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Characteristics of Spin of a Particle in Hydrogen

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Abstract

We report the hydrogen-based nuclear magnetic resonance (H-NMR), super quantum interference device (SUQUID) and electromagnetic field associating with spin which is a tiny device. Although spin has described in an angular momentum in quantum physics, the methods have not been established to detect a spin directly. So, we employ the HNMR and SUQUID in order to identify magnetization of the material. As one of examples of water, we introduce the difference of water every location. Furthermore, we explain nuclear transformation of radioactive cesium with spin. On the other hand, we discuss the interesting device of an electromagnetic field to engage placer gold and paramagnetic aluminum (insulator) in the resin as one of the medical treatments in the future. We estimate the system to discuss with spin.

Introduction

Theme seems to be very classic and basic subject. Namely, atomic nucleus of hydrogen atom itself is the most abundant in universe and basic element constituting our daily life substance such as water and organic compounds. H. Cavendish firstly recognized that hydrogen gas was a discrete substance [1, 2], and that it produced water when burned, the property for which it was later named: hydrogen means "water-former" in Greek [3]. If we look at hydrogen (molecule), there are many applications, particularly people in recent world wants to study the new energy source to use hydrogen gases. In industrial production level, they produce steam from natural gas, oil reforming, or coal gasification [4, 5], and electrolysis of water has also been popular. The production of hydrogen gas is not our subject here. So, we focus on the inside of hydrogen atom, not the molecule. Moreover, we do not report particle physics themselves such as leptons or quarks, namely hadrons bound with strong interaction are not our theme.

The most common isotope of hydrogen has one proton, one electron, and no neutron.

Therefore, our main item is to discuss "reciprocity" between proton and electron. In such a case, we notice spin of the particles. However, spin itself seems to be fuzzy. For instances, orbital angular momentum operator is the quantum mechanical counterpart to the classical angular momentum of orbital evolution, and discussed with its wavefunction [6, 7]. For photons, spin is the quantum-mechanical counterpart of the polarization of light, but there is not the spin for electron. The polarization is a property of transverse waves which specifies the geometrical orientation of the oscillation [8, 9]. We reported that infoton may oscillate and emit far-infrared and terahertz, besides nuclear transformation of cesium with spin [10, 11].

We report the novel findings related to spin in pico-sized water particle with nuclear magnetic resonance, super quantum interference device, and magnetic resonance imaging. Besides them, we introduce new device of paramagnetic metal (aluminum) and iron sand in the resin, which may be become an instrument of weak electric field and magnetic field.

Methods

We use water dissociated hydrogen bonds with pressure more than 100 MPa, in which we assume an elementary particle like-proton and electron pair. This particle exists neither hydrogen atom nor ions like separated proton and electron. The pico-sized particle functions chemical reduction and nuclear change. We cannot observe the particle with electron microscope etc. So, the instruments are hydrogen-nuclear magnetic resonance (H-NMR), super quantum interference device (SQUID) for indirect analysis of the water characteristics. The analysis are based on the concept related to spin in a substance, although we cannot look at spin itself. At the same time, we employ magnetic resonance imaging (MRI) which commonly used for medical treatments of human body to regard the hydrogen associating with spin.

Results and Discussion

General aspects

We focus on spin of proton and electron in hydrogen atom. The existence of electron spin angular momentum is inferred such as the Stern-Gerlach experiment, in which they used silver atoms move through magnetic field [7]. The existence of the electron spin can also be inferred theoretically from the Pauli exclusion principle. Spin is described mathematically as a tensor and a spinor field for some particles such as photons and electrons. On the other hand, W. Dittrich reported "On the Pauli-Weisskopf Anti-Dirac Paper" to formulate a quantum field theory of spinless particles [12], and he emphasized that Dirac's quantum field theory (for scalar or spinor particles) was obsolete.

We must discuss the basic physics in the applicable engineering, electric cable, computer tomography, linear motor car etc [13]. Furthermore, the magnetism has not been clear in view points of human health. So, the magnetic power limits up to 3 teslas with CT scanner for a whole body. In practice, spin is given as a dimensionless spin quantum number by dividing the spin angular momentum by the reduced Plank constant ħ, which has the same dimensions as angular momentum, although this is not the full computation of this value.

Nuclear magnetic resonance (NMR) spectra

We use H-NMR spectra to research water, which possesses dissociated hydrogen bonds. Firstly, the H-NMR is based on comparison of the time that a particle may end to resonate with a standard hydrogen in heavy water. We elucidate the time of free induction decay as shown in Fig. 1.

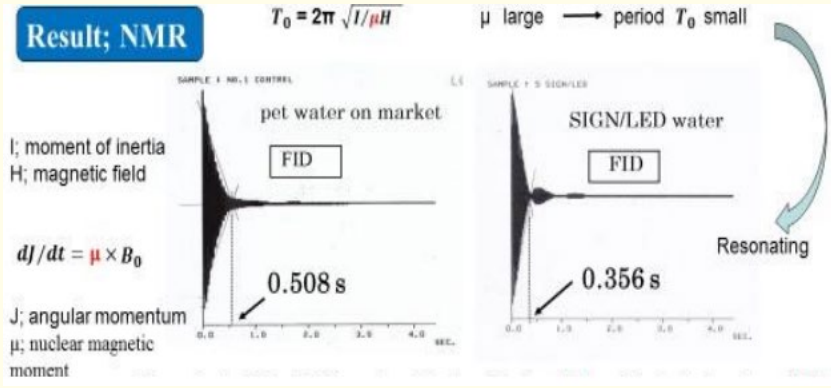


Figure 1: Free Induction Decay spectra in H-Nuclear Magnetic Resonance (H-NMR). Left; pet water on market and right depicts the water emitted with SIGN LED light. The abscissa describes time from 0 to 4 seconds.

Meaning of FID: the rotation (spin) of hydrogen atom compares the time resonating (second) with the standard hydrogen (heavy water). Therefore, smaller particle is, FID is smaller, namely; smaller particle is easily to resonate with the neighbours.

Let's look at qualitatively; the following describes,

$$I\beta = N. \quad (1)$$

Where I; moment of inertia ($kg \cdot m^3$), β; angular velocity (rad/s^2), N; outside force (Newton). If N is a constant, I means the force to continue the state will decrease since the velocity (β) is faster, and a particle is smaller. So, FID will be smaller.

Second spectra is to compare a time relaxation between one collision to next collision as shown in Figure 2.

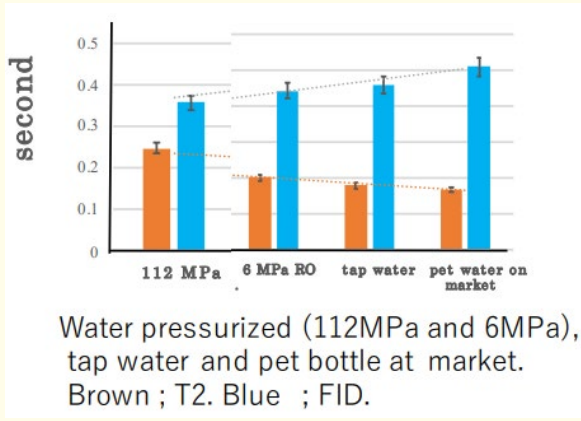


Figure 2: Relaxation time in H-Nuclear Magnetic Resonance (H-NMR). The bars moving to the left depicts smaller particle of water.

T2 describes the time to a particle collides with a next one. Therefore, smaller particle is, T2 is larger. The bars moving to the left depicts smaller particle of water.

The spectra is not absolute value, so it is necessary to compare with a tap water or deionized water meaning relative values. Both spectra involves spin in hydrogen atom of infoton, $<H^+ \sim e^->$ in our case.

Proton, H^+, no neutron in hydrogen atom.

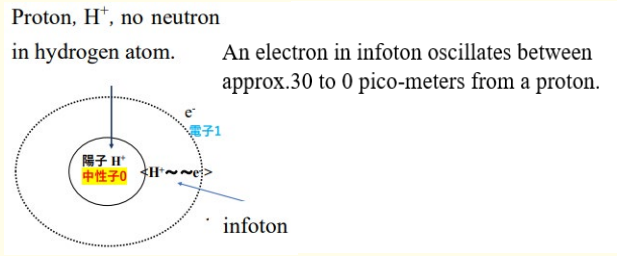


Figure 3: Common hydrogen atom model.

A tritium is one of the isotopes of hydrogen, its nucleus contains two neutrons besides a proton, written in $^{3}H_{1}$.

Water depending on the location

There are another evidence showing a difference of water depending on near place to volcano (Table 1).

Water	*T2*	*FID*	*FID/T2*	*index*
Tap water	0.272	0. 19	2.27	1
Zaiho	0.295	0.528	1.79	0.78
Kirishima	0.322	0.554	1.72	0.75
MICA	0.322	0.424	1.317	0.579
SIGN	0.322	0.439	1.3 3	0.599

Note; Zaiho: pond in Kirishima city, Kirishima: volcano, MICA; MICA water (3MPa), Seawater activated with SIGN (110 MPa). Index; When a tap water is 1, the value is calculated from FID/T2.

Table 1: Comparison of a few waters with H-NMR spectra.

We have had many experimental data with H-NMR for more than ten years.

Therefore, we may elucidate the size of water to compare with our activated water.

Because our activated water may be a pico-sized particle involving infoton, $<H^{+}\sim e^{-}>$, we can consider that the index above Table 1 shows smaller value in the activated water. We have reported many effects of the water smallness on a plant, human body as well as remedy of diseases, previously [14, 15].

Another essential characteristic is physical viewpoints relating nuclear spin of the particle including electron. Spin should relate to a nucleus which associates with whether nuclear spin is integer or half-integer [1, 17].

We introduce the theme in the next section. Unfortunately, a magnetism relating spin has not been clear even in physics.

Super quantum interference device (SQUID)

We introduce the next physics associating with spin; this is to investigate of a substance the magnetization under the magnetic field. The very low levels of magnetization can be detected by super quantum interference device (SQUID).

Here, we employ the borosilicate glass which is normally diamagnetic. We can consider a diamagnetic does not show hysteresis along with the magnetic field as Fig. 4.

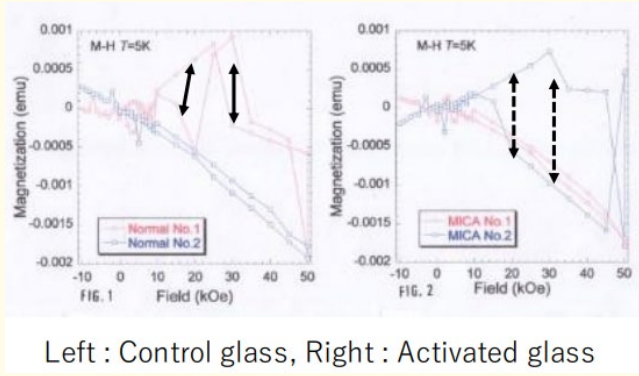


Figure 4: Super Quantum Interference Device (SQUID) spectra.

So, normal glass does not show remarkable hysteresis, meanwhile, the activated MICA glass uses a certain energy on the normal glass to cancel, so the first magnetization is smaller. After a while, the electron spinning on the MICA glass will recover resulting in the larger amount of magnetization (Fig. 4).

Figure 4 shows hysteresis in magnetization of the activated glass (MICA glass) and control one at 5K (liquid He atmosphere). The magnetic field is up to 5 T (50,000 Gausses). The common glasses are activated with MICA water. The electrons in the MICA glasses will increase the momentum resulting in a larger magnetic moment (μB) according to the equation; angular velocity;

$$\omega = M/m\, r^2. \quad (2)$$

Where M; angular momentum, m; mass of particle, r; radius.

Thus, the equation does not include spin. Therefore, spin itself seems to be difficult measurement as the physical observable parameters.

Magnetic resonance imaging (MRI) which is widely medical diagnosis consists of the usage of hydrogen atom used to generate a macroscopic polarization that is detected by antennas close to the subject being examined [1]. Most MRI scans essentially map the location of water and fat in the body. Pulses of radio waves excite the nuclear spin energy transition, and magnetic field gradients localize the polarization in space. A patient in MRI receives one tesla (10,000 Gauss) magnetic field, in which all hydrogen nucleuses in the patient focus on one way. The focus of the nucleus changes to another toward, when the fixed radio wave radiates, and stop to radiate it. The nucleus returns to an original focus, but they detect the difference and perform an image analysis shown in the cross section photographs.

This procedure relates to spin, but they do not identify spin itself in MRI [18].

Spin and spinor

In atomic physics, the spin quantum number is a quantum number designated m_s which describes the spin angular momentum (or simply spin) of an electron or other particle [19, 20]. In the 1920s physicists discovered that spinors are essential to describe to intrinsic angular momentum, or spin of the electron and other subatomic particles.

We assume that the infoton itself has spin in all directions including rotation in a space, and this movement link with the movement of infoton.

Spinors behave similarly to vectors, but its movement is wider to possess definite magnitudes and they change under rotations. The infoton may be defined the non-polarization, and it possesses a property of transverse waves and longitudinal waves. We elucidated the wave equation as following [21]. This is based on the Dirac's equation.

As the equation (3), the infoton emits both transverse and longitudinal waves corresponding to our experimental results of the measurement of dielectric constant such as approx. 4 [10, 11].

$$H = \int \psi^* \left[\omega \cdot (i\hbar c\, \mathrm{grad} + e A)\psi - mc^2 \beta\psi\right] d\tau + \int \left[2\pi c^2 P_l^{\,2} + \frac{1}{8\pi}(\mathrm{curl}\, A)^2\right] d\tau + \frac{1}{2}\iint \frac{\rho(r,t)\rho(r',t')}{|r-r'|} d\tau\, d\tau' \quad (3)$$

Transverse wave — Longitudinal wave

P: momentum, A: electromagnetic potential, ρ; electric charge
r-r' ; distance between the nucleus and the infoton

Example of spin changes in forming of different nucleus

Here is β-decay in nuclear changes resulting in formation of proton, electron, and anti-neutrino. the mark, 《 》 in the following reaction indicates a stable atom;

The first numeral of the spin state in Eq. (4), 7/2, depicts the nuclear spin of $^{137}Cs_{55}$, and the parenthesis { } in infoton, where the number, 1 shows an infoton, and second 1, addition of each a half-spin (1/2) of proton and electron. The last numeral, 0, describes the spin of stable $^{138}Ba_{56}$.

Finally, [down] means from the spin, 7/2, of $^{137}Cs_{55}$ decreases to stable $^{138}Ba_{56}$ which reaction may generate;

$n \rightarrow p + e^- + \bar{\nu}$, where the, $p + e^-$

$$^{137}Cs_{55} + 1 <H^+ \sim e^-> \rightarrow \quad 《^{138}Ba_{56}》 \quad (4)$$

spin state; 7/2 × {1×1 (=1/2+1/2)} → 0; [down],

We reported the energy and mass balance in the nuclear reaction of infoton with $^{137}Cs_{55}$ by way of increasing kinetic energy with radiation from cesium [11]. This phenomenon may indicate by assigning the particle a spin quantum number [19].

Moreover, we found the gravitational force plays a role for the nuclear transmutation when the infoton close to a certain radioactive nucleus. The equation describes the theoretical equation to reduce radioactivity. This equation is based on the Einstein's gravitation equation and Yukawa potential, although we abbreviate detail developments.

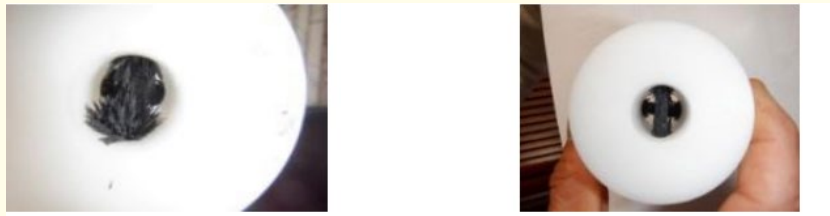
$$\int dN/N = \{-\lambda t + (Mv/d^2)\} \int dt + \int (8\pi G/c^4)\, T_{\mu\nu}\, dt \qquad (5)$$

N: is the number of atoms, λ : is decay constant of radioactive substances, $\frac{8\pi G}{C^4}$: is Einstein's gravity constant, $T_{\mu\nu}$; is energy and momentum tensor, G: is gravity constant, c: is light velocity. Mv/d^2 is referred from Yukawa potential.

When the infoton closes to a radioactive atom, it receive the kinetic energy from the radiation, then the proton from $<H^+ \sim e^->$ may enter cesium nucleus shown in (4).

Interesting practice to change aluminum to magnetization, and electrically conductive material

The system is typical electromagnetic phenomena. But essential difference may occur superconductivity in a resin device at room temperature. Besides that, aluminum is a paramagnetic material which electronic structure is 3s23p1, in which a peripheral electron is apt to be magnetized.



Left ; without Al bar inside resin. Right; with SIGN Al bar inside resin.

Figure 5: Magnetization of diamagnetic aluminum in an electromagnetic field embedded into the resin, where there are placer gold powders.

Plastic resin contains two aluminum bars in vertical direction and in horizontal one. The Al bars do not involve infoton in the resin meaning no SIGN, meanwhile, Al bars in right side resin contain infoton, $<H^{+}\sim e^{-}>$ meaning SIGN.

The eddy current generates around an Al bar due to magnetic flax density change. The inductive current forms because superconductivity occurs between infoton of Al bars and magnetic powder inside the inner hole. Figure 6 shows the relationship between the SIGN aluminum bars and magnetic powders. These phenomena look like circular coil forming the following classical electromagnetic equation;

$$H=A/\ 2r, \quad (6)$$

Where H (ampere/meter); strength of magnetic field, A; current (ampere), and r; radius of circle (meter).

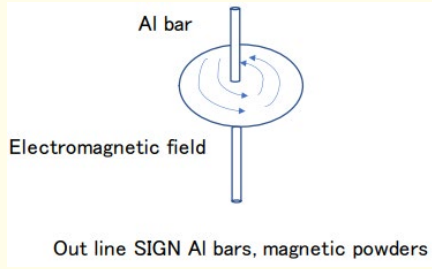


Figure 6: Al is magnetized in the SIGN field.

In this device, we may consider both a transverse wave and longitudinal wave. In a longitudinal wave, the direction of the oscillation is same direction of motion of the wave and the information from the infoton, $<H^{+}\sim e^{-}>$ may be transferred to aluminum stick leading to transferring an electron so that the number of electrons in Al may increase resulting in the even number of two in the peripheral electron. Then, the electronic structure may change from $3S^{2}3P^{1}$ to $3S^{2}3P^{2}$ leading to match the spin direction for magnetization.

Conclusion

We report the H-NMR, SQUID, and electromagnetic field associated with spin. Although spin has described in an angular momentum in quantum physics, the methods have yet been established to detect spin directly. So, we employ the hydrogen-based NMR and super quantum interference device (SQUID) to identify the material's magnetization. As one of the applications, we introduce the difference in water every location. Moreover, we report the nuclear transformation of cesium with spin. On the other hand, we introduce the exciting device of an electromagnetic field to engage placer gold and paramagnetic aluminum in the resin which is insulator. We estimate the system to discuss with spin.

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