ELECTRON INTRINSIC SPIN ANALYZER

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Abstract

In the field of quantum physics, dealing with the intrinsic properties of the free electron spin directly on the free space in a pure beam of free electrons has been an unsolvable and a century-long challenge. Because the high magnetic field gradient predicted there was thought impossible to generate, according to a historical note which Bohr and Pauli considered its objective observation as impossible while some other scientists believe that the observation is maybe possible. This invention shows in action that: It is possible to observe and measure the phenomenon (the spin measuring or detecting of free electrons on the free space) by using a sharply pointed magnet to reach a higher magnetic gradient at the near location of free electron's beam and adjusting the voltage in a certain distance.

1. Historical background:

For the first time, the concept and theory of "spin" were theorized by Samuel Goudsmit, George Uhlenbeck, and Wolfgang Pauli in 1920 on quantum physics. Some physicists such as Wolfgang Pauli and Niels Bohr believed that the measurement, observation, and separation of subatomic particles such as free electrons is impossible in action, as they stated that: "It is impossible to observe the spin of the electron, separated from its orbital momentum, by means of experiments based on the concept of classical particle trajectories."' Because, When the free electrons placed in an inhomogeneous magnetic field, a force exerted from the field. According to te this note that the mass and the radius of free electrons are low. So, If we consider the classical physics calculations about the separation of free electrons, then:

$$\text{F=-}\nabla\text{U=-}\nabla\ (\mu.\text{B});\ \Delta Z = \tfrac{1}{2}at^2 + vt \cong \tfrac{1}{2}\left(\tfrac{\mu_B}{m_e}\right)\nabla B\left(\tfrac{l}{v}\right)^2[\text{m}];\ \tfrac{\mu_B}{m_e} \cong 10^7 \quad \left[\tfrac{j}{T.K_g} = \tfrac{m}{S^2.T}\right];$$

Therefore, It shows that this experiment cannot be practically observed for free electrons because the mass is very low and the speed is very high in the classical physics calculations. so, it seems it's impossible to overcome the Lorentz force, produce the required magnetic field gradient, and achieve separation and purification of the particles smaller than ions and atoms in the classical Stern-Gerlach experiment. In the experimenting medium, particle beam should not be affected by any free charges, neutral atoms, ionic charges, or unforeseen factors. But the theory of spin proved in generally by using symmetric atoms, like an atomic gas of silver atom which was the idea of Stern and Gerlach for the first time, because silver atoms have an electron at the last level of energy and heavy and in the weak magnetic field, the spin of the nucleus and spin-orbital angular momentum are not an essential factor.

2. Description:

This present invention comprises a special glass lamp that regarding some of several deionizations (with acceptable percentages) and paralleling process to remove the effects of negative ions and neutral atoms. the free electron beam on free space (without any energy constraint for the electrons such as atomic bands or energy levels in semiconductors) shoot to the phosphorescent plate to interact with a perpendicular magnetic field (a higher magnetic field gradient produced according to two-wired field calculation).

When the free-electron beams go through magnets that created inhomogeneous (not changing with time) electromagnetic field, the electrons with different quantum spin's properties will be separated so a free-electron beam converts into two separated beam which is visible to allow direct observation and measurement of several physical phenomena on the classical physics, quantum mechanics, and plasma theory. the present invention used a sharp and curve magnet to produce a similar magnetic field gradient similar to the two-wire calculations field.

Reaching too high inhomogeneous magnetic gradient: Assume two thin wires that have a different direction of electric current, The density of magnetic field lines changes from the vicinity of the magnets (higher-order) to a further area (lower order) The value of the magnetic field gradient is larger in the vicinity of the two wires. As the wires become closer, the density of the magnetic field lines and the value of the magnetic field gradient increase. Then, for reaching a better view of advantage, the distance of wires (2a) must be limited to zero. So, in a lower range of the magnetic field amplitude, this is possible to make a higher gradient by the lower amplitude of the magnetic field.

$$\nabla B = \frac{\partial B}{\partial Z} \propto \frac{1}{a}\ |B| \quad ;\nabla B = \frac{\partial B}{\partial Z} = \frac{\delta|B|}{a}\ \delta < 1\ or\ \delta \approx 1\ ;\ \lim_{a\to 0}(2a)$$

"B" is the amplitude of the magnetic field; $\frac{\partial B}{\partial Z}$ is the magnetic field gradient;
"δ" is the normalization constant; "a" is the radius of the sharp edges of the sharp magnet.
For any observational or experimental aims, the high magnetic gradient is not enough completely because the velocity of free electrons is another main factor in the observational or experimental results. According to the plasma calculations and instead of classical physics, the present research shows experimentally the beam of free electrons does not move in a straight line of free space. So, the range of velocity of free electrons on the main axis of direction will be reduced to a lower range.

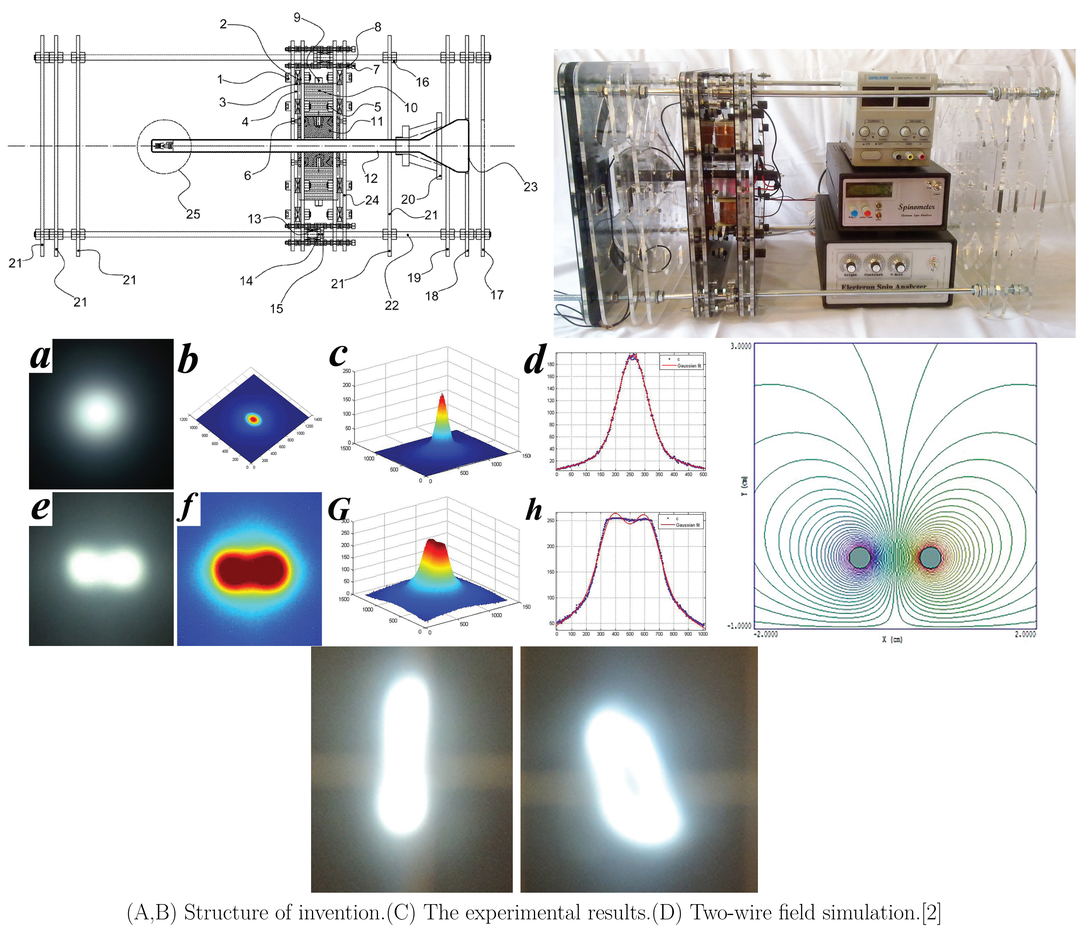
The present invention has used the Grids for several deionizations and paralleling process to make a pure beam of free electrons. It has used the Langmuir probe method to calculate the electrical current from Grid 105 and to measure the velocity, energy, electron temperature, electron density and other physical parameters of free electrons to reach better precision and details. The electrical elements emitted free electrons and the Grids deionized the free electrons beam by a micrometric hole on the Grid 105 and also, it has performed the paralleling process of the pure beam of free electrons. For reaching better and safer details, no electric field and no magnetic field do not change with time and the amplitude of magnetic fields that are produced by the coils and the stationary magnets are stable and it does not work like monitoring systems. The electrical current from Grid 105 is measurable for plasma parameters and the floating potential."φ_f". According to Debye length "λ_d" relation,The thermal velocity of free electrons is "$v_{e,th}$" that is calculated by:

$$\lambda_d = \sqrt{\frac{\epsilon_0 K_B T_e}{e^2 n_e}}\ ;\ v_{e.th} = \sqrt{\frac{8K_B T_e}{\pi m_e}} = 0.18\times 10^4\sqrt{T_e}\ \ ;\ v_{e.th} = \sqrt{\frac{8eT_{eV}}{\pi m_e}} = 6.7\times 10^5\sqrt{T_{eV}};$$

$$\frac{dLn(I_p)}{dV} = \frac{1}{T_{eV}};\ v_{e,th} = \sqrt{\frac{8ev}{\pi m_e}\frac{dV}{dLn(I_p)}};$$

Therefore, the range of using voltage on the electrical element prevents several unwanted phenomena, and the electrical current changes in Grid 105 shows plasma parameters such as the velocity of free electrons. As the general notes from the Langmuir probe section on the plasma theory state, the velocity of free electrons must calculate before carrying out each experiment on the free electrons beam. At the present invention, power supply helps to produce a suitable range of voltages between the anode and cathode to reach the experimental data. For checking the main plasma properties, users can choose the range of voltage by the power supply. Parameters show the thermal velocity ($v_{e,th}$) of the free electrons to be approximately between approx (10) ^4 [m/s] to approx (10) ^5[m/s].

3. Figures and diagrams:



(A,B) Structure of invention.(C) The experimental results.(D) Two-wire field simulation.[2]

4. Practical usage:

The process of spin's separation on the free space could be used in Quantum computer, Quantum Cryptography, Quantum information, Quantum Communications, Quantum memories, and Quantum teleportation, etc which they are many different fields of Quantum physics.

5. Results:

It shows some of the main advantages from several physical phenomena and intrinsic properties of the free electron's spin, which are separated and observed by using a high inhomogeneous magnetic field gradient (Its produced by a sharp magnet and a curve magnet) and electing a suitable voltage value to reach the lower range of velocity of free electrons. The scientific results are achieved by electrical measurements the plasma parameters and observational measurements which are analyzed by an image processing algorithm and Gaussian fitting that could be a great study base on different fields on physics. Also, it would be a practical device on the scientific laboratories which work by particle systems such as free electrons or it may use in many different fields of quantum devices (spintronic devices) and it may be used for checking several phenomena on physics such as the Lorentz force effect by using dual flat magnets (to make homogeneous magnetic field), "electron diffraction effect" and "sequence electron spin separation effect" etc. For checking the spin separation phenomena by free electrons, the applied experiment has been carried out in DC voltage range and stable electrical current (and stationary magnets). As the present invention considered the spin of free electrons in action, further research about the spin of particles will be started to study for spin properties of sub-electron particles to reach experimental results.

6. References:

[1] Hosein.Majlesi, IR patent application number: 139450140003005386 Issued Number(Granted patent number): 97126 (Continuation of granted number: 84973 (IR patent application number:139350140003006698 - first title of invention "spino meter")and Continuation in part of WO2017009817A1(PCT/IB2016/054596) and US201562246629P and US15/273,334) [2] Link:http://www.ou.edu/research/electron/bmz5364/calc-kv.html;[3] W. Pauli, Handbuch der Physik (Springer, Berlin,1958), vol. 1, chap. Secs. 9, 12, 23. [4] J.A.Wheeler and W.H.Zurek,Quantum theory and Measurement, (Perinceton University Press,Princeton,1983),P.699.[5] W.Pauli ,in le Magnetisme , Proccedings of the VI Solvay conference (Gauthier-Villars , Paris , 1932),Sec.II.1. b,p.175.[6] N. F.Mott,Proce.R soc.london,s, Ser. A 124,440(1929).[7] N.F.Mott and H.S.W.Massey, The Theory of Atomic Collisions, 3rd ed. (Clarendon Press, OxFord, 1965),pp. 214-219.[8] W.pauli, in Handbuch der Physik, edited by S. Flugge (Springer, Berlin, 1958),Vol.5,Pt.1,p.165.[9] G. A. Gallup, H. Batelaan, and T. J. Gay, Phys.Rev. Lett. 86, 4508 (2001).[10] N.Bohr,j.Chem.Soe. 134, 349(1932):134,368(1932).[11] M.A.Liberman, j.Lichtenberg , Principles of plasma discharge and materialsprocessing, John Wiley, sons,chapter 6,(2005). [12] I. Langmuir and H. Mott-Smith, "The theory of collectors in gaseous discharges," Phys. Rev. 28, 727–763 (1926). [13] J.Meichsner, Lecture notes in physics, springer, Berlin Heidelberg, chaoter 5, (2005).[14] Robert L. Merlino, Understanding Langmuir probe current-voltage characteristics, Am. J. Phys.75 (12), December 2007.[15] Walter R. Hoegy and Larry H. Brace, Use of Langmuir probes in non-Maxwellian space plasmas, Rev. Sci. Instrum., Vol. 70, No. 7, July 1999.[16] J.B. Hoag and S.A. Korff, Electron and Nuclear Physics, Van Norstrand (New York, 1952),Chapter 8. [17] M.A. Heald and C.B. Wharton, Plasma Diagnostics with Microwaves, Wiley (New York, 1965),page 380.[18] A.M. Howatson, An Introduction to Gas Discharges, Pergamon Press (Oxford, 1965). [19] Roth, J. Reece, Industrial plasma Engineering, chapter 9,(1995). [20] B. E. Cherrington, "The use of Langmuir probes for plasma diagnostics:A review," Plasma Chem. Plasma Process. 2, 113–140 (1982).[21] O. Auciello and D. L, "How Langmuir probes work," in Plasma Diagnostics, Discharge Parameters and Chemistry, Flamm (Academic, Boston, 1989), Vol. 1, Chap. 3. [22] B. E. Cherrington, "The use of Langmuir probes for plasma diagnostics: A review," Plasma Chem. Plasma Process. 2, 113–140 (1982).[23] K.-U. Riemann, "The Bohn sheath criterion and sheath formation," J. Phys. D 24, 493–518(1991). [24] G. D. Severn, "A note on the plasma sheath and the Bohm criterion," Am. J. Phys. 75, 92–94 (2007).[25] F. F. Chen, Introduction to Plasma Physics and Controlled Fusion, 2nded. (Plenum, New York, 1984), Vol. 1, p. 290. [26] D.Dorranian, F.Shahbaz Tahmasebi, Y.Golian, M.Alizadeh, J of Theoretical and Apl. Phys.4-1,25-29, (2010).

** Physics concepts: $e = 1.6\times 10^{-19}\ [C]$; ;$\epsilon_0 = 8.85\times 10^{-12}\left[\frac{C^2}{N.m^2}\right]$; $K_B = 1.38\times 10^{-23}\ \left[\frac{j}{K}\right]$; ; $\pi = 3.14$;; μ=0.927×10^{-23} [amp. m^2]; m $_e$=9.11×10^{-31} [kg]; And r$_e$=2.8179×10^{-15}[m];