Hydrogen Spectrum and New Atomic Model

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Abstract

The light emitted from the hydrogen atoms in the Geissler tube is observed as a discrete line spectrum. In order to elucidate such a luminescence mechanism, I devised a new atomic model and adjusted it to fit with the theoretical system (relational physics) that I had previously established. The results are presented in the form of concrete calculations, which are in agreement with the observed data. Through this process, I discovered new phenomena in the microscopic world, such as Object Elasticity and Superluminal Rotation. This will lead to various academic developments and technological applications in the future.

Keywords: Balmer Series; Transition; Electron Elasticity; Superluminal Phenomenon; Equivalence of Pulse and Rotation; Determinism

Introduction

As the era entered the 20th century, scientists opened the door to the exploration of the microscopic world and acquired powerful tools to understand the behavior of objects from their very roots. It blossomed as quantum mechanics, a new methodology distinct from classical physics. The beginning was the observation of the strange spectral lines originating from hydrogen gas in Geissler tubes, along with the discovery of the emission law for black-body radiation. The four discrete lines in the visible light region, red, green, blue, and violet, were named the Balmer series [1] after the discoverer (Figure 1).

Figure 1: Each Spectral Line in the Balmer Series

While a solar spectrum world have a continuous distribution of all wavelengths of light, this was not the case for the hydrogen spectrum. Neils Bohr was inspired by this and built his own atomic model. The idea of a transition, in which an electron orbiting around a nucleus (proton) instantly jumps to another orbit when it receives energy from an external source and emits light on its return, remains a breakthrough that continues to fascinate researchers almost 100 years after its birth.
This time, my relational physics challenged the work of this giant head-on.
It is the most universal system of study among all the theories ever created by mankind, covering all domains from the macro world to the micro world. Its most distinctive feature is that it is based on the theory of remoteness and sees the relationship between objects as a force or energy. I have expressed this idea using a simple mathematical formula. In this paper, through its operation, I would like to discuss how microscopic objects (electrons) behave based on their essence, and in turn, what atomic structures can be deduced from them.

Methodology

Hydrogen spectral lines are spectroscopic lines of light emitted from hydrogen gas enclosed in a glass tube when a voltage is applied from outside the tube. The secret as to why the spectra are scattered seems to lie in the structure of hydrogen atoms. In particular, the behavior of electrons in the atomic structure seems to be related to the luminescence mechanism. In this respect, hydrogen luminescence and ionization are thought to have something in common. An accurate description of the ionization energy of hydrogen atoms has been obtained in my past research [2]. By applying the mechanism there, it should be possible to explain the principle of discrete hydrogen luminescence.
Now, let us explore them through calculations. Under my relational physics, gravity and electromagnetic forces are already unified, but I will use both models in my calculations here. They are given in the form of the following variant equations.

$$E = k_{\mathrm{a}} \frac{L}{(l_1 - l_2)\mathrm{c}^2} \ [\mathrm{J}] \qquad \text{—(1)}$$

$$E = k_{\mathrm{b}} \frac{\pi (l_1 - l_2)^2 L}{n\left(\dfrac{\pi (l_1 - l_2)^3 \mathrm{c}^2}{\mathrm{J}n}\right)} \ [\mathrm{J}] \qquad \text{—(2)}$$

(1) is the electromagnetic force deformation formula and (2) is the gravity deformation formula. In the equation, E represents ionization energy, k_{a} represents the Electromagnetic Force

Exponent Variable (value here is 1, unit is [$\mathrm{kg \cdot m^4 \cdot s^{-4}}$]), k_b represents the Gravity Exponent Variable (value here is 10^{-13}, unit is [$\mathrm{kg^2 \cdot m^{-1} \cdot s^{-2}}$]), L represents the energy foundation range, c represents light speed, n represents the number of parties, J is the Junichi Constant (value is 10^{13}, unit is Sakura [Skr = $\mathrm{kg^{-1} \cdot m^5 \cdot s^{-2}}$]), l_1 is the radius of the hydrogen atom (3.90206×10^{-11} [m]), and l_2 is the Electron Disappearance Width (here for one whole electron).
Now, let us calculate the ionization energy of a hydrogen atom by substituting each value in the order of (1) and (2) (for details, please refer to my previous papers).

$$
\begin{aligned}
E &= k_{\mathrm{a}} \frac{L}{(l_1 - l_2)\mathrm{c}^2} \\
&= \frac{1[\mathrm{kg \cdot m^4 \cdot s^{-4}}] \times (6.3716 \times 10^{-12})[\mathrm{m}]}{\{(3.90206 \times 10^{-11})[\mathrm{m}] - (6.3716 \times 10^{-12})[\mathrm{m}]\} \times 299792458^2 [\mathrm{m^2 \cdot s^{-2}}]} \\
&= 2.1713869 \times 10^{-18}\ [\mathrm{J}] \\
&= 13.5527\ [\mathrm{eV}]
\end{aligned}
$$

$$
\begin{aligned}
E &= k_{\mathrm{b}} \frac{\pi (l_1 - l_2)^2 L}{n \left(\dfrac{\pi (l_1 - l_2)^3 \mathrm{c}^2}{\mathrm{J} n} \right)} \\
&= \frac{10^{-13}[\mathrm{kg^2 \cdot m^{-1} \cdot s^{-2}}] \times 3.14 \times \{(3.90206 \times 10^{-11})[\mathrm{m}] - (6.3716 \times 10^{-12})[\mathrm{m}]\}^2 \times (6.3716 \times 10^{-12})[\mathrm{m}]}{1 \times \left(\dfrac{3.14 \times \{(3.90206 \times 10^{-11})[\mathrm{m}] - (6.3716 \times 10^{-12})[\mathrm{m}]\}^3 \times 299792458^2 [\mathrm{m^2 \cdot s^{-2}}]}{10^{13}[\mathrm{kg^{-1} \cdot m^5 \cdot s^{-2}}]} \right)} \\
&= \frac{2.13264181 \times 10^{-45} [\mathrm{kg^2 \cdot m^2 \cdot s^{-2}}]}{9.82156524 \times 10^{-28} [\mathrm{kg}]} \\
&= 2.1713869 \times 10^{-18}\ [\mathrm{J}] \\
&= 13.5527\ [\mathrm{eV}]
\end{aligned}
$$

Thus, the same values were obtained for both models. The computational process here well explains the phenomenon of ionization. This is because, especially in equation (2), we can see that the loss of size of one electron leads to a reduction in the size and mass of the entire hydrogen atom, which in turn leads to the release of energy. Given this, it appears that "Electron Size Change" is a major key point of the emission principle. In the phenomenon of ionization, it seems to be a phenomenon of change from the size of one electron to the size of zero electrons. If it results in luminescence, then the same computational model should be applicable to the energy of light in each spectral series, including the Balmer series. I will discuss this in more detail later.
Let us now derive the energy value of each light from the wavelength of each spectral line in the Balmer series. The model used in the calculations will follow the conventional theory (E = hc/ λ [J]). Let us present the process in the following order.

(1) H α Line (Red, λ = 6.563 × 10^{-7} [m])

$$E = \frac{(6.626\times10^{-34})[\mathrm{N\cdot m\cdot s}]\times 299792458[\mathrm{m\cdot s^{-1}}]}{(6.563\times10^{-7})[\mathrm{m}]}$$
$$= 3.0267025\times10^{-19}\ [\mathrm{J}]$$

(2) H β Line (Green, λ = 4.861 × 10^{-7} [m])

$$E = \frac{(6.626\times10^{-34})[\mathrm{N\cdot m\cdot s}]\times 299792458[\mathrm{m\cdot s^{-1}}]}{(4.861\times10^{-7})[\mathrm{m}]}$$
$$= 4.0864531\times10^{-19}\ [\mathrm{J}]$$

(3) Hɤ Line (Blue, λ = 4.34 × 10^{-7} [m])

$$E = \frac{(6.626\times10^{-34})[\mathrm{N\cdot m\cdot s}]\times 299792458[\mathrm{m\cdot s^{-1}}]}{(4.34\times10^{-7})[\mathrm{m}]}$$
$$= 4.5770157\times10^{-19}\ [\mathrm{J}]$$

(4) H δ Line (Purple, λ = 4.102 × 10^{-7} [m])

$$E = \frac{(6.626\times10^{-34})[\mathrm{N\cdot m\cdot s}]\times 299792458[\mathrm{m\cdot s^{-1}}]}{(4.102\times10^{-7})[\mathrm{m}]}$$
$$= 4.8425764\times10^{-19}\ [\mathrm{J}]$$

These are the energy values for each visible ray in the Balmer series.
Next, let us summarize each change in electron size (loss width) derived from these values using equation (2) as a table (Table 1).

	Spectral Lines	Electron Size Loss Width
(1)	H α Line (Red)	$l_2 = 1.0333536\times10^{-12}[\mathrm{m}]$
(2)	H β Line (Green)	$l_2 = 1.38234795\times10^{-12}[\mathrm{m}]$
(3)	H γ Line (Blue)	$l_2 = 1.54173673\times10^{-12}[\mathrm{m}]$
(4)	H δ Line (Purple)	$l_2 = 1.6274582\times10^{-12}[\mathrm{m}]$

Table 1: Electron Size Change Ranges

These are the Electron Size Change Ranges that are the basis for producing the visible light corresponding to each spectral line in the Balmer series. Although much smaller than the Electron Size Change (6.3716 × 10^{-12} [m]) that produced the ionizing radiation, they all share a common feature in that size reduction is what causes the emission. Let us illustrate this with a simple schematic diagram (Figure 2).

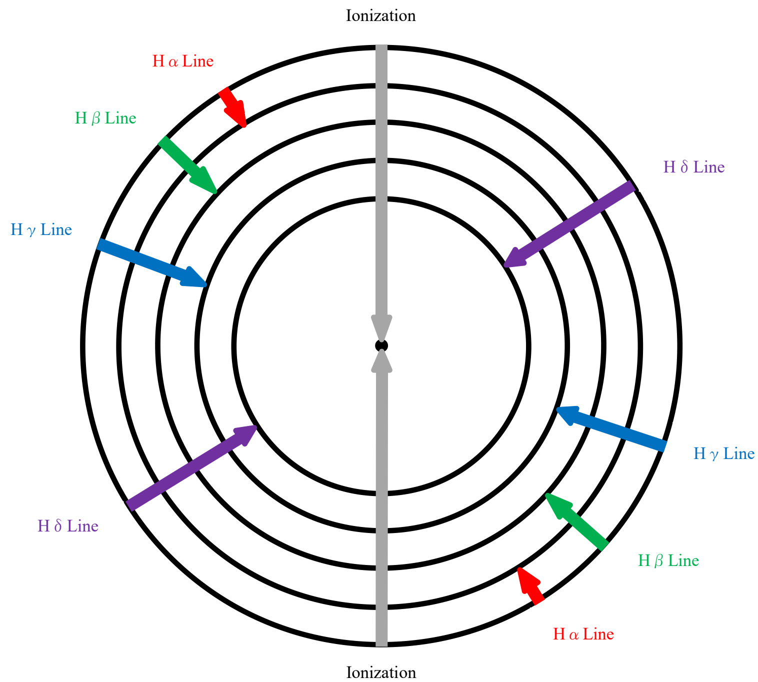

Figure 2: Electron Size Change Width

As you can see, when a voltage is applied from outside the Geissler tube, the electrons shrink and their disappearance is converted into energy, which is emitted out of the atom. In the next section, I will take a deeper look at the microscopic reality that contains electrons.

Discussion

Bohr's atomic model used the theory of transitions between multiple orbitals to explain the discrete nature of hydrogen spectral line. On the other hand, a closer look at my relational physics-based calculation process reveals that only a simple change in the size of the electrons is involved in the emission. In other words, the electrons do not undergo transitions, but instead undergo stretching and contracting motions. When the electrons are stable in a strong relationship with the protons, they rotate as well as revolve, but when they become unstable due to an external voltage, they change the form of their motion from spinning to stretching. Why is this so? Relational physics states that when two objects face each other and show their "faces" and "backs" to each other at high speed while rotating, they establish a "relationship" and generate energy. This means that in order to form a deep bond with a particular partner, they must show each other "everything", and to do so, they must rotate along their own axis of rotation and show each other both the front and back sides of their bodies. If this is the case, then if the stable relationship between partners is disrupted by a third party force from the outside, the significance of the high-speed spinning motion is lost, and the partners should shift to a different form of motion. Conversely, if the object is to form a shallow relationship in all directions with

an unspecified number of partners, it will be obliged to use the complex kinematic expression of expansion and contraction.
In short, when they establish a deep relationship with a specific partner, the object rotates, and when they establish a shallow relationship with an unspecified number of partners, the object expands and contracts. I coined the term “Object Elasticity”. In this case, it is the electrons that are doing the stretching and shrinking, so it could also be called “Electron Elasticity”. The discrete luminescence mechanism of hydrogen atoms is exactly supported by the Electron Elasticity. Only by doing so, light is emitted. There is no transition. The electron has only one orbital, not many orbits, in the case of the hydrogen atom. The electron orbits only one circular orbit, expanding and contracting, from which it emits electromagnetic waves corresponding to all spectral lines, including the Balmer and Lyman series. That is the difference between the new atomic model derived from my relational physics and the Bohr model. The two equations above tell us that.
Nevertheless, you may wonder why I have also introduced equation (2), when only equation (1) is sufficient to explain the “Electron Size Change” theory. There is a good reason for that.
The denominator of the right-hand side in equation (2) is the term for the mass of the object. The mass value is obtained by substituting each value including the light energy and the Electron Size Change Width corresponding to each spectral line in the Balmer series. Let us summarize them in the form of a list (Table 2).

	Spectral Lines	**Hydrogen Atom Mass**
(1)	H α Line (Red)	$m = 1.54697927 \times 10^{-27}$[kg]
(2)	H β Line (Green)	$m = 1.50473282 \times 10^{-27}$[kg]
(3)	H γ Line (Blue)	$m = 1.48569713 \times 10^{-27}$[kg]
(4)	H δ Line (Purple)	$m = 1.47552619 \times 10^{-27}$[kg]

Table 2: Mass Changes of Hydrogen Atoms

The mass of a hydrogen atom is 1.674×10^{-27} [kg] [3]. As you can see from the table, the mass is smaller than it should be. After emitting light, the hydrogen atom has lost mass. This is truly a “Mass Contraction” phenomenon. In order for you to know this, I have also added equation (2) as an explanatory material.
I would also like to add that for equation (2), there is a limit of application that is logically derived from the mechanism of “Electron Elasticity”. This new concept has the limitation that it cannot have a vanishing width that exceeds its diameter value (6.3716×10^{-12} [m]) due to the nature of an object with a finite size, the electron. In other words, the electron cannot shrink indefinitely, and it reaches its limit when it reaches the loss width of one whole unit. Therefore, hydrogen atoms normally cannot emit light with an energy value exceeding the ionizing radiation, which corresponds to the fact that hydrogen atoms cannot emit light exceeding the electromagnetic wave with the maximum energy in the ultraviolet region (Lyman limit) [4]. This is why the ionization energy values is equal to the Lyman Limit.
That is not all that equation (2) teaches us. It is the fact that the immediate transfer of information (non-locality principle) occurs in the emission process as if it were quantum entanglement.

As we have seen above, Electron Size Change (Electron Contraction) gives rise to various physical phenomena. In this regard, the discrete nature of hydrogen emission can ultimately be explained by a combination of Electron Contraction and proton rotation. I have already mentioned that in order for the relationship to be established between the objects, they must rotate. By doing so, each other's "face" and "back" are repeatedly shown to each other in turn, and when the "face" and "face" face each other, the relationship is "connected", and when the "back" and "back" face each other, the relationship is "unconnected". In other words, the fact that the proton rotates on its own axis means that it is not always in a relationship with its partner electrons, but that there are times when a "relational vacuum" (disconnected state) is created. Thus, even if Electron Contraction, another condition for luminescence, is in progress, if the proton turns its "back" and a "relational vacuum" is created, no energy will be produced. On the other hand, if the proton is facing "face" and the Electron Contraction is also occurring, the relationship is concluded and energy is generated, which means that light will be emitted. In this way, light is emitted or not, creating a sporadic state. This is the mechanism of the discontinuity exhibited by the hydrogen spectral line. From the standpoint of relational physics, this is a logical necessity.
Finally, let us consider why there are difference in color and energy in the various types of light corresponding to hydrogen spectral lines. In exploring this, it is useful to operationalize my pulse equation in relational physics. It is a relational equation between the energy of light and the pulse interval, which, when transformed into a form suitable for this application, gives the following equation.

$$t = \sqrt{\frac{4En_{\mathrm{c}}^2\pi^2(l_1 - l_2)^3}{k_{\mathrm{a}}L}}\ [\mathrm{s}] \qquad \text{—(3)}$$

t is the pulse interval, E is the light energy, n_{c} is the number of rotations, l_1 is the radius of the hydrogen atom, l_2 is the Electron Size Loss Width (Contraction Width), k_{a} is the Electromagnetic Force Exponent Variable (here the value is 1), and L is the light energy foundation range. The values to be substituted into the equation are those already know. Now, let us substitute the data for each visible ray in the Balmer series and perform the calculation. The values are given through the following processes.

(1) Red Light (H α Line)

$$t = \sqrt{\frac{4\times(3.0267025\times10^{-19})[\mathrm{J}]\times1^2\times3.14^2\times\{(3.90206\times10^{-11})[\mathrm{m}]-(1.0333536\times10^{-12})[\mathrm{m}]\}^3}{1[\mathrm{kg}\cdot\mathrm{m}^4\cdot\mathrm{s}^{-4}]\times(1.0333536\times10^{-12})[\mathrm{m}]}}$$
$$= 7.95750195\times10^{-19}\,[\mathrm{s}]$$

(2) Green Light (H β Line)

$$t = \sqrt{\frac{4\times(4.0864531\times10^{-19})[\mathrm{J}]\times1^2\times3.14^2\times\{(3.90206\times10^{-11})[\mathrm{m}]-(1.38234795\times10^{-12})[\mathrm{m}]\}^3}{1[\mathrm{kg}\cdot\mathrm{m}^4\cdot\mathrm{s}^{-4}]\times(1.38234795\times10^{-12})[\mathrm{m}]}}$$
$$= 7.88439522\times10^{-19}\,[\mathrm{s}]$$

(3) Blue Light (H γ Line)

$$t = \sqrt{\frac{4\times(4.5770157\times10^{-19})[\mathrm{J}]\times1^2\times3.14^2\times\{(3.90206\times10^{-11})[\mathrm{m}]-(1.54173673\times10^{-12})[\mathrm{m}]\}^3}{1[\mathrm{kg}\cdot\mathrm{m}^4\cdot\mathrm{s}^{-4}]\times(1.54173673\times10^{-12})[\mathrm{m}]}}$$
$$= 7.85100675\times10^{-19}\,[\mathrm{s}]$$

(4) Purple Light (H δ Line)

$$t = \sqrt{\frac{4\times(4.8425764\times10^{-19})[\mathrm{J}]\times1^2\times3.14^2\times\{(3.90206\times10^{-11})[\mathrm{m}]-(1.6274582\times10^{-12})[\mathrm{m}]\}^3}{1[\mathrm{kg}\cdot\mathrm{m}^4\cdot\mathrm{s}^{-4}]\times(1.6274582\times10^{-12})[\mathrm{m}]}}$$
$$= 7.83304998\times10^{-19}\,[\mathrm{s}]$$

The above solutions were obtained. What exactly do those values mean? Relation physics states that an object rotating and an object emitting a pulse are synonymous in value (equivalence of pulse and rotation). On that basis, let us compare the pulse interval value of a hydrogen atom with each of the above values. There are two ways to determine the pulse interval value of a hydrogen atom. One is to calculate it using the pulse equation, and the other is to derive it by dividing the circumference length ($2\pi l = 2.4504937\times10^{-10}$ [m]) by the rotation speed ($v = 299792458$ [$\mathrm{m}\cdot\mathrm{s}^{-1}$]), but in any case it is $t = 8.17397\times10^{-19}$ [s]. Then, what do we see? As a premise, it is easy to assume that the difference in the color of the light in (1) through (4) is caused by the difference in the pulse interval value. However, what we notice here is that the pulse interval value at the time of emission (Electron Contraction) is slightly smaller than the pulse interval value at the steady state of the hydrogen atom. In other words, the rotation speed of the hydrogen atom (electron orbital speed) at steady state is equal to the speed of light, but the electron orbital speed at luminescence exceeds it. From the equivalence of pulse and rotation, the fact that the pulse interval value is smaller than that of a normal hydrogen atom means that the electron orbit is superluminal.

In a world full of light, the superluminal motion of electrons is a very common phenomenon since the aforementioned mechanism has been recognized.

Results

In order to investigate the mystery of the strange light traces emitted by hydrogen atoms, I devised a new atomic model based on relational physics, which I founded myself. This model has made it possible to explain the discontinuity of hydrogen spectral lines in a simple and understandable way. The new explanatory principle of "Electron Elasticity" which has an inevitable limit of application imposed by the nature of finite objects, is related to the fact that the luminous energy value that can be produced there is equal to the energy value of the ultraviolet radiation corresponding to the Lyman limit. This emphasized the fact that my newly created atomic model is a very faithful representation of the reality of nature. Furthermore, I used the pulse equation in the relational physics to calculate the pulse interval values of the four Balmer series lights, and theoretically found the superluminal phenomenon of electron orbits.

Conclusion

The atomic structure operates within the same framework as the classical solar system model, in which the hydrogen atom and its inner protons and electrons all have a definite substance as particles and behave according to the law of causality. In this paper, the behavior of matter and energy in such a microscopic world is clarified deterministically through an original, new computational method. This fact tells us that it is in principle possible for humans to determine the fate of objects using scientific methods. In the future, I intend to extend this method to many-electron atoms to further increase the usefulness of my theory.

References

1. Shoichiro. K (2021) Quantum Theory. SHOKABO Co., Ltd. 12.
2. Junichi. H (2022) Theory of Everything. Journal of Innovations in Energy science. 2, 15-17.
3. David W. B (2004) Physical Chemistry 2nd. ed. Kagaku-Doujin Publishing. 416.
4. Fumiko. Y (2015) Encyclopedia of Physical Laws Read by Person. Asakura Publishing Co., Ltd. 427.