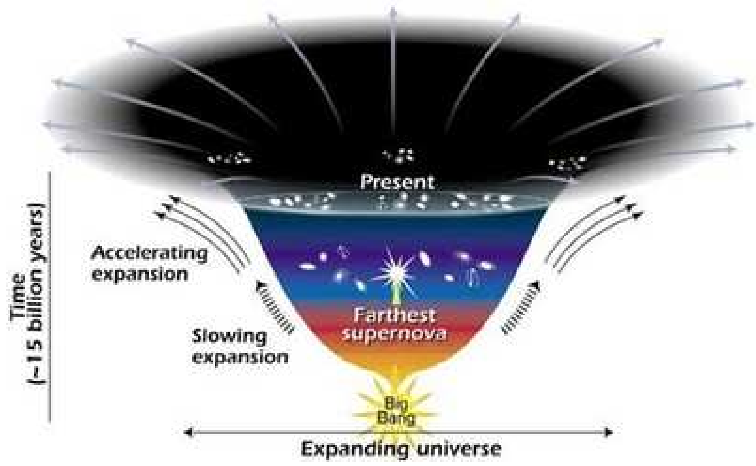
The scenario is plausible, says Raymond Volkas, a physicist at the University of Melbourne who was not involved in the study, but the missing pulsar problem might easily turn out to have a mundane explanation through known stellar effects. "It would, of course, be exciting to have dramatic direct astrophysical evidence for asymmetric dark matter," Volkas says. "Before believing an asymmetric dark matter explanation, I would want to be convinced that no standard explanation is actually viable."

The authors of the study, Joseph Bramante of the University of Notre Dame and Tim Linden of the Kavli Institute for Cosmological Physics at the University of Chicago, agree that it is too early to jump to a dark matter conclusion. For example, Linden says, maybe radio observations of the galactic center are not as thorough as scientists have assumed and the missing pulsars will show up with better searches. It is also possible some quirk of star formation has limited the number of pulsars that formed at the galactic center.

The reason nearby pulsars would not be as affected by asymmetric dark matter is that dark matter, of any kind, should be densest at the cores of galaxies, where it should congregate under the force of its own gravity. And even there it should take dark matter a very long time to accumulate enough to destroy a pulsar because most dark particles pass right through stars without interacting. Only on the rare occasions when one flies extremely close to a regular particle can it collide, and then it will be caught there. In normal stars the regular particles at the cores are not dense enough to catch many dark matter ones. But in superdense pulsars they might accumulate enough to do damage. "Dark matter can't collect as densely or as quickly at the center of regular stars," Bramante says, "but in pulsars the dark matter would collect into about a two-meter ball. Then that ball collapses into a black hole and it sucks up the pulsar."

If this scenario is right, one consequence would be that pulsars should live longer the farther away they are from the dark matter–dense galactic center. At the far reaches of the Milky Way, for example, pulsars might live to ripe old ages; near the core, however, pulsars would be created and then quickly destroyed before they could age. "Nothing astrophysical predicts a very strong relation between the age of a pulsar and its distance from the center of a galaxy," Linden says. "You would really see a stunning effect if this scenario held." It is also possible, although perhaps not probable, that astronomers could observe a pulsar collapse into a black hole, verifying the theory. But once the black hole is created, it would be near impossible to detect: As dark matter and black holes are each unobservable, black holes made of dark matter would be doubly invisible. [12]

Everything You Need to Know About Dark Energy



For a long time, there were two main theories related to how our universe would end. These were the Big Freeze and the Big Crunch. In short, the Big Crunch claimed that the universe would eventually stop expanding and collapse in on itself. This collapse would result in…well…a big crunch (for lack of a better term). Think "the Big Bang", except just the opposite. That's essentially what the Big Crunch is. On the other hand, the Big Freeze claimed that the universe would continue expanding forever, until the cosmos becomes a frozen wasteland. This theory asserts that stars will get farther and farther apart, burn out, and (since there are no more stars bring born) the universe will grown entirely cold and eternally black.

Now, we know that the expansion of the universe is not slowing. In fact, expansion is increasing. Edwin Hubble discovered that the farther an object was away from us the faster it was receding from us. In simplest terms, this means that the universe is indeed expanding, and this (in turn) means that the universe will likely end as a frozen, static wasteland. However, this can all change there is a reversal of dark energy's current expansion effect. Sound confusing? To clear things up, let's take a closer look at what dark energy is.

How We Discovered That The Universe Is Expanding:

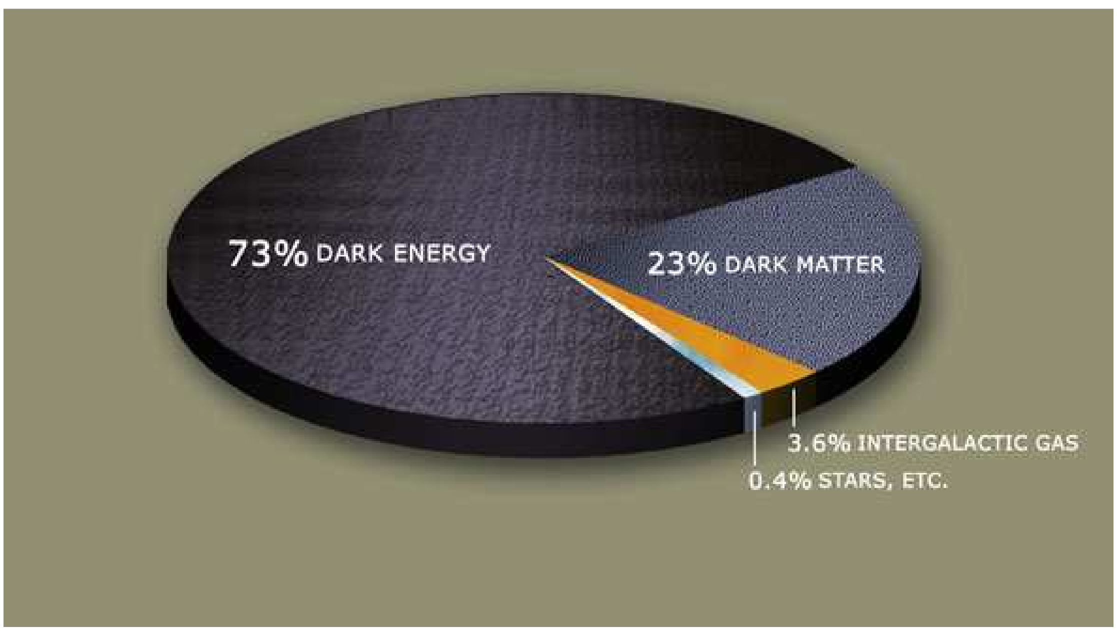
The accelerating expansion of the universe was discovered when astronomers were doing research on type 1a supernova events. These stellar explosions play a pivotal role in discerning the distance between two celestial objects because all type 1a supernova explosions are remarkably similar in brightness. So if we know how bright a star should be, we can compare the apparent luminosity with the intrinsic luminosity, and we get a reliable figure for how far any given object is from us. To get a better idea of how these work, think about headlights. For the most part, car headlights all have the same luminosity. So if one car's headlights are only 1/4 as bright as another car's, then one car is twice as far away as the other.

Incidentally, along with helping us make these key determinations about the locations of objects in the universe, these supernova explosions also gave us a sneak preview of one of the strangest observations ever made about the universe. To measure the approximate distance of an object, like a star, and how that distance has changed, astronomers analyze the spectrum of light emitted. Scientists were able to tell that the universe is increasing in expansion because, as the light waves make the incredibly long journey to Earth—billions of light-years away—the universe continues to expand. And as it expands, it stretches the light waves through a process called "redshifting" (the "red" is because the longest wavelength for light is in the red portion of the electromagnetic spectrum). The more redshifted this light is, the faster the expansion is going. Many years of painstaking observations (made by many different astronomers) have confirmed that this expansion is still ongoing and increasing because (as previously mentioned) the farther away an object is, the more redshifted it is, and (thus) the faster it is moving away from us.

How Do We Know That Dark Energy Is Real?

The existence of dark energy is required, in some form or another, to reconcile the measured geometry of space with the total amount of matter in the universe. This is because of the largely successful Planck satellite and Wilkenson Microwave Anisotropy Probe (WMAP) observations. The satellite's observations of the cosmic microwave background radiation (CMB) indicate that the universe is geometrically flat, or pretty close to it.

All of the matter that we believe exists (based on scientific data and inferences) combines to make up just about 30% of the total critical density of the observed universe. If it were geometrically flat, like the distribution suggests from the CMB, critical density of energy and matter should equal 100%. WMAP's seven year sky survey, and the more sophisticated Planck Satellite 2 year survey, both are very strong evidence of a flat universe. Current measurements from Planck put baryonic matter (atoms) at about 4%, dark matter at 23%, and dark energy making up the remainder at 73%.



What's more, an experiment called Wiggle Z galaxy sky survey in 2011 further supported the dark energy hypothesis by its observations of large scale structures of the universe (such as galaxies, quasars, galaxy clusters, etc). After observing more than 200,000 galaxies (by looking at their redshift and measuring the baryonic acoustic oscillations), the survey quantitatively put the age of when the universe started increasing its acceleration at a timeline of 7 billion years. After this time in the universe, the expansion started to speed up.

How Does Dark Energy Work?

According to Occam's razor (which proposes that the hypothesis with the fewest amount of assumptions is the correct one), the scientific community has favored Einstein's cosmological constant. Or in other words, the vacuum energy density of empty space, imbued with the same negative pressure value everywhere, eventually adds up with itself to speed up and suffuse the universe with more empty space, accelerating the entire process. This would kind of be similar to the energy pressure when talking about the "Casimir effect," which is caused by virtual particles in so-called "empty space", which is actually full of virtual particles coming in and out of existence.

The Problem With Dark Energy:

Called "the worst prediction in all of physics," cosmologists predict that this value for the cosmological constant should be 10^ -120 Planck units. According to dark energy equation, the parameter value for w (for pressure and density) must equal -1. But according to the latest findings from Pan-STARRS (short for Panoramic Survey Telescope and Rapid Response System), this value is in fact -1.186. Pan-STARRS derived this value from combining the data it obtained with the observational data from Planck satellite (which measured these very specific type 1a supernovas, 150 of them between 2009 and 2011, to be exact).

"If w has this value, it means that the simplest model to explain dark energy is not true," says Armin Rest of the Space Telescope Science Institute (STScI) in Baltimore. Armin Rest is the lead author of the Pan-STARRS team reporting these results to the astrophysics Web site arXiv (actual link to the paper) on October 22, 2013.

The Significance:

What exactly does the discrepancy in the value in the cosmological constant mean for our understanding of dark energy? At first glace, the community can dismiss these results as experimental uncertainty errors. It is a well accepted idea that telescope calibration, supernova physics, and galactic properties are large sources of uncertainties. This can throw off the cosmological constant value. Several astronomers have immediately spoken up, denying the validity of the results. Julien Guy of University Pierre and Marie Curie in Paris say the Pan-STARRS researchers may have underestimated their systematic error by ignoring a source of uncertainty from supernova light-curve models. They have been in contact with the team, who are looking into that very issue, and others are combing over the meticulous work on the Pan-STARRS team to see if they can find any holes in the study.

Despite this, these results were very thorough and made by an experienced team, and work is already on its way to rule out any uncertainties. Not only that, but this is third sky survey to now produce experimental results that have dependencies for the pressure and density value of w being equal to 1, and it is starting to draw attention from cosmologists everywhere. In the next year or two, this result will be definitive, or it will be ruled out and disappear, with the cosmological constant continue being supported.

Well, if the cosmological constant model is wrong, we have to look at alternatives. That is the beauty of science, it does not care what we wish to be true: if something disagrees with observations, it's wrong. Plain and simple. [11]

The Big Bang

The Big Bang caused acceleration created radial currents of the matter, and since the matter is composed of negative and positive charges, these currents are creating magnetic field and attracting forces between the parallel moving electric currents. This is the gravitational force experienced by the matter, and also the mass is result of the electromagnetic forces between the charged particles. The positive and negative charged currents attracts each other or by the magnetic forces or by the much stronger electrostatic forces!?

The gravitational force attracting the matter, causing concentration of the matter in a small space and leaving much space with low matter concentration: dark matter and energy.

There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

Study Reveals Indications That Dark Matter is Being Erased by Dark Energy

Researchers in Portsmouth and Rome have found hints that dark matter, the cosmic scaffolding on which our Universe is built, is being slowly erased, swallowed up by dark energy.

The findings appear in the journal Physical Review Letters, published by the American Physical Society. In the journal cosmologists at the Universities of Portsmouth and Rome, argue that the latest astronomical data favors a dark energy that grows as it interacts with dark matter, and this appears to be slowing the growth of structure in the cosmos.

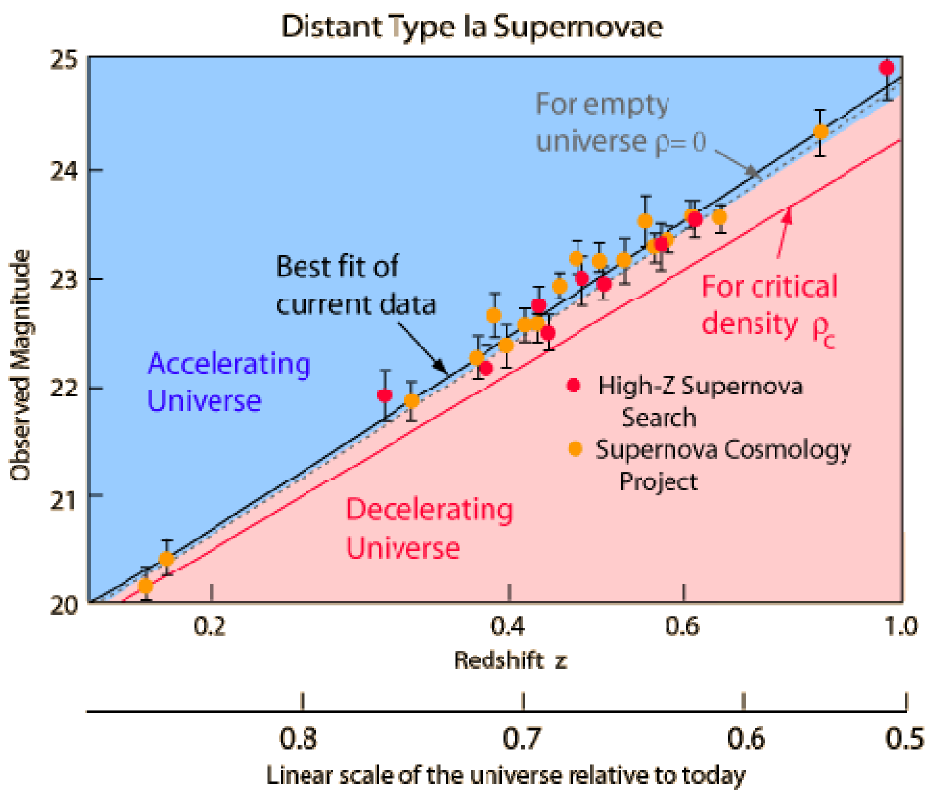
“Dark matter provides a framework for structures to grow in the Universe. The galaxies we see are built on that scaffolding and what we are seeing here, in these findings, suggests that dark matter is evaporating, slowing that growth of structure.”

Cosmology underwent a paradigm shift in 1998 when researchers announced that the rate at which the Universe was expanding was accelerating. The idea of a constant dark energy throughout space-time (the “cosmological constant”) became the standard model of cosmology, but now the Portsmouth and Rome researchers believe they have found a better description, including energy transfer between dark energy and dark matter. [10]

Evidence for an accelerating universe

One of the observational foundations for the big bang model of cosmology was the observed expansion of the universe. [9] Measurement of the expansion rate is a critical part of the study, and it has been found that the expansion rate is very nearly "flat". That is, the universe is very close to the critical density, above which it would slow down and collapse inward toward a future "big crunch". One of the great challenges of astronomy and astrophysics is distance measurement over the vast distances of the universe. Since the 1990s it has become apparent that type Ia supernovae offer a unique opportunity for the consistent measurement of distance out to perhaps 1000 Mpc. Measurement at these great distances provided the first data to suggest that the expansion rate of the universe is actually accelerating. That acceleration implies an energy density that acts in opposition to gravity which would cause the expansion to accelerate. This is an energy density which we have not directly detected observationally and it has been given the name "dark energy".

The type Ia supernova evidence for an accelerated universe has been discussed by Perlmutter and the diagram below follows his illustration in Physics Today.



The data summarized in the illustration above involve the measurement of the redshifts of the distant supernovae. The observed magnitudes are plotted against the redshift parameter z. Note that there are a number of Type 1a supernovae around z=.6, which with a Hubble constant of 71 km/s/mpc is a distance of about 5 billion light years.

Equation

The cosmological constant Λ appears in Einstein's field equation [5] in the form of

$$R_{\mu\nu} - \frac{1}{2}R\,g_{\mu\nu} + \Lambda\,g_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu},$$

where *R* and *g* describe the structure of spacetime, *T* pertains to matter and energy affecting that structure, and *G* and *c* are conversion factors that arise from using traditional units of measurement.

When Λ is zero, this reduces to the original field equation of general relativity. When *T* is zero, the field equation describes empty space (the vacuum).

The cosmological constant has the same effect as an intrinsic energy density of the vacuum, ρ_{vac} (and an associated pressure). In this context it is commonly moved onto the right-hand side of the equation, and defined with a proportionality factor of 8π: $\Lambda = 8\pi\rho_{vac}$, where unit conventions of general relativity are used (otherwise factors of *G* and *c* would also appear). It is common to quote values of energy density directly, though still using the name "cosmological constant".

A positive vacuum energy density resulting from a cosmological constant implies a negative pressure, and vice versa. If the energy density is positive, the associated negative pressure will drive an accelerated expansion of the universe, as observed. (See dark energy and cosmic inflation for details.)

Explanatory models

Models attempting to explain accelerating expansion include some form of dark energy, dark fluid or phantom energy. The most important property of dark energy is that it has negative pressure which is distributed relatively homogeneously in space. The simplest explanation for dark energy is that it is a cosmological constant or vacuum energy; this leads to the Lambda-CDM model, which is generally known as the Standard Model of Cosmology as of 2003-2013, since it is the simplest model in good agreement with a variety of recent observations.

Dark Matter and Energy

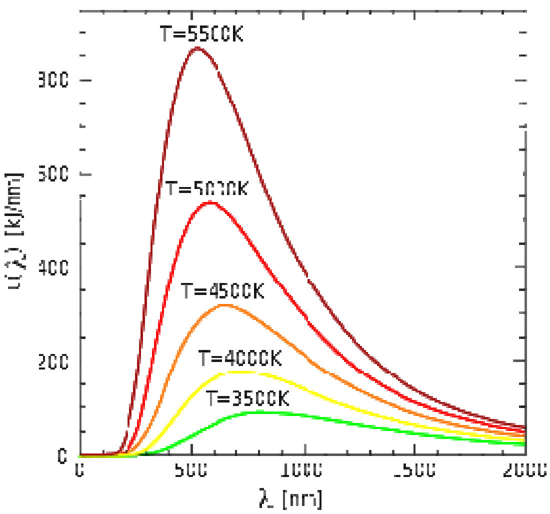
Dark matter is a type of matter hypothesized in astronomy and cosmology to account for a large part of the mass that appears to be missing from the universe. Dark matter cannot be seen directly with telescopes; evidently it neither emits nor absorbs light or other electromagnetic radiation at any significant level. It is otherwise hypothesized to simply be matter that is not reactant to light. Instead, the existence and properties of dark matter are inferred from its gravitational effects on visible matter, radiation, and the large-scale structure of the universe. According to the Planck mission team, and based on the standard model of cosmology, the total mass–energy of the known universe contains 4.9% ordinary matter, 26.8% dark matter and 68.3% dark energy. Thus, dark matter is estimated to constitute 84.5% of the total matter in the universe, while dark energy plus dark matter constitute 95.1% of the total content of the universe. [6]

Cosmic microwave background

The cosmic microwave background (CMB) is the thermal radiation assumed to be left over from the "Big Bang" of cosmology. When the universe cooled enough, protons and electrons combined to form neutral atoms. These atoms could no longer absorb the thermal radiation, and so the universe became transparent instead of being an opaque fog. [7]

Thermal radiation

Thermal radiation is electromagnetic radiation generated by the thermal motion of charged particles in matter. All matter with a temperature greater than absolute zero emits thermal radiation. When the temperature of the body is greater than absolute zero, interatomic collisions cause the kinetic energy of the atoms or molecules to change. This results in charge-acceleration and/or dipole oscillation which produces electromagnetic radiation, and the wide spectrum of radiation reflects the wide spectrum of energies and accelerations that occur even at a single temperature. [8]



Electromagnetic Field and Quantum Theory

Needless to say that the accelerating electrons of the steady stationary current are a simple demystification of the magnetic field, by creating a decreasing charge distribution along the wire, maintaining the decreasing U potential and creating the **A** vector potential experienced by the electrons moving by **v** velocity relative to the wire. This way it is easier to understand also the time dependent changes of the electric current and the electromagnetic waves as the resulting fields moving by c velocity.

It could be possible something very important law of the nature behind the self maintaining **E** accelerating force by the accelerated electrons. The accelerated electrons created electromagnetic fields are so natural that they occur as electromagnetic waves traveling with velocity c. It shows that the electric charges are the result of the electromagnetic waves diffraction.

One of the most important conclusions is that the electric charges are moving in an accelerated way and even if their velocity is constant, they have an intrinsic acceleration anyway, the so called spin, since they need at least an intrinsic acceleration to make possible they movement .

The bridge between the classical and quantum theory is based on this intrinsic acceleration of the spin, explaining also the Heisenberg Uncertainty Principle. The particle – wave duality of the electric charges and the photon makes certain that they are both sides of the same thing. Basing the gravitational force on the accelerating Universe caused magnetic force and the Planck Distribution Law of the electromagnetic waves caused diffraction gives us the basis to build a Unified Theory of the physical interactions. [4]

Lorentz transformation of the Special Relativity

In the referential frame of the accelerating electrons the charge density lowering linearly because of the linearly growing way they takes every next time period. From the referential frame of the wire there is a parabolic charge density lowering.

The difference between these two referential frames, namely the referential frame of the wire and the referential frame of the moving electrons gives the relativistic effect. Important to say that the moving electrons presenting the time coordinate, since the electrons are taking linearly increasing way every next time period, and the wire presenting the geometric coordinate. The Lorentz transformations are based on moving light sources of the Michelson - Morley experiment giving a practical method to transform time and geometric coordinates without explaining the source of this mystery.

The real mystery is that the accelerating charges are maintaining the accelerating force with their charge distribution locally. The resolution of this mystery that the charges are simply the results of the diffraction patterns, that is the charges and the electric field are two sides of the same thing. Otherwise the charges could exceed the velocity of the electromagnetic field.

The increasing mass of the electric charges the result of the increasing inductive electric force acting against the accelerating force. The decreasing mass of the decreasing acceleration is the result of the inductive electric force acting against the decreasing force. This is the relativistic mass change explanation, especially importantly explaining the mass reduction in case of velocity decrease.

The Classical Relativistic effect

The moving charges are self maintain the electromagnetic field locally, causing their movement and this is the result of their acceleration under the force of this field.
In the classical physics the charges will distributed along the electric current so that the electric potential lowering along the current, by linearly increasing the way they take every next time period because this accelerated motion.

Electromagnetic inertia and Gravitational attraction

Since the magnetic induction creates a negative electric field as a result of the changing acceleration, it works as an electromagnetic inertia, causing an electromagnetic mass.

It looks clear that the growing acceleration results the relativistic growing mass - limited also with the velocity of the electromagnetic wave.

Since $E = h\nu$ and $E = mc^2$, $m = h\nu / c^2$ that is the m depends only on the ν frequency. It means that the mass of the proton and electron are electromagnetic and the result of the electromagnetic induction, caused by the changing acceleration of the spinning and moving charge! It could be that the m_o inertial mass is the result of the spin, since this is the only accelerating motion of the electric charge. Since the accelerating motion has different frequency for the electron in the atom and the proton, they masses are different, also as the wavelengths on both sides of the diffraction pattern, giving equal intensity of radiation.

If the mass is electromagnetic, then the gravitation is also electromagnetic effect caused by the accelerating Universe! The same charges would attract each other if they are moving parallel by the magnetic effect.

The Planck distribution law explains the different frequencies of the proton and electron, giving equal intensity to different lambda wavelengths! Also since the particles are diffraction patterns they have some closeness to each other – can be seen as a gravitational force.

Electromagnetic inertia and mass

Electromagnetic Induction

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Relativistic change of mass

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The frequency dependence of mass

Since $E = hv$ and $E = mc^2$, $m = hv/c^2$ that is the m depends only on the v frequency. It means that the mass of the proton and electron are electromagnetic and the result of the electromagnetic induction, caused by the changing acceleration of the spinning and moving charge! It could be that the m_o inertial mass is the result of the spin, since this is the only accelerating motion of the electric charge. Since the accelerating motion has different frequency for the electron in the atom and the proton, they masses are different, also as the wavelengths on both sides of the diffraction pattern, giving equal intensity of radiation.

Electron – Proton mass rate

The Planck distribution law explains the different frequencies of the proton and electron, giving equal intensity to different lambda wavelengths! Also since the particles are diffraction patterns they have some closeness to each other – can be seen as a gravitational force. [1]

There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

Gravity from the point of view of quantum physics

The Gravitational force

The gravitational attractive force is basically a magnetic force.

The same electric charges can attract one another by the magnetic force if they are moving parallel in the same direction. Since the electrically neutral matter is composed of negative and positive charges they need 2 photons to mediate this attractive force, one per charges. The Bing Bang caused parallel moving of the matter gives this magnetic force, experienced as gravitational force.

Since graviton is a tensor field, it has spin = 2, could be 2 photons with spin = 1 together.

You can think about photons as virtual electron – positron pairs, obtaining the necessary virtual mass for gravity.

The mass as seen before a result of the diffraction, for example the proton – electron mass rate Mp=1840 Me. In order to move one of these diffraction maximum (electron or proton) we need to intervene into the diffraction pattern with a force appropriate to the intensity of this diffraction maximum, means its intensity or mass.

The Big Bang caused acceleration created radial currents of the matter, and since the matter is composed of negative and positive charges, these currents are creating magnetic field and attracting forces between the parallel moving electric currents. This is the gravitational force experienced by the matter, and also the mass is result of the electromagnetic forces between the charged particles. The positive and negative charged currents attracts each other or by the magnetic forces or by the much stronger electrostatic forces!?

The Graviton

In physics, the graviton is a hypothetical elementary particle that mediates the force of gravitation in the framework of quantum field theory. If it exists, the graviton is expected to be massless (because the gravitational force appears to have unlimited range) and must be a spin-2 boson. The spin follows from the fact that the source of gravitation is the stress-energy tensor, a second-rank tensor (compared to electromagnetism's spin-1 photon, the source of which is the four-current, a first-rank tensor). Additionally, it can be shown that any massless spin-2 field would give rise to a force indistinguishable from gravitation, because a massless spin-2 field must couple to (interact with) the stress-energy tensor in the same way that the gravitational field does. This result suggests that, if a massless spin-2 particle is discovered, it must be the graviton, so that the only experimental verification needed for the graviton may simply be the discovery of a massless spin-2 particle. [2]

Conclusions

Dark matter may be a problem to be understood by crossing fields and looking for hidden possibilities. Dr Bateman adds: “Also from this point of view, the paper comprises a milestone on the history of our department: for the first time there has been a publication involving authors from all three groups in Physics and Astronomy, which shows how valuable it can be to cross boundaries and to look beyond one’s own field.” [14]

Dark matter preying upon neutron stars and belching the remnants our way is certainly an exciting theory, but, for now, the source of FRBs remains a mystery. We'll have to wait and see what new insights and observations 2015 will provide to us about these elusive events. [13]

If dark matter comes in both matter and antimatter varieties, it might accumulate inside dense stars to create black holes. It is also possible, although perhaps not probable, that astronomers could observe a pulsar collapse into a black hole, verifying the theory. But once the black hole is created, it would be near impossible to detect: As dark matter and black holes are each unobservable, black holes made of dark matter would be doubly invisible. [12]

For a long time, there were two main theories related to how our universe would end. These were the Big Freeze and the Big Crunch. In short, the Big Crunch claimed that the universe would eventually stop expanding and collapse in on itself. This collapse would result in…well…a big crunch (for lack of a better term). Think "the Big Bang", except just the opposite. That's essentially what the Big Crunch is. On the other hand, the Big Freeze claimed that the universe would continue expanding forever, until the cosmos becomes a frozen wasteland. This theory asserts that stars will get farther and farther apart, burn out, and (since there are no more stars bring born) the universe will grown entirely cold and eternally black. [11]

Newly published research reveals that dark matter is being swallowed up by dark energy, offering novel insight into the nature of dark matter and dark energy and what the future of our Universe might be. [10]

The changing temperature of the Universe will change the proportionality of the dark energy and the corresponding dark matter by the Planck Distribution Law, giving the base of this newly published research.

The gravitational force attracting the matter, causing concentration of the matter in a small space and leaving much space with low matter concentration: dark matter and energy.

There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

The electric currents causing self maintaining electric potential is the source of the special and general relativistic effects. The Higgs Field is the result of the electromagnetic induction. The Graviton is two photons together. [3]

References

[1] 3 Dimensional String Theory

Author: George Rajna

Publisher: Academia.edu
http://www.academia.edu/3834454/3_Dimensional_String_Theory

[2] Graviton Production By Two Photon and Electron-Photon Processes In Kaluza-Klein Theories With Large Extra Dimensions

http://arxiv.org/abs/hep-ph/9909392

[3] Higgs Field and Quantum Gravity

Author: George Rajna

Publisher: Academia.edu
http://www.academia.edu/4158863/Higgs_Field_and_Quantum_Gravity

[4] The Magnetic field of the Electric current

Author: George Rajna

Publisher: Academia.edu
https://www.academia.edu/3833335/The_Magnetic_field_of_the_Electric_current

[5] http://en.wikipedia.org/wiki/Einstein_field_equations

[6] http://en.wikipedia.org/wiki/Dark_matter

[7] http://en.wikipedia.org/wiki/Cosmic_microwave_background

[8] http://en.wikipedia.org/wiki/Thermal_radiation

[9] http://hyperphysics.phy-astr.gsu.edu/hbase/astro/univacc.html

[10] http://scitechdaily.com/study-reveals-indications-dark-matter-erased-dark-energy/

[11] http://www.fromquarkstoquasars.com/everything-you-need-to-know-about-dark-energy/

[12] Dark Matter Black Holes Could Be Destroying Stars at the Milky Way's Center
http://www.scientificamerican.com/article/dark-matter-black-holes-destroying-pulsars/

[13] The Radio Burp from Dark Matter's Lunch?
http://astrobites.org/2014/12/30/the-radio-burp-from-dark-matters-lunch/

[14] Could a New Proposed Particle Help Detect Dark Matter?
http://www.fromquarkstoquasars.com/new-proposed-particle-help-detect-dark-matter/

[15] Has a Hungarian physics lab found a fifth force of nature?
http://www.nature.com/news/has-a-hungarian-physics-lab-found-a-fifth-force-of-nature-1.19957

[16] Physicists confirm possible discovery of fifth force of nature
http://phys.org/news/2016-08-physicists-discovery-nature.html