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Restoring Classical Order: Atomic Structure from Augmented Newtonian Principles

Dilip D James

Independent Researcher, Ooty India
Physics

Abstract: ***This paper proposes a new theoretical framework, within Augmented Newtonian Dynamics (AND), for describing atomic structure and spectral emission without invoking quantum jumps or probabilistic transitions. According to AND theory, atoms consist of well-defined shells and orbitals determined by energy balance between the nucleus and electrons. Stable orbitals do not emit or absorb radiation. Electrons in stable orbitals do however undergo continuous self-interactions via virtual photons to ensure orbital stability, they do not emit or absorb real photons. Only atoms with unpaired (odd) electrons exhibit photon emission or absorption, which occurs deterministically in accordance with precise energy matching. Recoil of the electron off the nucleus and strict conservation of energy and momentum ensure that photon absorption and re-emission obey directional laws analogous to optics. The theory is presented as a response to the inadequacies of spontaneous emission theory in the face of ultra-high-precision technologies such as optical atomic clocks and GHz-range quantum processors.***

Keywords: emission spectra, absorption spectra, photon structure, atomic structure

1. Introduction

The quantum theory of atomic transitions has served physics well, but its probabilistic framework and reliance on spontaneous processes are increasingly at odds with the deterministic precision demanded by modern technology. Devices now routinely operate at frequencies in the multi-GHz range, while optical atomic clocks demonstrate that photons are emitted and absorbed at precisely defined frequencies in the hundreds of terahertz. These observations suggest the need for a new model—one that explains atomic behavior with the rigor of classical causality.

2. Historical and Theoretical Background

The prevailing quantum picture stems from Bohr's model and subsequent wave mechanics, culminating in quantum electrodynamics (QED). Despite its predictive success, QED depends on phenomena like spontaneous emission, quantum jumps, and virtual fluctuations that cannot be explained causally. The Lamb shift, for example, is interpreted as arising from vacuum fluctuations rather than internal mechanisms of the atom. Such models conflict with intuitive and classical notions of conservation and causality.

Core Postulates of AND Theory

Augmented Newtonian Dynamics theory (AND) offers a fundamentally classical and mechanistic view of atomic structure, where electrons are treated as solid particles with definite mass and position. Unlike quantum mechanics, which postulates a wave-particle duality, AND theory asserts that an object with measurable mass—such as the electron—cannot be both a wave and a particle. The electron is, to all intents and purposes, a solid particle, and it behaves as such in all physical interactions.

Electrons occupy defined shells and orbitals around the nucleus, following circular or slightly elliptical paths determined by energy equilibrium. These orbits are stable and geometrically simple, eliminating the need for abstract orbital shapes like dumbbells or petals. Stability in the atom arises from the pairing of electrons within orbitals. Paired (stable) orbitals neither absorb nor emit real photons. Only unpaired or externally excited orbitals engage in energy exchange, and all real energy transfers occur exclusively via photons.

A key mechanism in AND theory is the dynamic process by which an unpaired electron absorbs a photon. This causes an instantaneous transfer of energy that propels the electron inward toward the nucleus. The electron then recoils, obeying the classical law of reflection where the angle of incidence equals the angle of reflection. Upon returning to its original orbital, the electron emits a photon of identical energy in the opposite direction. The recoil from this emission returns the electron to its original position, where it promptly absorbs another photon from the same source. This absorption-emission cycle is repeated at a rate of hundreds of trillions of times per second, maintaining orbital stability.

In addition to real photon exchange, AND theory introduces the role of virtual photons as a mechanism for self-stabilization. These exchanges occur within a universal medium—often equated with dark matter or a virtual photon aether—that permeates all space. Through this medium, electrons continuously adjust their energy without emitting detectable radiation, preserving energy balance across all orbitals.

In rejecting wave-particle duality, probability clouds, and spontaneous wavefunction collapse, AND theory restores a deterministic, physical realism to atomic structure—anchored in causality, conservation laws, and classical geometry.

Bohr Model of the Atom

Niels Bohr developed his atomic model in 1913 by addressing a key mystery in atomic physics: the discrete spectral lines observed in hydrogen, especially the Balmer series. Johann Balmer had empirically found a formula in 1885 that predicted the visible spectral lines of hydrogen with remarkable accuracy:

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{n^2}\right) \quad \text{for } n = 3, 4, 5, \ldots \quad (1)$$

where R is the Rydberg constant. Balmer had no theoretical explanation for why this formula worked — it was a purely mathematical construct.

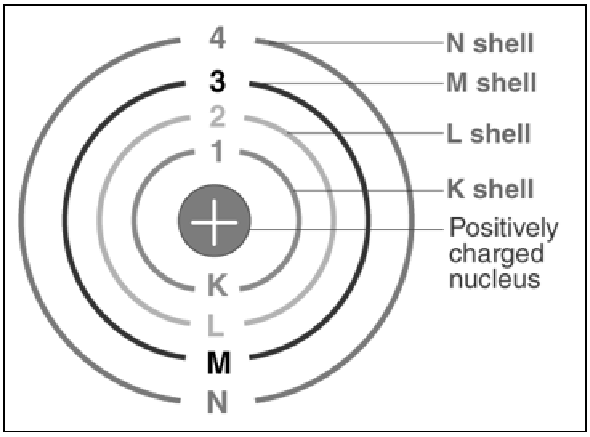

Figure 1: Bohr's model of an atom

Bohr attempted to provide a physical basis for Balmer's empirical formula using early quantum ideas inspired by Planck and Einstein:

1) Quantized Orbits: Bohr postulated that electrons move in circular orbits around the nucleus but only certain discrete orbits are allowed, where the angular momentum is quantized:

$$L = n\hbar = n\frac{h}{2\pi}, \quad n = 1, 2, 3, \ldots \quad (2)$$

2) Energy Levels: Each orbit corresponds to a specific energy level. Using classical mechanics and Coulomb's law, he derived the energy of an electron in the nth orbit of a hydrogen atom:

$$E_n = -\frac{13.6\,\text{eV}}{n^2} \quad (3)$$

3) Photon Emission and Absorption: When an electron jumps from a higher orbit (n_i) to a lower orbit (n_f), it emits a photon with energy equal to the difference between these levels:

$$E_{\text{photon}} = E_{n_i} - E_{n_f} = h\nu \quad (4)$$

4) Link to Balmer's Formula:
Bohr showed that this energy difference translated directly into the Rydberg formula for hydrogen's spectral lines:

$$\frac{1}{\lambda} = R\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) \quad (5)$$

For the Balmer series, $n_f = 2$, which matches Balmer's original formula exactly.

Significance of the Bohr model

Bohr's model was revolutionary because it combined classical mechanics with quantum postulates, explaining the quantized nature of atomic spectra. Although it had limitations—it couldn't explain fine structure, multi-electron atoms, or chemical bonding—it was the first model to explain atomic spectra theoretically and marked the transition from classical to quantum physics. For the next decade Bohr's model of the atom enjoyed tremendous popularity and is in fact still popular today as it presents such a clear picture of the atom, although fundamental and basic to what was to follow.

R∞=1.0973731568508×10^7 m^−1

The Quantum Mechanical Model of the Atom

The Quantum Mechanical Model emerged in the 1920s to replace Bohr's model, which, despite its success with hydrogen, failed to accurately describe more complex atoms and finer experimental details. This new model was based on quantum theory, particularly the wave nature of particles and the uncertainty principle, and it provides what is thought to be a much deeper and more accurate understanding of atomic structure. The Quantum Mechanical Model, developed in the mid-1920s, provided that framework. Rooted in the mathematics of wave mechanics and the principles of quantum theory, it replaced Bohr's concept of fixed electron orbits with a more abstract, probabilistic view of atomic structure. This model fundamentally reshaped our understanding of matter at the microscopic scale.

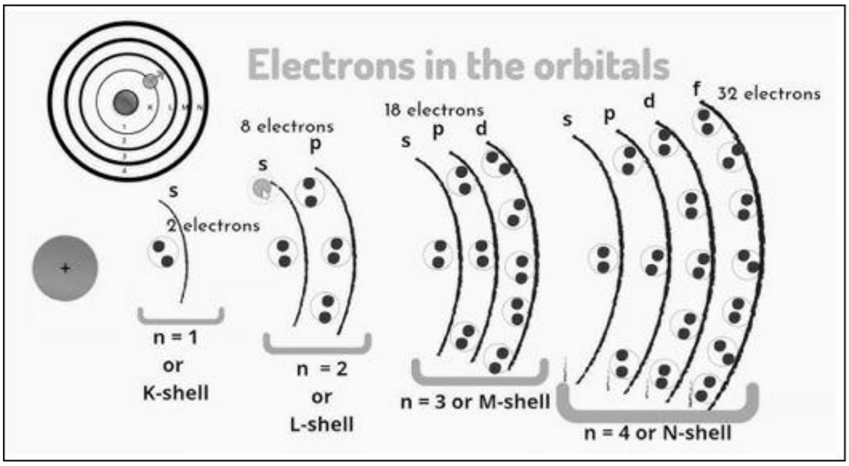

Figure 2: Quantum mechanical model of atom showing sub-shells

A crucial development that led to the quantum mechanical view was the idea of wave-particle duality, introduced by Louis de Broglie in 1924. He proposed that particles such as electrons possess wave-like properties, just as light exhibits both particle and wave behavior. This hypothesis suggested that electrons could not be treated simply as tiny orbiting particles, but as entities whose behavior could be described by wave equations. Building on this concept, Erwin Schrödinger formulated a fundamental equation of quantum mechanics in 1926. His wave equation describes the evolution of a system's wavefunction ψ, which contains all the measurable information about the particle's state. Solving this equation for the hydrogen atom yielded a set of quantized energy levels—just as Bohr had postulated—but without the need for circular orbits. Thus the electron was no longer regarded as a particle orbiting the nucleus but as an abstract wave function that could predict the probability of where in the atom the electron was most likely to be found,

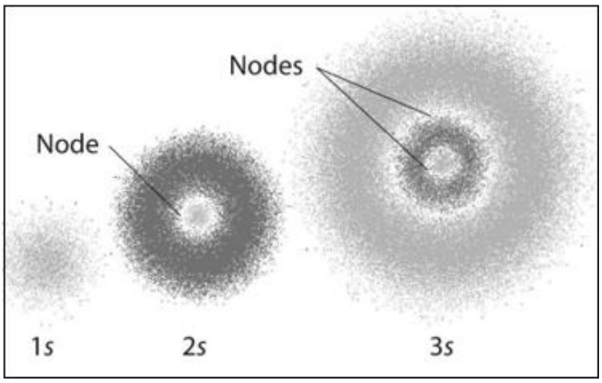

Figure 3: Quantum mechanics description of electrons as electron clouds or wave-functions.

One of the most profound implications of this model is that electrons do not follow defined paths. Instead, they exist in regions of space called orbitals, where the probability of finding the electron is highest. These orbitals arise naturally from the mathematical solutions of Schrödinger's equation and take on distinct shapes—spherical (s), dumbbell-shaped (p), and more complex geometries for higher energy levels. The exact configuration of these orbitals in an atom is governed by a set of quantum numbers that describe the electron's energy, angular momentum, orientation in space, and intrinsic spin. The adoption of this new theory of atomic structure with the electron as a cloud or wave-function, also explained the main objection to Bohr's atomic model which was that an electron as a charged particle moving around the nucleus in an accelerated state should radiate away all of its energy and fall into the nucleus in 10 pico-seconds (Ten trillionths of a second.).

The Heisenberg Uncertainty Principle, introduced in 1927, reinforced this probabilistic view. It states that one cannot simultaneously know both the position and momentum of a particle with arbitrary precision. This principle underscores the fundamental departure of quantum mechanics from classical ideas: the atom is not a miniature solar system, but a dynamic, fuzzy, and probabilistic system where certainty is replaced by likelihood.

The quantum mechanical model successfully explains a wide range of phenomena that the Bohr model could not. It accounts for the fine structure of atomic spectra, the behavior of multi-electron atoms, chemical bonding, and the periodicity observed in the periodic table. It also introduces concepts such as electron spin, the Pauli Exclusion Principle (which states that no two electrons in an atom can share the same set of quantum numbers), and even quantum phenomena like tunneling and entanglement. These features are not just theoretical curiosities; they are essential to the functioning of modern technologies, including semiconductors, lasers, and quantum computers.

Given in this section are a few of the *basic equations* of quantum mechanics (particularly the ones that led to the introduction of subshells and orbitals) in the quantum mechanical model of the atom.

Basic equation of the quantum mechanical model of the atom (Schrodinger's equation).

The foundational equation of the QM model of atomic structure is the time-independent Schrödinger equation:

$$\hat{H}\psi = E\psi \tag{6}$$

For the hydrogen atom, this becomes:

$$-\frac{\hbar^2}{2m_e}\nabla^2\psi(r,\theta,\phi) - \frac{Ze^2}{4\pi\varepsilon_0 r}\psi(r,\theta,\phi) = E\psi(r,\theta,\phi) \tag{7}$$

Where:
- $\psi(r,\theta,\phi)$ is the wavefunction.
- E is the energy of the state.
- $\hbar$ is the reduced Planck's constant.
- m_e is the mass of the electron.
- Z is the nuclear charge.
- e is the elementary charge.
- ε_0 is the vacuum permittivity.

Resulting quantum numbers and sub shells:

Solving Schrödinger's equation in spherical coordinates leads to quantum numbers:
1) Principal quantum number (n): Energy level or shell (n = 1, 2, 3…)
2) Azimuthal quantum number (l): Orbital angular momentum; defines subshells (s, p, d, f, etc.)
$$l=0 \text{ (s)},\ l=1 \text{ (p)},\ l=2 \text{ (d)},\ l=3 \text{ (f)} \tag{8}$$
3) Magnetic quantum number (m_l): Orientation in space, ranging from $-l$ to $+l$
4) Spin quantum number (m_s): Spin orientation $+\frac{1}{2}, -\frac{1}{2}$

Each combination of these defines an orbital, and the Pauli exclusion principle restricts each orbital to two electrons (one with spin up, one down).

In conclusion, the Quantum Mechanical Model of the atom represents a fundamental shift in how we understand the microscopic world. It moved away from the semi-classical orbits of Bohr to a full quantum treatment grounded in mathematics and observation. While more abstract, it claimed to provide a more complete and accurate picture of atomic behavior and remains the foundation upon which modern physics, chemistry, and materials science are built. Through this model, the atom is no longer a simple structure with defined electron paths, but a probabilistic system governed by the elegant yet counterintuitive laws of quantum mechanics.

The Augmented Newtonian Dynamics Model of the Atom

In contrast to the quantum mechanical model of the atom with its dependence on abstract mathematical wave-functions, its multiple dimensional Hilbert spaces and ideas of wave-particle duality and probabilities, augmented Newtonian dynamics offers a return to classical concepts of physics. For instance, AND theory dispenses with the bizarre orbital shapes of the s,p,d, and f orbitals and returns to the concept of simple circular or slightly elliptical orbits. The need for probabilistic wave-functions to determine the electrons position is dispensed with. Apart from that AND theory retains the basic idea behind Bohr's model of the atom with its K, L, M, N, O and P shells while eliminating the quantum leaps and jumps that are so awkward. Similarly, the quantum mechanical model is also not completely dispensed with as the idea of sub-shells and orbital is retained. The fact that there are no quantum leaps and no transitions and no spontaneous emission makes AND theory an extremely sleek and effective theory, allowing for the rapid absorption and emission of photons at the rate of hundreds of trillions per second, which is what our latest knowledge shows must happen. This rapid rate of absorption and transmission mean that rays or lines of identical connected photons are created that explain both the rectilinear nature of light and the fact that light follows the inverse square law. It should be noted that according to AND theory, only optical photons are directly emitted by bound electrons in the atom. Gamma rays are created at the time of the destruction of the nucleus while x-rays are created outside the atom through the acceleration and rapid braking of free electrons.

It should be noted that the AND model of the photon differs fundamentally from the quantum mechanical view, which treats the photon as an excitation of the electromagnetic field. In contrast, AND theory proposes that the photon is generated within the electron itself and serves as the electron's mechanism for mediating its energy. As a charged particle, the electron seeks to preserve its energy integrity, and the photon can thus be regarded as an emergent byproduct of this self-regulation process. When the electron possesses excess energy, it emits a sequence of polarized electrical pulses. The initial pulses are stronger than those that follow, leading to the formation of a stable dipole structure—this stable configuration is what AND theory identifies as the photon. Look at Figure 4 and 5 below:

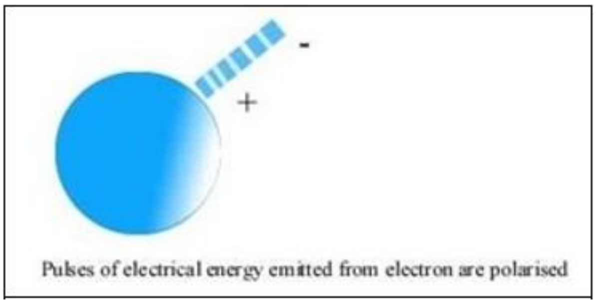

Figure 4: Formation of photon from electrical pulses emitted by the electron

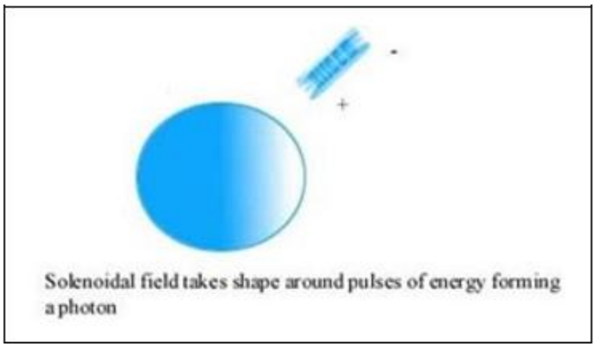

Figure 5: Showing how solenoid field forms around pulses of electric energy giving rise to a stable dipole configuration.

A fully formed photon can be seen in Figure 6 below. It should be noted that photons do not exist in isolation but die to their dipole structure have the ability to link together both linearly and laterally forming connected fields, this process explains both the rectilinear properties of light and explains how photons obey the inverse square law while propagating.

Figure 6: Depiction of what both a real photon and a virtual photon might look like. The only difference is the energy content or the time over which the photon exists before it is absorbed.

This interpretation of the photon's origin significantly narrows the conceptual distance between emission and absorption processes. In contrast to the quantum mechanical view, where photons are field excitations and their interactions with matter are mediated through abstract and often non-local mechanisms, the AND model offers a localized, intrinsic mechanism of photon generation within the electron itself. Because the photon emerges as part of the electron's continuous effort to regulate its own energy, the emission and re-absorption of photons can occur at rates of hundreds of trillions of times per second. This rapid cycling would be highly improbable under the field-excitation model of quantum electrodynamics, but is entirely coherent within the AND framework, which does not require the involvement of an external electromagnetic field to mediate these interactions.

The AND model, photon interactions with the atom follow classical optical rules, it is almost a return to the Bohr model of the atom, because it combines classical mechanics with quantum postulates, explaining the quantized nature of atomic spectra, in a much more sophisticated and detailed manner than any theory has yet achieved.

When a photon is absorbed by an electron, the energy and angle at which it strikes determine the resulting energy transfer, the direction of reflection, and the displacement of the re-emitted photon. Upon absorbing this energy, the electron is propelled toward the atomic nucleus, which, due to its mass being approximately 2000 times greater than that of the electron, effectively acts as an immovable, smooth, and flat surface. As a result, the electron's interaction with the nucleus obeys classical laws of reflection, with the angle of incidence equaling the angle of reflection.

Importantly, the absorbed photon is not destroyed in this process. Instead, once energy equilibrium is re-established within the system, the photon is re-emitted. This emission occurs in a direction that mirrors the original path of the incoming photon, thereby preserving the directional characteristics of the absorbed radiation and ensuring that linear momentum is conserved throughout the interaction.

Spectral Line Formation

Unlike quantum theory, which interprets spectral lines as transitions between probability clouds, AND theory describes them as the deterministic consequence of energy interactions in atomic subshells with odd electron configurations. Because only exact energy matches lead to absorption, spectral lines remain discrete. Orbitals that are fully paired remain inert, contributing no transitions. This ensures sharp, well-defined lines rather than a continuous spectrum, matching observed data.

Table: Comparison of Electron Capacity per Shell in Bohr's Model and Quantum Mechanics

Principal Quantum Number (n)	Subshells (QM)	Maximum Electrons (QM)	Bohr Model Capacity
1	1s	2	2
2	2s, 2p	8	8
3	3s, 3p, 3d	18	18
4	4s, 4p, 4d, 4f	32	32

Comparison with Modern Experimental Technology

Modern optical atomic clocks achieve timing stability at the level of 1 part in 10^18, based on atoms transitioning at hundreds of terahertz. Therefore, optical atomic clocks depend on direct resonance response between the radiating optical frequency and the emission optical frequency to determine accurate time. These systems would not function if spontaneous, probabilistic emission were the governing mechanism. Similarly, semiconductors and quantum circuits operating at GHz frequencies rely on precise, deterministic photon exchange. The AND model naturally aligns with these requirements, while quantum theory must invoke statistical interpretations and averaging.

Advantages Over Quantum Mechanics

The proposed new atomic structure model offers several significant advantages over traditional quantum mechanics. Unlike quantum theory, which relies on spontaneous, uncaused events such as wavefunction collapse, this framework preserves a fully deterministic and mechanistic interpretation of physical phenomena. It maintains strict adherence to the conservation of energy and momentum at all stages, thereby avoiding the conceptual ambiguities often associated with quantum transitions. Spectral lines are explained not as probabilistic outcomes but as direct consequences of electron behavior, particularly through the influence of orbital parity on emission and absorption processes. Furthermore, the model introduces a coherent mechanism for self-stabilization of electrons through interactions with virtual photons, offering a physically intuitive alternative to abstract quantum principles. In doing so, it circumvents the metaphysical implications of the wave-particle duality and wavefunction collapse and provides a more grounded understanding of atomic dynamics.

Absorption and emission spectra according to quantum mechanics:

According to the quantum mechanical or Standard model of physics absorption spectra are formed as follows: To determine the absorption spectrum of a substance, scientists use a setup that measures how much light is absorbed by a sample at various wavelengths. The basic arrangement consists of a broadband light source, a monochromator or diffraction grating, a sample holder, and a detector connected to a display or data logger.

The process begins with the light source—usually a tungsten lamp for visible light—emitting continuous radiation covering a wide range of wavelengths. (Continuous spectrum) The selected beam then passes through the sample, which is typically in a transparent container such as a quartz or glass cuvette. As the beam passes through the sample, specific wavelengths are absorbed by the atoms or molecules, promoting electrons from lower to higher energy states.

This spectrum displays characteristic dark bands or lines corresponding to energies absorbed by the substance, revealing important information about its electronic structure. The quantum mechanics explanation for these dark lines in the composite spectrum is that the absorption spectrum arises when electrons in atoms or molecules absorb photons of specific energies, causing them to transition from lower to higher quantized energy levels. Each dark line in the spectrum corresponds to a photon whose energy matches the energy difference between these discrete levels.

The Augmented Newtonian Dynamics theory explanation for absorption spectra:

The AND theory of absorption spectra is as follows. The atoms of each element govern, with strict precision, the specific energies that their bound electrons can absorb. This is due to the quantized nature of the electron energy states within the atom. Thus when a sample is placed in a transparent glass container and irradiated with light from a tungsten lamp, only the electrons that are free to absorb specific radiation undergo excitation, this results in the rest of the composite spectrum passing through the sample without any interaction taking place and this can be seen on the screen. But what happens to the wave-lengths that are absorbed by the excited atoms? Do they stay in the electron or are they later emitted? The answer according to AND theory is that photon emissions and absorptions are both instant and highly directional and are governed by the classical laws of reflection where, angle of reflection equals angle of incidence. In this particular case the concerned

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electrons absorb the photons but because they emit them directly back at the source, only black lines are seen on the screen behind the sample. The prediction of AND theory is that if a screen is set up in front of the sample, the lines which appear black on the screen behind the sample will show up in colour on the screen in front of the sample.

The quantum mechanics explanation for emission spectra:
The emission spectrum of a substance is observed by measuring the light it emits after being excited by an external energy source. The typical experimental setup includes an excitation source, a sample holder, a dispersive element such as a diffraction grating or prism, and a detector.

The process begins with the excitation of the sample. This can be done by heating the substance in a flame (flame test), passing an electric current through it (discharge tube), or using a laser or UV lamp. The excitation adds energy to the atoms or molecules, causing their electrons to jump to higher energy levels. When these electrons fall back to lower energy states, they release the excess energy as photons of specific wavelengths.

The emitted light is collected and passed through a spectroscope or monochromator, which separates the light into its component wavelengths. The resulting spectrum is captured by a detector, which may be connected to a computer or photographic plate for recording and analysis.

The final emission spectrum appears as a series of bright lines or bands on a dark background. Each line corresponds to a specific transition between energy levels and is characteristic of the emitting substance. This makes emission spectroscopy a powerful tool in both qualitative and quantitative analysis, as it allows for the identification of elements and compounds based on their unique spectral fingerprints.

The Augmented Newtonian Dynamics theory explanation for emission spectra:
According to Augmented Newtonian Dynamics theory the explanation for emission spectra is as follows. The rule allowing only specific absorption and emission in any given substance is strictly followed. Therefore, when the sample is heated, only those electrons that are accessible get excited, the rest of the electrons remain quiescent and do not emit even if an excitation force is available. This explains the emission spectra shown on the screen, only allowed excited states of the electron (when considering the Hydrogen atom) appear on the screen since the application of heat to the sample is continuous all the spectral lines of hydrogen are displayed but the rest of the continuous spectrum disappears from the screen. The difference between AND theory and quantum mechanics is that unlike in quantum mechanics, emission is instant (within 10^{-14} s) and ordered, not spontaneous or delayed and undefined.

3. Conclusion

AND theory offers a deterministic, conservation-based alternative to quantum models of atomic structure. By redefining the emission and absorption of photons as physically causal events grounded in orbital energy dynamics, this theory removes the need for quantum jumps and probabilistic transitions. In doing so, it aligns theoretical physics with the demands and realities of modern precision technology.

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