Dark Matter May Feel a “Dark Force”

Astronomers watching galaxies collide found evidence of nongravitational forces that could suggest dark matter interacts with itself. [13]

The main feature of dark matter is that it remains undetectable (invisible) to telescopes. But that doesn’t mean that dark matter can’t sometimes intermingle with light. Scientists have now studied the prospect that dark matter distributes star light, creating a potentially visible luminosity around galaxies. [12]

Astronomers believe they might have observed the first potential signs of dark matter interacting with a force other than gravity. [11]

A new study of colliding galaxy clusters has found that dark matter doesn't even interact with itself. [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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Dark Matter May Feel a "Dark Force" That the Rest of the Universe Does Not

After decades of studying dark matter scientists have repeatedly found evidence of what it cannot be but very few signs of what it is. That might have just changed. A study of four colliding galaxies for the first time suggests that the dark matter in them may be interacting with itself through some unknown force other than gravity that has no effect on ordinary matter. The finding could be a significant clue as to what comprises the invisible stuff that is thought to contribute 24 percent of the universe.

"This result, if confirmed, could upend our understanding of dark matter," says physicist Don Lincoln of the Fermi National Accelerator Laboratory in Illinois, who was not involved in the research. So-called "self-interacting dark matter" has been suggested for some time but it has generally been considered unorthodox. The simplest model of dark matter portrays it as a single particle—one that happens to interact with others of its kind and normal matter very little or not at all. Physicists favor the most basic explanations that fit the bill and add extra complications only when necessary, so this scenario tends to be the most popular. For dark matter to interact with itself requires not only dark matter particles but also a dark force to govern their interactions and dark boson particles to carry this force. This more complex picture mirrors our understanding of normal matter particles, which interact through force-carrying particles. For example, protons interact through the electromagnetic force, which is carried by particles called photons (particles of light).

Now scientists led by Richard Massey at Durham University in England report in Monthly Notices of the Royal Astronomical Society the first signs that dark forces and dark bosons might really exist. Researchers used the MUSE (Multi Unit Spectroscopic Explorer) instrument on the Very Large Telescope in Chile, along with the Hubble Space Telescope to examine the Abell 3827 cluster, where four galaxies are colliding in a cosmic car wreck.

To determine where the invisible dark matter lies, astronomers took advantage of a natural phenomenon called gravitational lensing, predicted by Einstein's general theory of relativity. Lensing occurs when mass warps spacetime, causing light traveling through this bent region to take a curved path. The dark matter in Abell 3827 is plentiful, so it warps the space around it significantly. When light from a distant object behind the cluster travels to Earth, it passes through this distorted area and produces telltale signs of lensing, such as arcs of light and double images, that astronomers used to "weigh" the unseen matter in the cluster. The scientists found that in at least one of the colliding galaxies the dark matter in the galaxy had become separated from its stars and other visible matter by about 5,000 light-years.

One explanation is that the dark matter from this galaxy interacted with dark matter from one of the other galaxies flying by it, and these interactions slowed it down, causing it to separate and lag behind the normal matter.

The interactions would be similar to what happens when two protons pass near one another. Each releases a photon that is absorbed by the other, causing both particles to recoil. This repellent force happens between any two particles with the same electromagnetic charge and it could happen between any two dark matter particles as well. But because dark matter is not affected by the electromagnetic force, only a new "dark" force, carried by a so-called dark-photon, could produce the repulsion. It could also be that only some portion of dark matter interacts with itself whereas the bulk of it is a more traditional single-particle type. "It does seem pretty good for our kind of model, in which only a small fraction of the dark matter interacts," says Harvard University physicist Lisa Randall, who has envisioned such a model.

The study leaders are cautious about interpreting their observations. "This is very, very exciting because it is the first potential detection of nongravitational interactions, but we have to see this in more of these objects," says team member David Harvey of the École Polytechnique Fédérale de Lausanne in Switzerland.

"It's by no means confirmed." It is possible, for example, that the pattern the telescopes observed was caused by extra dark matter outside the cluster but along Earth's line of sight, rather than self-interacting dark matter. "This is one of the situations where it would be so incredibly exciting if it ended up being dark matter that everybody will need to be a little bit cautious in how they approach it just because of that simple fact," says physicist Neal Weiner of New York University, who was not involved in the study.

Self-interacting dark matter with dark forces and dark photons may not be as simple as the single-particle explanation but it is just as reasonable an idea, Weiner says. “The strongest motivation for considering dark matter to have its own interactions is simply that when we look at the Standard Model,” which describes all the known particles and forces, “we see that it’s full of all sorts of different interactions. It seems quite natural that dark matter could have its own force.” This setup could also explain some small discrepancies between predictions of the single-particle model and what astronomers actually observe. For example, the single-particle model says that the centers of galaxies should be denser than they really are; if dark matter interacts with itself, however, it would tend to collide in galactic cores and push away.

So far, no signs of self-interacting dark matter have showed up in other galaxy collisions. Another famous crash site, the Bullet Cluster, was one of the first to provide strong evidence that dark matter exists, because gravitational lensing shows that most of the cluster’s mass resides in a different place than the visible matter. But the separation there is not large enough to suggest that the dark matter is interacting. “The result is not in conflict with the Bullet Cluster,” says Maruša Bradač of the University of California, Davis, one of the leaders of the original 2006 Bullet Cluster study, because that example put only upper limits on how strong the interaction could be. And another more recent study, led by Harvey and published in March in Science, surveyed 72 collisions of galaxy clusters and also found no signs of self-interacting dark matter. But the targets of that study, as well as the Bullet Cluster, are colliding galaxy clusters—not individual galaxies crashing together as in Abell 3827. Lone galaxies collide at slower speeds than entire clusters do, and that might have given the dark matter particles more time to interact with one another and slow down. The true test will come when astronomers look at other individual galaxy smashups. “There are other clusters that we can look at that are in similar states but none are as perfect as this,” Harvey says. “But with future surveys we’ll hopefully be able to see these objects.” [13]

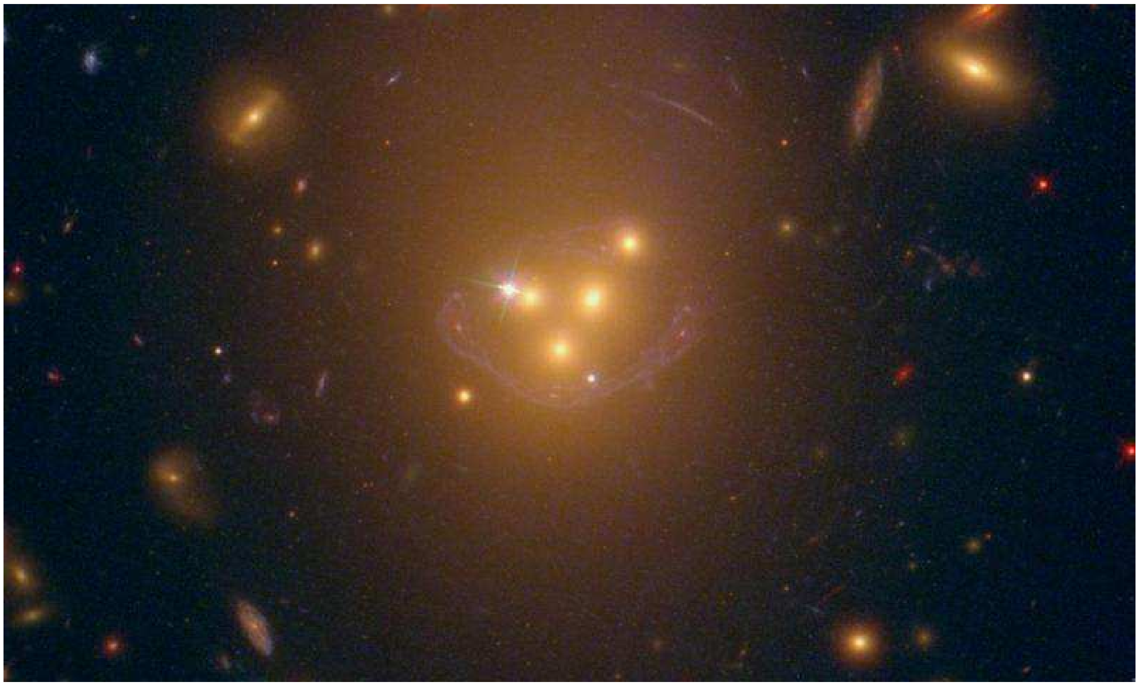
Glow in the Dark Matter: Dark Matter Not So Dark?

The main feature of dark matter is that it remains undetectable (invisible) to telescopes. But that doesn’t mean that dark matter can’t sometimes intermingle with light. Scientists have now studied the prospect that dark matter distributes star light, creating a potentially visible luminosity around galaxies. The group found no definite indication of this “light halo,” but they claim that extended wavelength interpretations could offer a chance to “see” dark matter. Astronomers conclude the presence of dark matter from motion of galaxy. Rotating galaxies, for instance, would apparently fly apart if not for gigantic clouds of massive particles attaching them in place. The mutual supposition is that these particles have zero contact with light, but some models do picture that dark matter can decay into photons or distribute photons in unusual cases.

Joseph Silk and Jonathan Davis from the Institute of Astrophysics of Paris, France, examine a probable sign of dark matter in scattered light. They take, Pinwheel galaxy M101, as a illustrative example the matter, which is a well-studied spiral galaxy situated 21 million light years away from us. They picture light emerging out of the galaxy and bouncing off of dark matter in the external boundary. This scattered light would generate a glimmering around the galaxy—a bit like the glimmering around a lamp encircled by fog. Such a glimmering is already witnessed at visible wavelengths by the Dragonfly telescope array, but as it could come completely from other causes, for example dust and isolated stars, there is presently no way to confirm that dark matter makes any influence. Nevertheless, Davis and Silk spectacle that astronomers might have a better chance of spotting a dark matter glow at infrared wavelengths, where backgrounds are inferior but no such type observations have yet been taken with enough understanding.

This research paper was published in Physical Review Letters. [12]

Potential signs of 'interacting' dark matter suggest it is not completely dark after all



Approximately real-color image from the Hubble Space Telescope, of galaxy cluster Abell 3827. The galaxy cluster is made of hundreds of yellowish galaxies. At its core, four giant galaxies are smashing into each other. As the topmost of the four galaxies fell in, it left its dark matter trailing behind. The dark matter is invisible in this image, but its position is revealed by tell-tale gravitational lensing of an unrelated spiral galaxy behind the cluster, whose distorted image is seen as a blue arc. Trailing dark matter is predicted by theories in which dark matter is not perfectly dark, but feels more of the fundamental forces than just gravity. Credit: Dr. Richard Massey (Durham University)

An international team of scientists, led by researchers at Durham University, UK, made the discovery using the Hubble Space Telescope and the European Southern Observatory's Very Large Telescope to view the simultaneous collision of four distant galaxies at the centre of a galaxy cluster 1.3 billion light years away from Earth.

Writing in the journal Monthly Notices of the Royal Astronomical Society today (Wednesday, April 15, 2015), the researchers said one dark matter clump appeared to be lagging behind the galaxy it surrounds.

They said the clump was currently offset from its galaxy by 5,000 light years (50,000 million million km) - a distance it would take NASA's Voyager spacecraft 90 million years to travel.

Such an offset is predicted during collisions if dark matter interacts, even very slightly, with forces other than gravity.

Computer simulations show that the extra friction from the collision would make the dark matter slow down, and eventually lag behind.

Scientists believe that all galaxies exist inside clumps of dark matter - called "dark" because it is thought to interact only with gravity, therefore making it invisible.

Without the constraining effect of its extra gravity, galaxies like our Milky Way would fling themselves apart as they spin.

In the latest study, the researchers were able to "see" the dark matter clump because of the distorting effect its mass has on the light from background galaxies - a technique called gravitational lensing.

The researchers added that their finding potentially rules out the standard theory of Cold Dark Matter, where dark matter interacts only with gravity.

Lead author Dr Richard Massey, Royal Society Research Fellow, in Durham University's Institute for Computational Cosmology, said: "We used to think that dark matter sits around, minding its own business.

"But if it slowed down during this collision, this could be the first dynamical evidence that dark matter notices the world around it.

"Dark matter may not be completely 'dark' after all."

The researchers note that while they appear to have observed the offsetting of dark matter, more investigation will be needed into other potential effects that could also produce a lag between the dark matter and the galaxy it hosts. Similar observations of more galaxies and computer simulations of galaxy collisions are under way to confirm the interpretation.

Team member Professor Liliya Williams, of the University of Minnesota, said: "Our observation suggests that dark matter might be able to interact with more forces than just gravity.

"The parallel Universe going on around us has just got interesting. The dark sector could contain rich physics and potentially complex behavior."

Last month (March 2015), Dr Massey and colleagues published observations showing that dark matter interacted very little during 72 collisions between galaxy clusters (each containing up to 1,000 galaxies). [11]

Dark matter is ghostly and non-interactive

The findings reported in the journal Science, mean some existing dark matter models - which give the mysterious substance properties similar to normal matter - will need to be revised.

"We have concluded that dark matter is most probably not interacting, so it exists in its ghostly state without interacting," says the study's lead author Dr David Harvey of the École Polytechnique Fédérale de Lausanne in Switzerland.

"This is surprising because we see in our world that all the particles interact with each other quite highly, whereas dark matter does not seem to do that."

Astronomers first noticed dark matter when they realized that there wasn't sufficient gravitational attraction to keep stars orbiting as fast as they do around the centers of galaxies.

Another apparently invisible substance, which scientists now call dark matter, must be providing the additional gravity.

Scientists estimate that dark matter makes up 85 per cent of all the matter in the universe.

All the normal matter - which makes up all the stars, planets, dust and gas clouds (which scientists call baryonic matter) - makes up just 15 per cent of all the matter in the universe.

Gravitational lensing

The new research by Harvey and colleagues, examined 72 galaxy cluster collisions to see how dark matter interacts.

Galaxy clusters are huge, gravitationally-bound collections of galaxies - interspersed with immense clouds of gas - which form some of the largest structures in the universe.

The authors compiled optical and X-ray images of galaxy cluster collisions using data from the Earth orbiting Chandra X-ray observatory and Hubble Space Telescope.

The X-rays are emitted by gas allowing scientists to pinpoint where the gas clouds are located, while the optical data shows the location of galaxies.

"Hubble allows us to see the galaxies in the galaxy cluster and also look at the galaxies behind galaxy clusters," says Harvey.

"By looking at background galaxies behind the cluster, you can see how light from those galaxies is bent by the mass of the foreground cluster.

The way light is bent provides clues about where the cluster's dark matter is located, and how it interacts during collisions.

The authors found galaxies pass through each other unimpeded during collisions, with their movement controlled by gravity.

They also found that the gas of each galaxy cluster interacts with the gas of the colliding cluster as they merge, slowing down and separating from its original galaxy cluster.

The question is; what is the dark matter doing during these collisions?

"We found the dark matter doesn't slow down, so as these huge dense lumps of dark matter come together, they go through each other without any interaction, they just follow the galaxies, or more accurately the galaxies are sticking to the dark matter," says Harvey.

"This is telling us that dark matter will most likely not interact the way protons [of normal matter] do, so it's ruling out models of dark matter that try to mirror the universe we have.

"Various dark matter models predict that dark matter will self interact to a certain degree, but what we've shown is that it doesn't."

Time for a rethink

According to Harvey, theorists will now need to tweak their dark matter models of 'mirror universes' and 'dark photons' in order to match his teams' observations.

"At the moment there are inconsistencies ... what we are doing is getting us closer to understanding what dark matter is," says Harvey.

The authors work complements the dark matter research about to be undertaken by the Large Hadron Collider at CERN.

"What CERN and the other ground based detector experiments are looking to do is seeing how dark matter relates to the standard model of particle physics," says Harvey.

"What I'm looking at is how dark matter interacts with in its own dark sector, its own dark universe side, which you can't do from the ground." [10]

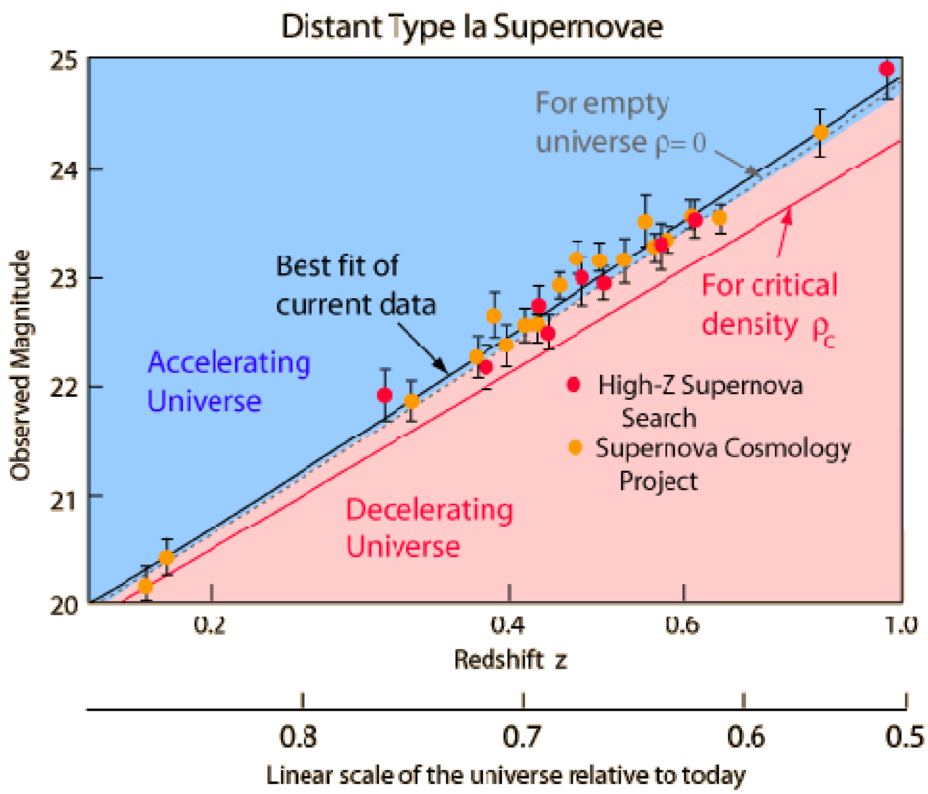
The Big Bang

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.

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

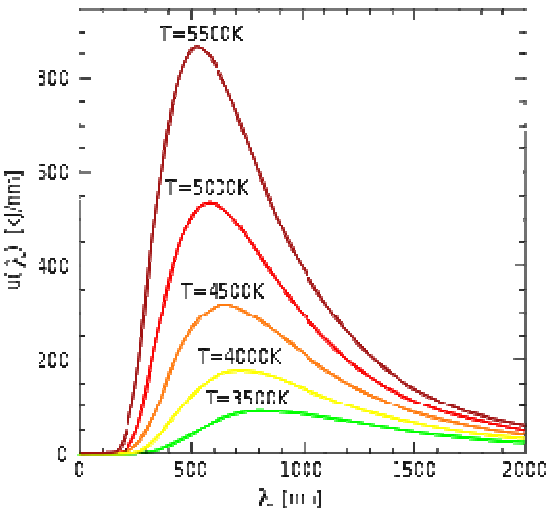
Dark matter is a type of matter hypothesized in astronomy and cosmology to account for a large part of the mass that appears to be missing from the universe. Dark matter cannot be seen directly with telescopes; evidently it neither emits nor absorbs light or other electromagnetic radiation at any significant 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 $E = hv$ 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.

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

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. [1]

Relativistic change of mass

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The frequency dependence of mass

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Electron – Proton mass rate

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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

After decades of studying dark matter scientists have repeatedly found evidence of what it cannot be but very few signs of what it is. That might have just changed. A study of four colliding galaxies for the first time suggests that the dark matter in them may be interacting with itself through some unknown force other than gravity that has no effect on ordinary matter. The finding could be a significant clue as to what comprises the invisible stuff that is thought to contribute 24 percent of the universe. [13]

Nevertheless, Davis and Silk spectacle that astronomers might have a better chance of spotting a dark matter glow at infrared wavelengths, where backgrounds are inferior but no such type observations have yet been taken with enough understanding. [12]
Today's latest research concerns the motion of individual galaxies. Researchers say that the collision between these galaxies could have lasted longer than the collisions observed in the previous study - allowing even a small frictional force to build up over time.
Taken together, the two results bracket the behavior of dark matter for the first time. Dark matter interacts more than this, but less than that. Dr Massey added: "We are finally homing in dark matter from above and below - squeezing our knowledge from two directions. [11]
"What CERN and the other ground based detector experiments are looking to do is seeing how dark matter relates to the standard model of particle physics," says Harvey.
"What I'm looking at is how dark matter interacts with in its own dark sector, its own dark universe side, which you can't do from the ground." [10]
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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]

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