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Dark Matter According to Augmented Newtonian Dynamics: (AND)

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Abstract: ***Augmented Newtonian Dynamics extends Newtonian dynamics into the realm of the very, very small. By venturing into the subject of the sub-atomic which was once thought to be the sole domain of quantum mechanics, AND challenges quantum mechanics concepts such as the Schrodinger equation, wave-particle duality, superposition, quantum entanglement and the wave function. In place of these esoteric theories AND offers purely classical concepts as they apply to the very, very small, while at the same time incorporating into its ideology; quantum mechanics concepts such as Planck's constant, the atomic model, and the concept of photons. This is made possible by adopting the hypothesis of an aether-like medium, that permeates the whole of the Universe. Dark Matter, an elusive substance that can account for anything from 85% to 90% of all matter in the Universe, is a possible candidate for such a medium or aether. The existence of an aether-like medium through which both light and gravity can propagate, would (a) justify Newton's Law of Universal Gravitation and (b) account for the propagation of light without invoking the wave function, time dilation or length contraction. Scientists have gathered compelling indirect evidence for the existence of dark matter, yet its true nature remains unknown. Alternative theories, such as MOND (Modified Newtonian Dynamics), do not align with observational data of Dark Matter. Similarly, extensive astronomical searches have yielded no support for the idea that the missing matter could be contained in compact objects made of ordinary matter. This paper offers a compelling alternative.***

Keywords: Dark Matter, aether, photons, electrons, photon emission, photon absorption, CMBR

1. Introduction to Dark Matter

Dark matter is one of the last remaining mysteries in modern science, just as the ultra-violet catastrophe had been in the late nineteenth Century, hopefully its solution will have as positive an effect on science as did Max Planck's discovery that radiation consists of infinitesimal, discrete, indivisible packets of energy called quanta with energies determined by a new fundamental constant, called Planck's constant. Although dark matter makes up more than 85% of all matter in the universe, it remains completely invisible and undetectable by conventional sensors. [1] (Jan Conrad, Professor Dept. of Physics, Stockholm University, " 85 % of all matter in the universe is dark matter.") Scientists know it exists, but they can't see it directly. Its presence is inferred from its gravitational effects on visible matter—without dark matter, the behavior of stars, planets, and galaxies would be impossible to explain. Different theories have been formulated to try and explain the large-scale structure of the Universe without invoking Dark Matter, without success.

What is Dark Matter

The search for dark matter is a vibrant and thrilling field of research in physics and astronomy. It holds the potential to reveal new insights into the nature of our universe. Until its secrets are unlocked, we can only marvel at the enigmatic dark side of the cosmos. Dark matter is the mysterious stuff that fills the universe but that no one has ever seen. Dark matter constitutes over 85% of all matter in the universe, yet it remains unseen by scientists. While these properties of being non-tactile, invisible, and possessing low to zero interaction with matter, make dark matter an intriguing mystery, scientists are still trying to determine its exact nature. Various hypotheses have been put forward, but none have been confirmed. One theory that has gained ground suggests that dark matter is composed of weakly interacting massive particles (WIMPs). These subatomic particles only interact with ordinary matter through gravity and the weak nuclear force. Another possibility is that dark matter consists of axions. Axions are extremely light, electrically neutral particles, that interact very weakly with other particles, which makes them difficult to detect. They were first introduced in the 1970s to solve a theoretical problem in particle physics related to the strong nuclear force. If axions exist, they could account for a significant portion of dark matter, and ongoing experiments are seeking to detect them directly through their rare interactions with electromagnetic fields. Some of the other candidates for dark matter include sterile neutrinos, superheavy dark matter, self-interacting dark matter, and fuzzy dark matter. However, none of these candidates have been definitively proven or ruled out. Yet another candidate for dark matter are sterile neutrinos, which are relic neutrinos existing from the time of the Big Bang. Neutrinos are tiny particles that pass through ordinary matter almost undetected. They are produced in large numbers by the sun, and although they rarely interact with matter, they can pass through the Earth and everything in it. There are three known types of neutrinos, the sterile neutrino is theorized to be a fourth type, and is proposed as a dark matter candidate. Unlike regular neutrinos, sterile neutrinos only interact with normal matter through gravity. Unfortunately, sterile neutrinos are still only theoretical entities, a sterile neutrino has never been detected.

Neutrinos exist in large numbers. It is estimated that 10^{10} neutrinos pass through every square centimetres of our bodies every second but because of their very low interaction with matter, this does not trouble us at all. [2] (Mitchell Soderberg, Syracuse University: "You may not know it, but every second 100 billion extremely tiny, invisible subatomic particles called neutrinos pass through every square centimeter of your hand.").

History of Dark Matter

Dark matter was first proposed in the 1930s by Swiss astronomer Fritz Zwicky. While studying galaxy clusters, Zwicky noticed that the visible mass of galaxies was

insufficient to explain their gravitational effects, suggesting the presence of unseen mass that was exerting a gravitational influence. This 'missing mass' became known as dark matter. In the 1970s, American astronomer Vera Rubin confirmed the existence of dark matter by observing the rotational curves of galaxies, which also showed they were moving faster than expected, indicating more mass was present to account for this phenomenon than could be seen. According to Newtonian dynamics as applied to the solar system, planets that are furthermost from the sun should move more slowly than inner planets and this indeed was found to be the case. However, when Vera Rubin started to study the Andromeda Galaxy, she found that this simple law did not hold true. Stars at the outer edge of the Andromeda Galaxy were found to be moving much faster than they should have been moving, in fact they were moving so fast that they should have been flung away into space, because the gravity of the baryonic matter that was visible in the Galaxy could not account for how these stars at the edge of the Andromeda Galaxy were being held in place, at the speeds at which they were moving. The gravitational attraction from the available baryonic mass would not have been sufficient to account for the shape of the Galaxy or the speed at which the stars were moving. When performing the calculations to see what percentage of mass would be needed to keep the outermost stars in the Galaxy in place Vera Rubin estimated that about 85% more mass than what could be seen was required to explain these high rotational speeds, leading to the conclusion that unseen 'dark matter' must be present. This groundbreaking work was crucial in supporting the dark matter hypothesis. [3] (Rubin, V. C., & Ford, W. K. (1976). "The rotation of spiral galaxies." *Annual Review of Astronomy and Astrophysics*, 14, 479-538.).

Despite decades of research, dark matter has not been directly detected, and its exact nature remains unknown. It is thought to make up about 85% of the universe's mass-energy content, yet it doesn't emit light or interact with normal matter except through gravity.

Augmented Newtonian Dynamics (AND) and Dark Matter:

It is interesting to note that Astrophysicists are so intrigued by the idea of relic neutrinos from the Big Bang as being the main constituents of dark matter. Yet, one problem that besets the 'neutrino as dark matter theory' is that neutrinos simply did not exist in the numbers needed to explain dark matter. According to AND a far better candidate for dark matter would be relic light from the Big Bang era. By using relic light from the Big Bang as the candidate for dark matter, the problem of numbers is immediately solved because light is produced at the rate of hundreds of trillions per second by electron emissions and absorptions. [4] (Oates et al. (2019), "Optical clocks, which operate at much higher frequencies than microwave-based cesium clocks, provide a direct link to photon production rates where optical frequencies are concerned."). It is no longer speculation but fact that bound electrons within atoms absorb and emit photons at the rate of hundreds of trillions of times per second. Further, if one looks at the working of any smart phone, it is possible to see that data is being processed at the rate of Gigabytes per second, therefore for the miniscule electron to oscillate at speeds of less than hundreds of terahertz would be an anomaly. Further the working of optical atomic clocks bears out the fact that electrons do in fact oscillate and emit and absorb photons at the rate of hundreds of trillions per second.

The quantum mechanics theory that electrons emit photons by making jumps from one energy level to another energy level and then dropping back down and emitting a photon with energy equal to the transition from one energy level to another, no longer holds good. Further the QM explanation for how this process takes place in atoms with multiple electrons is hardly convincing. QM claims that ALL the electrons in a multiple electron atom combine into a single wave function and that the whole wave function thus formed, makes quantum leaps from one energy level to another and then back down to emit a photon.[5] (Griffiths' *Introduction to Quantum Mechanics* (Chapter 4), ("the whole wave function 'jumps' or undergoes a change due to the interaction" i.e., changes shape.).

The phenomena of photon absorption and emission is central to the AND theory of how Dark Matter was formed, therefore a separate paragraph will be devoted to the QM explanation for photon emission and absorption and recoil, followed by the AND theory of photon emission and absorption and recoil.

Photon, emission, absorption and recoil according to Quantum Mechanics:

The wave function, Ψ, represents the quantum state of a system. For a single electron in an atom, Ψ describes its probability distribution and energy. In multiple-electron atoms, the wave function becomes more complex as the wave-function must account for all electrons simultaneously, including their interactions. When an atom absorbs or emits a photon, the energy of the system changes, which may cause a "recoil" or shift in the wave function. This recoil reflects a redistribution of energy and probability across the electrons.

When an electron transitions between energy levels one of two things happens:

a) A photon is absorbed, increasing the energy of the system. The wave function shifts to reflect the new state.
b) A photon is emitted, reducing the energy of the system. This process also alters the wave function.

In multiple-electron atoms, the recoil involves not just the electron undergoing transition but potentially all electrons in the atom, due to their entanglement and the electron-electron repulsion.

Comment on the QM theory of electron absorption and emission:

This quantum mechanics interpretation of photon absorption and emission, involving as it does not single electrons but all of the electrons present in a multiple electron atom does not make sense when viewed through the proven reality that photon emission and absorption take place at phenomenal rates of hundreds of Terahertz. It is not correct: as in most instances involving multiple electron atoms, multiple electrons within the atom are simultaneously interacting with incoming EMR and emitting and absorbing photons. For instance, in a carbon atom with its 6 electrons, as many as three to four of the six electrons present might be absorbing and emitting photons at the rate of hundreds of Terahertz

simultaneously, each emitting photons of different frequencies. Given this scenario the QM explanation with its quantum jumps does not make sense.

Photon, emission, absorption and recoil according to AND:

In order to understand, how AND treats photon, emission and absorption, it is important to understand that while quantum mechanics views, photons as being excitations and perturbations of the electromagnetic field, AND views photons as being created within the electron. Here is how the AND theory of photons explains the process. The electron is a charged particle that always tries to maintain its base energy of 1.6 x 10^{-19} J intact. In order to do this, the electron mediates its energy by emitting and absorbing pulses of electric energy: See figure 1:

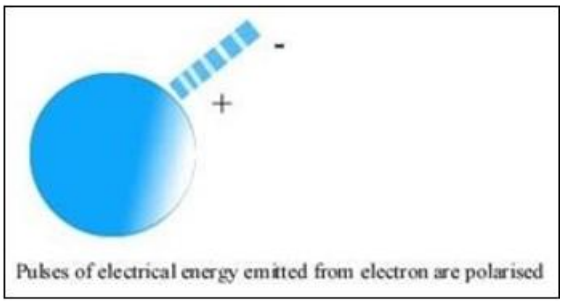

Figure 1

As can be understood from a study of Figure 1, it is apparent that the electron mediates any excess energy by emitting pulses of electric energy. These pulses undergo polarization due to the fact that the initial pulses of electric energy emitted by the electron are stronger than subsequent pulses of energy emitted by the electron. This leads to the formation of a dipole electric field forming around the pulses of emitted electric energy. See Figure 2:

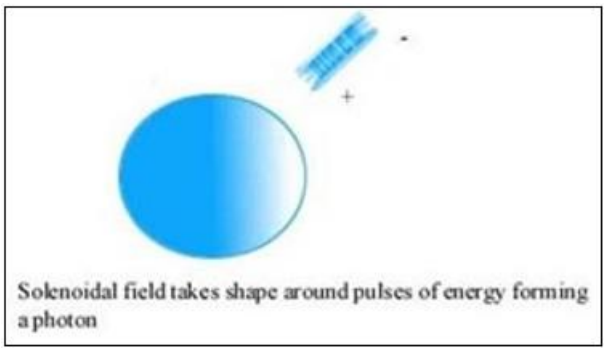

Figure 2

This is the structure of a photon according to AND, as can be seen the dipole structure means that the photon is electrically neutral, it is massless, it is a stable configuration, that can maintain its structure intact without undergoing change to its energy or dimensions, it is a structure that possesses a fixed energy and can maintain that energy over long periods of time. In short here is a configuration of the photon that possesses all of the properties that photons have been observed to possess. Another very important point to this model of the photon, isa that it can be created by the electron in an incredibly short time of about 10^{-18} s. This fast creation process of the photon means that the electron can create and emit hundreds of trillions of photons per second. The dimensions of the emitted photons should also be noted, the photon has a radius of about 10^{-16} m and a length that varies with its energy. These dimensions of the photon mean that it is possible for electrons and photons to interact on a one-on-one basis. Photons can be directly emitted and absorbed by electrons, making for very fast photon emissions and absorptions. According to AND, there are no energy transitions of electrons from one energy level to another, instead the photon emission process follows the laws of classical physics as they apply to momentum and recoil. When an incoming photon is absorbed by the electron, the electron does not jump to another energy level but instead is propelled towards the nucleus as would be the case in classical physics.

Another point to be noted is that according to AND frequency is treated as something real and not an abstract concept as in Quantum mechanics. [6] (Leonard Susskind, "The Theoretical Minimum: Quantum Mechanics"

"A photon is an excitation of the electromagnetic field, and its energy is related to the frequency of the field's oscillation, E=hf. However, unlike a classical wave, the photon itself does not have a frequency in the conventional sense. Instead, we say that the frequency of the photon corresponds to the frequency of the electromagnetic wave it would form if viewed as a wave.")

Therefore, with no transitions between energy levels, the emission and absorption process become straightforward. The electron absorbs an incoming photon, the energy imparted from absorption of the photon propels the electron towards the nucleus. When it reaches the nucleus, the electron undergoes momentary neutralization of charge, the energy imparted to the electron by the absorbed photon, causes the electron to recoil off the nucleus in keeping with classical rules of recoil where angle of incidence equals angle of reflection, when it reaches the energy level where it had absorbed the photon, it re-emits the photon. Recoil forces then cause it to retrace its steps, recoil off the nucleus and end up in its original position where it absorbs another photon and the whole process repeats at the rate of hundreds of trillions of times per second. This rapid emission of photons results in lines or rays of identical photons being formed, traveling in a single direction, this accounts for the rectilinear nature of light. The sheer numbers of photons involved in each ray or line of identical connected photons, also explains how light can follow the inverse square law as it travels.

This account of photon emission and absorption is important, but the main purpose of including it here is to illustrate the sheer number imbalance while considering photon to particle ratios. The figure of hundreds of trillions of photons emitted every second is important. In AND photon frequency is something real. This means that when we speak of a photon frequency of 600 THz, it means exactly that, namely photons are being emitted at the rate of 600 trillion photons per second.

Formation of photons according to AND:

Photons according to AND are formed in three categories. Photons of optical frequencies and wavelengths are directly

formed and emitted by electrons. Gamma rays are formed at the time of destruction of the atom as are neutrinos, x-rays are formed when fast electrons are suddenly stopped, and radio-waves are not emitted directly by electrons but are formed by a different process.

The Big Bang and AND:

Immediately after the Big Bang, the universe existed in an extremely hot and dense state, characterized by the Planck, Grand Unification, and Inflationary epochs. During these early phases, the universe expanded at an extraordinary rate, while within this dense plasma environment, particles of matter and photons were constantly interacting. For every particle of matter that formed, an enormous number of photons were created — hundreds of trillions per second, resonating at optical light frequencies. These photons were real, not virtual, and their production took place in the high-energy conditions of the early universe. Photons were admitted in colossal numbers per second per particle, for hundreds of thousands of years if not longer.

The quantity of photons produced in these conditions aligns with current measurements from optical atomic clocks, which operate at optical frequencies. Recent studies show that these clocks demonstrate precision at optical frequencies, offering a direct link to the photon production rates seen in the early universe—a phenomenon that persists today. As noted by [4] (Oates et al. (2019), "Optical clocks, which operate at much higher frequencies than microwave-based cesium clocks, provide a direct link to photon production rates at optical frequencies." i.e., electron resonates at irradiated rate and emits photons at that rate.) These photons could not pass over the edge of the Universe so began to fill the Universe, permeating every part of it.

These photons filled the universe and interacted within the dense plasma, creating an interconnected network of energy. Despite the vast number of photons being produced, the dense plasma environment inhibited their ability to propagate freely. Because of their dipole structure these early photons could link together forming a background fabric to the Universe. As the Universe expanded this network of background photons expanded with it. One result was that as the expansion of the Universe continued the energy of the individual photons forming the background fabric of the Universe was reduced finally reaching an energy of 10^{-51} J per individual photon. The original photons from the Big Bang had transitioned from being real photons to being virtual photons. One of the reasons these photons could exist for so long was the Heisenberg Uncertainty Principle. According to the provisions of the Heisenberg Uncertainty principle as it applies to energy and time:

$$\Delta T \Delta E \geq h \quad (1)$$

This equation states that if an interaction occurs over a very short period of time, the energy involved is uncertain, similarly if an interaction involves a very, very low energy the time over which the interaction takes place becomes arbitrary. In this particular case with an energy of 10^{-51} J involved the photons possessing such an energy could exist for billions of years. This network of very, very low energy virtual photons is what we know of as Dark Matter, this is the true relic radiation from the Big Bang and not as was previously held to be; the cosmic microwave background radiation. The reason that AND states that the CMBR is not relic radiation from the Big Bang is simple. One must remember that the Universe contains unimaginably massive clouds of hydrogen, it is in these clouds of hydrogen that galaxies were born. Therefore, to imagine that these clouds of Hydrogen are quiescent is absurd in the extreme. As it turns out the 1 mm wavelength attributed to the CMBR falls squarely within the Hydrogen spectrum. Thus, the CMBR is not relic radiation, it is very much radiation emanating from the Universe in the Present. This would account for the CMBR appearing to emanate from all directions and would also explain the black body characteristics of the radiation.

2. Conclusion

In conclusion, Dark Matter, maybe understood as being a network of virtual photons with electromagnetic properties, offering a profound explanation of energy propagation throughout the universe. These virtual photons, while essentially fixed in space, possess a remarkable 360-degree freedom of alignment, allowing them to orient themselves in any direction. This dipole nature plays a pivotal role in the transmission of light, as the virtual photon dipoles align along the path of real photons, creating a channel through which energy can travel efficiently. Therefore, when an electron emits a real photon, the virtual photons of dark matter form into a line along the direction of the emitted photon whose ends rest on the shoulders of infinity. The energy of the real photon then travels along this line of aligned virtual photons. The alignment of these dipoles aids the propagation of light in accordance with the inverse square law. As real photons travel, they can pass all of their energy to virtual photons which they come in contact with while their own energy is replenished from the line of real photons behind it. This exchange of energy laterally, naturally results in a loss of intensity over distance since less photons are in the original line and intensity is correspondingly reduced. However, the virtual photon dipoles, by aligning along the photon's trajectory, guide and facilitate the transfer of energy, while their own base energy of 10^{-51} J remains intact. This interaction between the real photons and the fixed, yet freely orientable, virtual dipoles enhance the efficiency of light's propagation across vast distances.

Rather than being passive relics of the early universe, these virtual photons are active agents in the electromagnetic processes that govern the flow of energy. Their fixed positions in space, coupled with their ability to align in any direction, create an intricate and dynamic network that supports the transmission of light and energy. This understanding of Dark Matter as a structured electromagnetic field not only redefines its role in the universe but also reveals its crucial involvement in the behavior of light, providing new insight into the fundamental forces that shape the cosmos.

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