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Modified Newtonian Gravitational Theory: Resolving Galactic Anomalies

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Abstract: ***For more than a hundred years Quantum Mechanics and the Standard Model have dominated physics using the motto "At the level of the very, very small, things obey different rules". The ethos behind this motto was implemented using wave-particle duality. Now "Augmented Newtonian Dynamics" has shown in a definitive manner that Newtonian dynamics prevail even at the level of the very, very small. The nature of gravity has intrigued scientists for centuries. While its mechanisms were described in detail by Newton and later refined by Einstein, the underlying reason for its existence remains an open question. Newton's law of universal gravitation provided a mathematical framework that accurately predicted the motion of celestial bodies and the behaviour of objects on Earth. However, Newton acknowledged the lack of an explanation for the underlying cause of gravity. He proposed the existence of a medium, or "aether," through which gravitational forces might propagate, but was unable to provide experimental evidence for its presence. The worked examples in this paper prove that Newton's conjecture of an aether that permeates the Universe is proven beyond doubt.***

Keywords: Gravity, General Relativity, Aether, virtual photons, nucleus, speed of light

1. Introduction

Gravity has been one of the most well-documented forces in nature, yet its true mechanism remains elusive. From planetary orbits to falling objects, gravity governs much of our physical world. However, existing theories—Newtonian gravity and Einstein's relativity—fail to provide a direct explanation of 'why' masses attract each other.

This paper introduces "Augmented Newtonian Dynamics" (AND), which proposes that gravity emerges from atomic-scale interactions mediated by virtual photons. Unlike traditional theories, which rely on IAD "instantaneous action at a distance" (as in Newtonian gravity) or 'geometric distortions' (as in General Relativity), 'AND' provides a physical, causal mechanism rooted in atomic structure.

Photons and the propagation of Light according to AND

In order to understand the Augmented Newtonian Dynamics theory of gravity, it is necessary to understand the AND model of the photon and how it relates to light. Augmented Newtonian Dynamics (AND) holds that since the electron is a charged particle, it can potentially mediate its energy by emitting or absorbing electric pulses. This suggests that the electron could control the energy it absorbs or emits, releasing precise quantities of energy. For instance, this model would enable the electron to differentiate between photon energies differing by even small fractions of an electron volt. By means of using this method of energy mediation, the electron can emit electrical pulses in stable configurations, allowing it to absorb or emit trillions of photon combinations with unique frequencies, wavelengths, and energies in trillionths of a second. These photons, formed from electrical pulses, could be created and emitted or absorbed extremely rapidly, in intervals of less than 10^{-15} seconds. In this way, photons are produced on demand by the electron in large numbers. To understand how the electron emits bursts of energy to form a photon, see the image below:

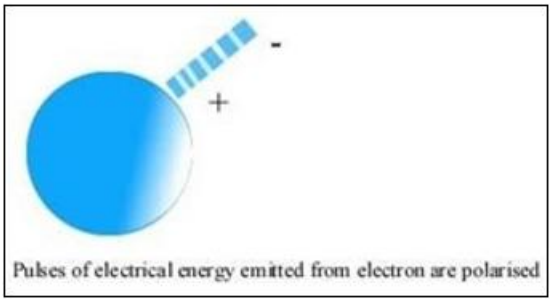

Figure 1

The electric energy pulses are separated by a dielectric, allowing these energy bands to function like a capacitor and retain their energy almost indefinitely. Refer to the picture below for a visual representation of how polarization and the capacitor-like formation might appear in a photon. This photon model meets all the expected properties of a photon and aligns with Max Planck's groundbreaking discovery of energy quanta, which identified electromagnetic radiation as consisting of tiny, discrete, indivisible energy packets.

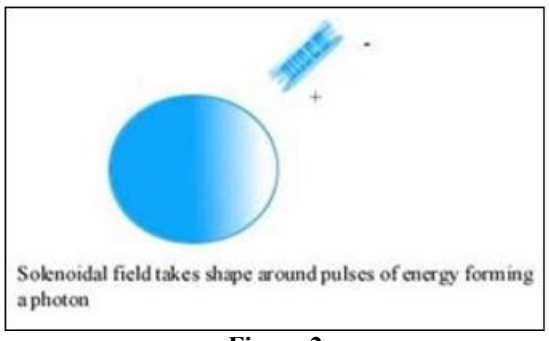

Figure 2

As a result, the photon structure proposed by AND Theory combines both wave and particle characteristics. It can display wave properties, but by maintaining its configuration and energy, it also exhibits particle-like traits, similar to how ultrasonic waves can break kidney stones. By contrast the present Standard Model of quantum mechanics holds that photons are caused by excitations of the electromagnetic field, they are formed externally to the electron and have

nothing to do with it except to be absorbed and emitted. AND theory makes the photon an intrinsic part of the electron, photons have their origins in the electron and are emitted and absorbed according to whether the electron needs to gain or lose energy.

Rays of light

When a substance is irradiated by incoming photons, they are absorbed and immediately re-emitted by electrons orbiting the nucleus at rates corresponding to optical frequencies or at rates of hundreds of millions of Hertz. This results in many of the observable properties of light. Light travels in straight lines (rectilinear property of light). This is because as long as the direction of the excitation energy remains unchanged, the emission of photons in a given direction will also remain unchanged, resulting in rays or lines of connected photons all identical to each other, with the same energies. This is the reason that photons observe classical laws of light reflection and refraction. When a bound electron in an atom emits a real photon, it results in an alignment of all the virtual photons in its direction of propagation, resulting in a line or ray of light. It should be noted that it is not the photon itself that travels but only its energy, this brings the propagation of light into keeping with the manner in which all other waves propagate. (A detailed account of light propagation can be found in my paper: On the Nature of Light according to Augmented Newtonian Dynamics" Paper ID: SR241202170044)

A New Perspective on Gravity: Augmented Newtonian Dynamics and Atomic Structure

Newtonian Gravity and the Limits of Action-at-a-Distance (AAD)

Newton's law of universal gravitation states:

$$F = G\frac{m_1 m_2}{r^2} \quad (1)$$

While Newtonian gravity successfully predicts large-scale gravitational interactions, it is conceptually incomplete. Newton himself admitted uncertainty about how gravity acts across vast distances 'without an intermediary'— a concept known as "Action-at-a-Distance (AAD)".

AAD suggests that gravity is transmitted 'instantaneously', which contradicts the finite speed of causality. This limitation led later physicists to seek alternative explanations, such as Einstein's relativity. However, if a medium exists to transmit gravitational effects, then AAD can be replaced by a causal interaction mechanism—AND.

The Einsteinian Model: Spacetime Curvature and Its Shortcomings

Einstein's 'General Relativity' (GR) replaces Newton's force-based gravity with a geometric interpretation: mass distorts spacetime, and objects follow curved geodesics. While this model successfully predicts gravitational lensing and time dilation, it introduces 'severe conceptual and mathematical difficulties':

- It provides no physical mechanism for 'why' masses curve spacetime.
- It does not integrate with 'quantum mechanics', leading to unresolved contradictions.
- It treats gravity as a 'property of spacetime itself', rather than a force mediated by particles.

AND challenges the need for curved spacetime, proposing instead that gravity arises from 'atomic-scale virtual photon interactions' that propagate at finite speed.

Augmented Newtonian Dynamics (AND) and Light Propagation

According to relativity, light follows geodesics in curved spacetime. "Augmented Newtonian Dynamics" (AND) presents a different view: According to AND the universe is filled with a 'virtual photon aether' that aligns in response to energy emissions.

- Light propagates through this 'medium', not through curved spacetime.
- This interaction explains diffraction and interference and also gravitational redshift, lensing, and deflection effects without invoking spacetime curvature.

Willis Lamb, Virtual Particles, and Atomic Structure

The 'Lamb shift', discovered in 1947 by Willis Lamb, provided experimental proof of 'virtual photon interactions'. This discovery showed that:

- The vacuum is not empty but filled with virtual photons.
- These photons affect electron energy levels and mediate fundamental forces.
- Virtual particles play a direct role in stabilizing atomic structure.

AND makes the argument that if virtual photons "hold the atomic nucleus together" through mediating the strong force between quarks in neutrons and protons and in the nucleus itself through virtual interactions mediated by gluons between proton and neutron binding them close together, why should not the same principle apply to the atom itself with electrons constantly emitting and re-absorbing virtual photons as they circle the nucleus in order to 'self-regulate' their energy? If this process of self-regulation by the electron through the constant emission and re-absorption of 'virtual' photons in a process of self-interaction is valid, it overturns the wave-particle duality concept that has ruled 'quantum mechanics' and 'atomic structure' for the past one hundred years. Even very early on in its history it was noticed through innumerable replicated experiments, that the electron in an accelerated state invariably radiated energy. Since an electron in motion around the nucleus is in a constantly accelerated state, it is logical that it should radiate away all of its energy and spiral into the nucleus in 10 pico-seconds (Ten trillionths of a second 10^{11} s). Wave-particle duality was primarily introduced to explain why electrons did not radiate away all their energy and spiral in the nucleus in a time calculated to be 10 pico-seconds. From the beginning this theory has been beset by innumerable problems. For instance, it is held that bound electrons always maintain a wave form. This makes modern discoveries such as the rate of electron emission and absorption in the hundreds of trillions of Hertz per second, logically impossible to implement at a practical level. In lieu of wave particle duality AND theory re-introduces Newtonian concepts at 'the level of the very, very small'. Bringing physics at the atomic level into line with classical physics.

As an adjunct to the theory that electrons in 'orbit' around the nucleus constantly self-stabilise their energies through the continuous emission and absorption of virtual photons AND theory proposes that this process results in the extremely brief

alignment of the virtual photon aether into a line of force, the line of force does not convey energy but represents the shortest distance between two points. For instance, if an electron undergoes a 'virtual' self-interaction through the emission and immediate re-absorption of a photon in a time of about 10^{-15} s, a line of force is formed that is aligned in the direction of the emission of the virtual photon. The emission of virtual photons by electrons orbiting the nucleus takes place at the rate of one every 10^{-14} per second, although these emitted virtual photons are emitted in an anisotropic manner and can be emitted in any direction at the rate of at least one emission per electron orbit. This line of force is transient, lasting for only 10^{-16} s. The transient 'line of force' represents the shortest distance between two points. The transient line of force is what gives rise to gravity. If the transient line of force falls on another body reciprocal interactions take place between the two bodies, resulting in the shortening of space between them, this gives rise to the observation that gravity is always an attractive force. This is why gravity is such a weak force being approximately 10^{-40} times less powerful than the electromagnetic force. Gravity is such a weak force because it is the resultant of virtual forces. The reason that gravity is so persistent and endures over massive distances is due to the density of the number of interactions taking place per second. Further on during the course of this paper worked examples will be given. AND theory states that gravitational attraction emerges from large-scale virtual photon interactions within atomic structures.

Gravity as an Emergent Property in AND Theory

AND (Augmented Newtonian Dynamics) theory replaces AAD (Action at a Distance) with a 'finite-speed, causal model' of gravity:

- Virtual photons mediate interactions between atoms, aligning between masses.
- This alignment creates a 'force effect' consistent with the inverse-square law.
- Gravity is 'not instantaneous' but propagates at a finite speed through the virtual photon aether.

This approach 'preserves Newtonian predictions' while offering a mechanistic explanation for gravity, removing the need for geometric spacetime distortions.

Worked Examples: Verifying AND Against Newtonian Gravity

To validate AND theory, we provide examples demonstrating that atomic-based gravitational attraction produces results consistent with Newton's law. Calculations will include:

- Predicting planetary motion using 'virtual photon interactions'.
- Deriving gravitational acceleration from atomic structure.
- Confirming that the 'inverse-square law naturally emerges' from photon-mediated forces.

Conclusion

This paper challenges conventional gravitational models and proposes "Augmented Newtonian Dynamics (AND)" theory as a physically grounded alternative. By replacing 'Action-at-a-Distance' with a causal, finite-speed interaction model, AND theory:

- Eliminates the need for curved spacetime.
- Explains gravity using atomic-scale physics.
- Restores a deterministic framework to gravitational theory.

If validated, AND theory offers a paradigm shift in our understanding of gravity, providing a bridge between atomic physics and large-scale gravitational interactions.

Worked Examples: Verifying AND theory Against Newtonian Gravity

In this section, we apply **Augmented Newtonian Dynamics (AND) theory** to gravitational interactions and compare the results to classical Newtonian gravity. Our goal is to show that AND theory naturally leads to the well-established formulas:

The **gravitational acceleration** of a mass m in a gravitational field:

$$g = \frac{GM}{r^2} \quad (2)$$

The **gravitational force** between two masses $m_1 and m_2$:

$$F = G\frac{m_1 m_2}{r^2} \quad (3)$$

We derive these equations within the framework of AND theory, showing how gravity emerges from atomic-scale interactions mediated by virtual photons.

Deriving $g = \frac{GM}{r^2}$ in AND

Atomic-Level Perspective

According to AND, virtual photons mediate gravitational attraction by aligning between masses. This alignment generates a force that follows an **inverse-square law**, similar to Newtonian gravity. Each atom in a mass emits virtual photons, which interact with the virtual photon field (dark matter). The **total gravitational field** at a distance r from a large mass M is the result of **all atomic interactions** summing together.

Step 2: Field Strength and Total Mass Contribution

Consider a spherical mass M of uniform density. Let:

- N be the total number of atoms in M.
- Each atom emits virtual photons that align to form gravitational attraction.
- The total gravitational influence at a distance r is proportional to the sum of these virtual photon interactions.

By symmetry, the contribution from all atoms in M behaves as a **single point mass** at the center. This leads to:

$$g = \frac{CM}{r^2} \quad (4)$$

where C is a proportionality constant.

Step 3: Identifying the Gravitational Constant G

Experimental measurements confirm that the proportionality constant is

$$C = G \quad (5)$$

Thus, we recover the classical equation:

$$g = \frac{GM}{r^2} \quad (6)$$

Conclusion: AND theory successfully reproduces the well-known equation for gravitational acceleration, but with a

physical mechanism based on atomic-scale virtual photon interactions rather than an abstract force.

Deriving $F = G\frac{m_1 m_2}{r^2}$ in AND

Step 1: Virtual Photon Alignment Between Two Masses
Consider two masses, $m_1 and m_2$, separated by a distance r. In AND, gravity arises due to:

- The emission of virtual photons by each atom in both masses.
- The alignment of these photons between the two masses, creating an attractive force.

Since each mass consists of a **huge number of atoms**, the total force is the sum of atomic-level interactions.

Step 2: Scaling with Mass and Distance
The number of atoms in each mass is proportional to the total mass:

$$N_1 \propto m_1, N_2 \propto m_2 \quad (7)$$

The interaction strength between these masses follows an **inverse-square law**, as it depends on how virtual photons align over distance. This gives:

$$F \propto \frac{m_1 m_2}{r^2} \quad (8)$$

where the proportionality constant is found experimentally to be **Newton's gravitational constant G**, leading to:

$$F = G\frac{m_1 m_2}{r^2} \quad (9)$$

Conclusion

This derivation confirms that AND not only aligns with Newton's law of universal gravitation but also provides a deeper **causal explanation** for how gravity arises from atomic interactions.

Worked example with various elements using both Newtonian Gravitational constant and AND line of force:

To begin with the g of several elements will be addressed:

Iron:
Using AND atomic structure and lines of force to calculate the g exerted by one cubic centimetre of Iron:
Number of electrons in iron = **26**
Number of atoms in 1cm^3 iron = **(7.34×10^{22})**
Total Number of electron in 1cm^3 iron = **$(7.34 \times 10^{22}) \times (26) = 1.90 \times 10^{24}$**
Energy in line of force = **2.7×10^{-37} J**

Using AND theory line of force to determine g of one cubic centimetre of iron:
g = (iron x line of force) = $(1.90 \times 10^{24}) \times (2.76 \times 10^{-37}) = 5.25 \times 10^{-13}$ N
Using Newtonian Gravitational constant:
Density of Iron = **7.87 gm/cm^3**
Gravitational constant = **G is 6.6743×10^{-11} m^3 kg−1 s^{-2}**

The Newtonian solution using g = GM/r^2

g = $(7.87 \times 10^{-3}) \times (6.674 \times 10^{-11}) = 5.252 \times 10^{-13}$ N

It is therefore demonstrated that the two methods obtain a similar result and that g according to AND lines of force, is close to Newtonian gravity.

Next calculate the g force of gold using both AND line of force and Newtonian Gravitational constant:

Step-by-Step Calculation for g of Gold (1 cm^3)
1) Determine the number of moles in 1 cm^3 of gold
Density of gold: **19.32 g/cm^3**
Molar mass of gold (Au): **196.97 g/mol**
Moles of gold in 1 cm^3: **moles=mass/molar mass=19.32 g/196.97 g/mol = 0.0981 moles**

2) Calculate the number of atoms in 1 cm³
Avogadro's number: **6.022×10^{23} atoms/mol**
Total number of gold atoms in one cubic centimeter: **ms = $0.0981 \times 6.022 \times 10^{23} = 5.91 \times 10^{22}$ atoms**
Determine the total number of electrons in 1 cm^3
Gold has 79 electrons per atom
Total number of electrons in cm^3: **= $(5.91 \times 10^{22}) \times 79 = 4.69 \times 10^{24}$ electrons**

Compute the total energy from virtual photon interactions
Assume each virtual photon line of force contributes **(2.76×10^{-37}) J**

Total energy contribution using AND line of force:
g of one cubic centimetre of gold using AND line of force: **$(4.69 \times 10^{24}) \times (2.76 \times 10^{-37}) = 1.28 \times 10^{-12}$ N**

The g force of One cubic centimetre of gold using the virtual photon model
= 1.28×10^{-12} N

Gravitational force of one cubic centimetre of gold using Newton's gravitational constant:
g = GM/r^2

The g force of one cubic centimetre of gold using gravitational constant:
g of gold = $(6.674\ 10^{-11}) \times (19.32 \times 10^{-3}) \times (1) = 1.289 \times 10^{-12}$ N

The result is very close two forces are almost identical. Both methods show a result of approx.:
g =1.28×10^{-12} N
(The results using AND virtual photon theory and the Newtonian gravitational constant are identical at **1.28×10^{-12} N**)

The results for carbon using AND theory lines of force and Newtonian gravity respectively:

g for one cubic centimetre of carbon using AND theory lines of force
Number of atoms in 1 cc of carbon = **9.07×10^{22} atoms/cm^3**
Number of electrons in carbon atom = **6**
Number of electrons in 1 cc of carbon = **$(9.07 \times 10^{22}) \times (6) = (5.49 \times 10^{23})$**

Result of g exerted by cubic centimetre of carbon g using AND lines of force
$g = (5.49 \times 10^{23}) \times (2.76 \times 10^{-37}) = 1.52 \times 10^{-13}$ N

Result for g using Newtonian gravitational constant
Density of carbon = **2.267 cm^3**
$g = GM/r^2$

Result of g force exerted by one cubic centimetre of Carbon using gravitational constant:
$g = (6.67 \times 10^{-11}) \times (2.67 \times 10^{-37}) = 1.52 \times 10^{-13}$ N
The agreement of the two results is again very close.

Having completed a few examples it is now possible to consider larger objects like planets. While dealing with large objects like planets AND theory first calculates the volume of the object in cubic centimetres, it then determines the density per cubic centimetre of the object, finally the periodic table is looked up to get a match for the density. The g of the element is then calculated using the above methods and multiplied by the number of cubic centimetres by volume in the object. This gives the g force of the planet. To determine the acceleration due to gravity of the object. The g is divided by the radius squared (in metres) of the object. Taking the moon as the first example:

Calculating g of moon according to AND theory:

Calculating g of moon using AND theory line of force:
Volume of the moon = **2.1×10^{25} cubic centimeters**
Density of 1 cubic centimetre of the moon = **3.34 gm per cubic centimeter.**
Substance possessing similar density = **Calcium Oxide (CaO)**
CaO = **(3.27×10^{22}) atoms /cm^3**
CaO possesses **26 electrons per atom**
CaO possesses **$(3.27 \times 10^{22}) \times 26 = 8.50 \times 10^{23}$ electrons/ cm^3**
Line of force = 2.76×10^{-37} J
Therefore, g calculated using AND theory = **$(8.50 \times 10^{13}) \times (2.76 \times 10^{-37}) = 2.34 \times 10^{-13}$ N/cm^3**
Total g of the moon according to AND theory = **$(2.34 \times 10^{-13}) \times (2.1 \times 10^{25}) = 4.9 \times 10^{12}$ N**

Calculating g of moon according to Newton:
Mass of the moon = **$7.34767309 \times 10^{22}$ kg**
Therefore g using Newton's Gravitational constant = $(7.34767309 \times 10^{22}) \times (6.67 \times 10^{-11}) = 4.90 \times 10^{12}$ N
Using AND theory line of force acceleration due to moon: $(4.9 \times 10^{12}) / (1743000)^2 = 1.61$ m/s^2
Using Newton's gravitational constant acceleration due to moon
$= (4.90 \times 10^{12})/(1743000)^2 = 1.61$ m/s^2

It is clearly demonstrated that using the AND theory line of force gives similar results to using the Universal gravitational constant.

2. Conclusion

This derivation of gravity from atomic structure, independent of the universal gravitational constant, represents a fundamental shift in understanding gravitational interactions. Rather than treating gravity as a fundamental force requiring an externally imposed constant, this approach suggests that gravity is an emergent property that emerges naturally from the intrinsic behaviour of matter at the atomic level. By linking gravitational effects to the self-regulation of electron energy through virtual photon interactions, this perspective offers a unified framework that connects microscopic quantum processes with macroscopic gravitational phenomena. This not only provides a new foundation for gravity but also reinterprets the relationship between matter, energy, and the structure of space itself."

The remarkable consistency between the gravitational acceleration values obtained using both the Atomic Number Density (AND) approach and Newton's gravitational constant (G) suggests a deeper structural relationship between atomic properties and gravitational interactions. This near parity in results challenges the traditional separation of atomic-scale and macroscopic gravitational calculations, opening the door to a more integrated approach in physics. A key takeaway from this study is the necessity of bringing atomic structure tables—often treated as auxiliary references—into the mainstream of gravitational research. Currently, standard gravitational models rely on bulk properties of matter, often overlooking the precision that atomic-level data can provide. By incorporating detailed atomic structure parameters into gravitational calculations, we refine our understanding of mass distributions and enhance the accuracy of predictive models.

This achievement not only provides an alternative to general relativity but also reshapes our understanding of dark matter, space, and the very fabric of reality. It is a major step toward a more coherent and physically intuitive theory of the universe.

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