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Magnetic Moments of Atoms not Due to Valence Electrons

Stern-Gerlach experiments revisited for H and H_2
Magnetically deflected hydrogen rays indicate ortho- and paramagnetic hydrogen that is not separated into nucleus and electron.

Pauli's exclusion principle and the H-atom

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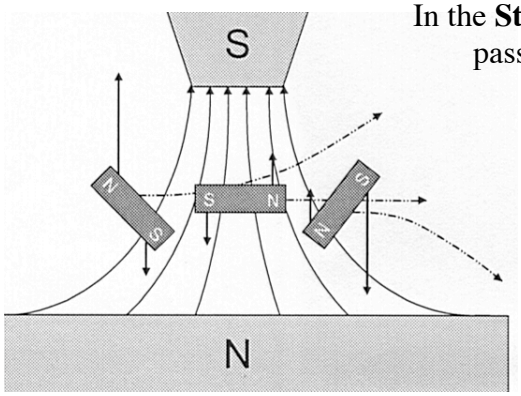
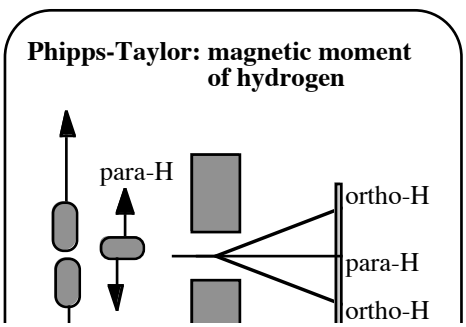


In the **Stern-Gerlach** experiment a ray of silver atoms passed through an inhomogeneous magnetic field. The observed split-up into two beams due to the inhomogeneity of the magnetic field was interpreted in terms of the *ad hoc* adapted Rutherford-Bohr atomic model. According to this adaptation the extranuclear electrons in the atomic shells rotate, so that the electrons have intrinsic magnetic moments, associated with an intrinsic angular momentum or *spin*. The figure shows the beam in the magnetic field. [HuSt]

From the observed data there is not the slightest indication for the nuclear model of the atom, namely that electrons surround a nucleus. Moreover, the electron spin interpretation is impossible. The Stern-Gerlach experiment shows only that some elements have magnetic moments. This feature depends on the mass number. Because elements with odd mass numbers
(^{1}H, ^{23}Na, ^{39}K, ^{41}K, ^{61}Cu, ^{63}Cu, ^{107}Ag, ^{109}Ag, ^{197}Au,)
show this feature, the conclusion is that only the last attached piece makes an element magnetic that is "odd". .) The present author proposed that all elements are made up of H-atoms, which have magnetic moment. Example Ag-107: it consists of 107 magnetically coupled H-atoms. 106 building blocks may have magnetic moments but they cancel. The 107th building block is not paired; it causes the magnetic experimental patterns.
Examples nitrogen and oxygen: They have even mass numbers but experience deflection in non-uniform magnetic fields: ^{14}N split into 4 components, ^{16}O split into 9 components. [KRYG]. The conclusion is that nitrogen has 2 varieties with different magnetic moments. The O_2 Stern-Gerlach experiment can be interpreted that gaseous O_2 molecules exist as a mixture of some para varieties and of one ortho form. Please see the article *The Nature of chemical Bonding*. Next to investigate is a crucial experiment of immense importance:



In 1927 **Phipps and Taylor** performed a Stern-Gerlach type experiment for hydrogen. The experiment shows the existence of magnetic patterns of hydrogen. Current theory claims that the Phipps-Taylor experiment showed the same effect as the Stern-Gerlach experiment,

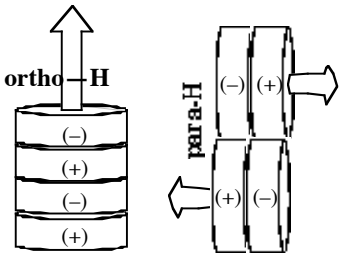
namely a split into two rays and that the observed two deflected rays demonstrate that there is a spin up and a spin down electron in hydrogen. If one reads the abstract of the Phipps-Taylor paper, it is true that

In the magnetic field the ray was separated into two branching rays,

yes. But this is only the half the truth! The next sentence of the paper is:

*There was also evidence of **a central** undeviated **ray** which is believed to be due to hydrogen active chemically but probably not in the atomic state*.

Hydrogen *not in the atomic state* is for example diatomic hydrogen, H_2. Is there the possibility to interpret the *central* not deflected ray due to a H_2 impurity? Today two varieties of H_2 are known: ortho- H_2 and para- H_2. For para- H_2 the magnetic moments cancel, thus the not deflected ray could be a para- H_2 ray. Concerning the ortho- H_2 , according to quantum theory, its magnetic moment is twice as much as that of H. Therefore a ray that consists of H_2 and H would be separated into 4 branching rays: 2 branching rays of ortho-H and 2 branching rays of ortho- H_2. Phipps and Taylor reported that the ray was separated into 2 branching rays! The H_2–impurity conjecture is wrong. But the experiment and its interpretation is theory-laden. The authors declare: *The peculiar character of the central line as described above, and our present conception of the hydrogen atom seem to preclude the possibility that is was caused by atomic hydrogen.* And regarding the experimental results there are no sharply defines lines!



If the H_2–impurity conjecture is wrong, then the central undeviated ray is probable due to H. If it is due to H, then quantum theory is falsified because the supposed spin up and spin down magnetic states of the electron cause only 2 deflected rays; the undeviated central ray is unexplainable.

Here, the deflection pattern of the Phipps and Taylor experiment is interpreted as due to two varieties of hydrogen: ortho-H and para-H. The deflected beams represent ortho-H, whereas the central, undeviated beam represent para-H. The figure shows the two hydrogen types.

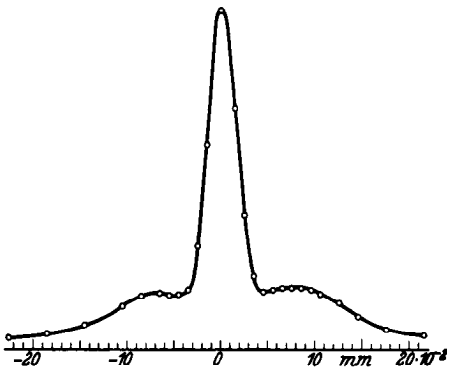


Fig. 12. Vollständiges Aufspaltungsbild von gewöhnlichem Wasserstoff bei 95° abs.; die Unsymmetrie ist apparativ bedingt.

Stern-Gerlach for H_2

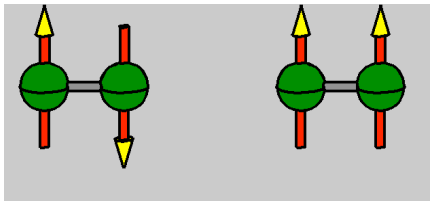
In 1933 *R. Frisch and O. Stern* [FriSt] reported a Stern-Gerlach experiment on the deflection spectrum of dihydrogen. The figure (12) of one of their results shows a peak at zero deflection and two lateral maxima.

The peak at zero deflection can be interpreted as the effect of para- H_2, because it has a paired anti-parallel magnetic moment ↑↓.

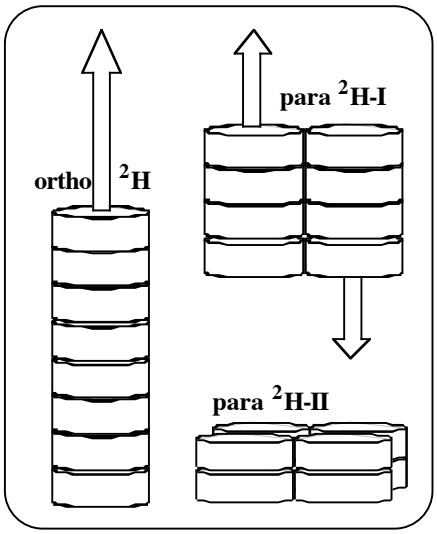
The lateral peaks are caused by ortho H_2, which has magnetic moment ↑.

Current quantum mechanics interprets the occurrence of ortho- and para- H_2 due to nuclear magnetic moments:

In the hydrogen molecule the nuclear spins can be either aligned or anti-aligned. Therefore, we have both: a <u>nuclear ortho- H_2</u> and a <u>nuclear</u>



para- H_2.
Figure: J. Bargon's homepage,
www.thch.uni-bonn.de/pc/bargon/



But both species have the same electronic state (electron spins anti-aligned) and are therefore at the same time also electronic para- H_2.
Recall that according to current theory the nuclear magnetic moment is 1/1836 that of the electronic magnetic moment. The consequence is that there is a para- H_2 with big (in comparison) anti-aligned magnetic moments and an ortho- H_2 with a small magnetic moment. The deflection spectra suggest that the magnetic moment of ortho- H_2 is not such a tiny one…
The figures show the allotropes of H_2. It is assumed that there are two varieties of para- H_2 and one type of ortho- H_2, These allotropes cause the deflection spectrum.

Fallacious derivation of magnetic moments
For quantum mechanics, the origin of the magnetic moments of an atom is due to the motion of its component charges. Regarding a single orbiting electron with spin there are two magnetic moments that we must distinguish: the first claim is that the orbiting electron represents an electric current and the magnetic moment is due to this circular electric loop. A conduction current in a loop causes a magnetic field and the loop acts like a bar magnet with North and South Pole. This is a fact but the underlying definition of conduction current
I = dq/dt is untenable. The claim is that in a wire free electrons ("electron gas cloud") move and that moving charges define the current. And therefore it was declared that a single orbiting electron represents an electric current that produces a magnetic moment! But electrical conduction is not a flux of charges but a propagating state of polarization and its frequency. See the arguments in the article *Electricity*.
The quantum mechanics formulas for the magnetic moments are based on erroneous assumption regarding the nature of electricity. Besides of this flawed foundation the quantum electrodynamics derivation of the magnetic moments is fallacious. The magnetic moments of electrons and protons are not inversely dependent on inert mass. For example the z-component of the electron spin magnetic moment depends
Not on mass: $\mu_{z\ spin} \neq S_z(-e/2m_e)$
The relationship $\mu_{proton} = \mu_{electron\ spin}/1836$
is erroneous. Also the formulas for the magnetic moments due to rotation of molecules are erroneous. See the arguments in the article *Flawed quantum electrodynamics: Magnetic moments of electron and proton are not inversely proportional to inert mass*

In this paper and in other papers I showed that the nuclear atomic model of Rutherford-Bohr is untenable. There are no extranuclear electrons possible. I proposed a hydrogen atom where *magnetic coupling* connects proton and electron. A

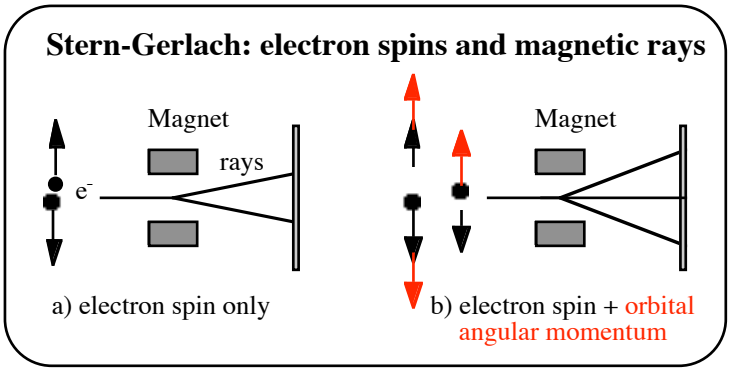
proton is suggested to consist of sub-particles, coupling of sub-particles is magnetic. The seize of all atomic sub-particles is in the same order of magnitude.
My proposal is that hydrogen exists in two varieties, namely as ortho- and para-hydrogen. In para-hydrogen the magnetic moments cancel and therefore the atom ray of para-H-atoms is not deflected. The two deflected rays are due to the deflection of ortho-hydrogen.

If the calculated magnetic moments of Stern-Gerlach experiments for different elements show equal magnitudes it would appear that it is in any case the magnetic moment of an *odd* hydrogen of the element. All elements consist of H-atoms. Elements with odd mass numbers consists of cores that have paired hydrogen atoms, the odd H atom is in the ortho state.

Its magnetic moment is detectable whereas the magnetic moments of the other constiuent H's cancel each other.

Why not Stern-Gerlach experiments for electrons? Current theory claims that it is impossible to separate an electron beam into its magnetic moments up and down components. The reason given is the Uncertainty Principle! Or: *The spreading of the electron wave packet washes out the separation effect due to the electron spin…*
[rug]
Observing the spin of a free electron did not succeed. [garr]
So-called fine structure (splitting of spectral lines) is allegedly caused by an electron flip. The calculated magnetic moment depends on the theoretical premises of a spinning electron. There is no direct measurement of the magnetic moment of an electron.

Summary: the experiments of Stern-Gerlach and Phipps-Taylor are not interpretable in terms of quantum atomic theory. This theory asserts that the atomic nucleus is surrounded by electron shells and that only the outermost lonely spinning valence electron produces a magnetic moment. (The magnetic moments of unpaired protons and neutrons are allegedly three orders of magnitude smaller and therefore they must not be taken into account! Wrong theory, see below.) According to Pauli, the valence electron has no angular momentum and therefore no magnetic moment due to its orbital motion. This rule was introduced in order to save the phenomena of the Stern-Gerlach experiment that shows only a 2 beam splitting. But Phipps-Taylor experiment refutes Pauli's assertion because there are 3 beams, where one beam is not deflected. This outcome is unexplainable in terms of Pauli's exclusion rules, see below.



Pauli's exclusion principle and the H-atom

The climax of quantum mechanics is the *exclusion principle*, which requires that no two electrons in the atom can have the same set of quantum numbers. Recall that the electron in Bohr's model of the H-atom has different orbits that depend on the energy of the electron. In the so-called ground state of the atom the principal quantum number n = 1 and the angular momentum of the orbiting electron is $L = n\hbar = 1\hbar$. Quantization is due to the double nature of the electrons; it is allegedly a corpuscle and a wave. The claim is that the electron is also a standing wave, therefore n times wavelength must be the length of the circumference, n being an integer: $n\lambda = 2\pi r$. Again, in the ground state the electron is moving around the nucleus and has therefore angular momentum and angular magnetic moment. In order to calculate the radius of the ground state, the so-called Bohr radius a_0, an orbiting electron with angular momentum must be presupposed.

According to Pauli's exclusion rules the electron in the ground state has *zero* angular momentum, which means that it does not surround the nucleus (as a consequence there is also a *zero* magnetic quantum number.)

Therefore, Pauli

… did not consider electrons to be something real, as otherwise he could never have prescribed conditions where the electron can pass through the very centre, the nucleus, of the atoms billions of times every microsecond. Those zeros imply the possibility of oscillation of the electron right through the atomic nucleus. [Aspden1]

According to Schroedinger's opinion the electron is not a real thing but a thing *'as if'*, an auxiliary concept which makes it possible to compose the equations for waves! Only waves have reality!

The current opinion is that of Born, namely that there are no waves and that by the famous Schroedinger Ψ differential equation solely the probability amplitudes of the electrons are calculable. But an oscillation of the electron *through* the atomic nucleus is impossible, the electron demolishes the wonderfully structured orbitals of electrons and crashes into the proton, and this is the exit of the quantum H-atom theory. (In textbooks one can read that Pauli's atomic model is an improvement of Bohr's!)

A fatal consequence of Pauli's 'improvement' of the architecture of the model is that the exact ionization energy is not calculable. Recall that the ionization energy is exactly the energy that is necessary to remove the electron from the ground state orbit into infinity and this energy depends on the orbital velocity. Experiments indicate a determinate energy and not a probable one.

As Pauli's atomic model is physically untenable, the reason for the introduction of the exclusion rules cannot be physically reasonable.

The reason why Pauli canceled the orbital movement of the ground state was the trouble in explaining phenomena. Regarding for example the outcome of the Stern-Gerlach experiment: An inhomogeneous magnetic field with a linear gradient was used to separately deflect the magnetic states *spin up* or *spin down* of neutral silver atoms $^{107}_{47}Ag_{60}$ or $^{109}_{47}Ag_{62}$. According to quantum physics the electron shell occupancy is the following: 2, 8, 18, 18, 1, where the outermost (valence) electron is alone on its shell and is responsible for chemical bonding, for spectral lines and for the atomic magnetic moment! In its ground- or not excited state this electron has no angular velocity, because Pauli made this assertion. Why?

The experiment shows clearly two separated beams of silver atoms. Only if it is assumed that the angular momentum of the electron is zero and that the angular momentum of the unpaired proton of the silver nucleus is negligibly small (see below), the outcome of the experiment is explainable in terms of quantum theory.

Otherwise, if there would be an additional angular momentum of the orbiting electron, then the net atomic angular momentum states are ~~±h~~ and 0, and there are 3 beams! In order to explain the phenomena the orbital angular momentum was canceled! But the Phipps-Taylor experiment for the investigation of the magnetic moment of hydrogen shows 3 beams, which contradicts the exclusion rules. Probably Pauli did not study accurately the outcome of the Phipps-Taylor experiment. When you read Pauli's Nobel lecture, no physical reasons for the exclusion rules are mentioned. The goal of his reasoning is to *save the phenomena*.
From a physical point of view a zero angular momentum is a zero angular velocity of the electron. It must crash into the nucleus and destroy the wonderful arranged electron shells of Ag! Also a hydrogen electron with zero angular velocity crashes immediately into the proton. Recall that the so-called centrifugal force protects the orbiting electron from its sudden fall. But an accelerated electron radiates, i.e. transmits energy to an all-pervasive electromagnetic medium and loses energy. Therefore also an orbiting electron must crash into the nucleus. The centrifugal force as any so-called inertial force is not rationally explainable if the frame of reference for the whizzing atomic particles and sub-particles is the vacuum. As I showed, the occurrence of inertial forces due to an acceleration of a body is a crucial experiment for the existence of a resisting electromagnetic medium.

To summarize: Pauli made the assertion that the orbital angular momentum in the ground state is *zero* in order to save the phenomena, namely the 2-beam outcome of the Stern-Gerlach experiment. The Phipps-Taylor experiment shows for hydrogen also a branching of 2 beams but there is a central not deflected beam, too. This experimental result contradicts the exclusion rules of Pauli.

Also the
Stern-Gerlach experiment cannot be crucial for the existence of orbiting and spinning electrons.

The outcome of this experiment is only that atoms are little magnets or are composed of little magnets. These magnets can be either permanent (ring) magnets or minute solenoids; they must not be an effect of moving charges!

The present author assumes that atoms are made up of hydrogen atoms and that hydrogen is made up of permanent elementary ring magnets.

To summarize: There is no empirical evidence for orbiting and spinning electrons. Orbiting and spinning electrons are figments. It is a premise of quantum mechanics that move in a vacuum. In a vacuum, the nature of the erroneously so-called inertial force of the electron remains unexplained. Recall that the so-called centrifugal force protects the orbiting electron from its sudden fall. In a vacuum, the angular momentum must be conserved. Quantum mechanics angular momentum is not a conserved magnitude. See the article History of Quantum Mechanics Flaws.
Cyclotron radiation is an empirical evidence for radiation due to acceleration of elementary particles. An orbiting electron is an accelerated one and produces radiation; the electron must fall into the kernel due to the energy loss. The Bohr model is untenable.
According to Schroedinger the electron and its movements are not real, they are only auxiliary things *'as if'*. Schroedinger assumes waves as constituents of the atom. The question of what is waving cannot be answered by Schroedinger's theory. If the waves are made up of charge then accelerated charges produce radiation. Due to the

energy loss the waves must crash into the nucleus.

The Bohr atomic model with a positively charged nucleus and extra nuclear negatively charged electrons does not work. The creation of a photon out of an energy difference during an electron jump is mysterious. The primordial defect of this model is its ontology. It is a modern version of atomism. Corpuscles have their interplay with distant or apparent (inertial) forces in the vacuum.
Spin flips of electrons or protons do not occur. Spectra show eigenfrequencies and not photons due to spin flips.

As a tentative assumption we propose that the magnetic moments are of the same order of magnitude for electrons, protons and their sub-particles. Also the size of those particles is assumed to be of the same order of magnitude. Particles are hypothesized as elemental ring magnets. Bonds are by magnetic coupling. Atoms are oscillators.
State of our ignorance: we don't know how we could calculate a proton's magnetic moment. Why should a bound proton have a spin? It is possible that nature has permanent elemental magnets.

((((Therefore the magnetic moment of the proton is "invisible' in a Stern-Gerlach experiment. But neutrons are visible, they split into 2 beams with small deflection.)))

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