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Very High-Temperature Superconductivity of Pure Mg Metals, UFOs and Cuprates

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Abstract

Very High-Temperature Superconductivity (VHTS) is possible, but requires the formation of electron-pairs by Coulomb forces. This is demonstrated by generalizing Bohr's model for H_2 molecules. Two electrons are then moving on quantized orbits in the median plane of the centers of neighboring Mg^{2+} ion cores. Even their effective charge is determined by Bohr's method and improves then the Thomas-Fermi model. Computation of the binding energy per electron-pair in a row of Mg atoms reveals that VHTS requires practically pure magnesium metals with a nearly perfect lattice structure. This proposition can be experimentally tested, but is already justified by observable properties of Unconventional Flying Objects (UFOs). Though cuprates are only moderate high-temperature superconductors, this phenomenon is also due to Coulomb forces and merits therefore a specific study.

Keywords

Superconductivity, Very High-Temperature Superconductivity, UFOs, Magnesium, UFO Propulsion, UFO Materials, Cuprates

1. Introduction

Drude proposed in 1900 that metals are good electric and thermal conductors, since they contain a gas of "free electrons". They can be set in motion, but are then scattered by small heavier particles that constitute the crystal lattice. The resulting friction seemed to be inevitable until Kamerlingh Onnes discovered in 1911 that the electrical resistivity of mercury vanishes below 4.2 K. Other elements and alloys were also found to yield superconductors, but only at very low temperature. The critical temperature where superconductivity is lost is usually lower than 10 K and never higher than 23 K. The underlying mechanism remained mysterious

until 1957, when Bardeen, Cooper and Schrieffer explained that two electrons can be bound to one another by exchanging phonons [1]. Since these electron-pairs are bosons, they can move without being scattered. This BCS theory and related discoveries were presented in a book [2] to show "how great scientific achievements were made".

By trial and error, Bednorz and Müller found in 1986 that superconductivity is possible up to 30 K for Ba doped La_2CuO_4 crystals and even 92 K for $YBa_2Cu_3O_4$. Since these discoveries indicated that superconductivity is not only possible by the BCS mechanism, they deserved the Nobel Price already the following year [3]. Other types of high temperature superconductors have been discovered, but cuprates remain very remarkable ones [4]. They contain layers of CuO_2, separated by LaO layers, providing charge carriers in $La_{2-x}Ba_xCuO_4$, for instance. However, the underlying mechanism was only partially understood and therefore said to be "one of the major unsolved problems of theoretical condensed matter physics" [5]. At present, the highest critical temperature for superconductors is still far below room temperature at normal atmospheric pressure.

Ashcroft suggested in 1968 that compressed hydrogen metals might allow for superconductivity at higher temperatures [6]. This proposition resulted from an extension of the BCS theory, but elicited an intense search. In 2011, Eremets and Troyan compressed molecular hydrogen by means of a diamond anvil cell and found spectroscopic signs that very pure hydrogen gas becomes solid at 295 K when the pressure reaches 200 GPa. Its electrical resistivity was suddenly reduced by several orders of magnitude at about 270 GPa [7]. Ashcroft mentioned in 2004 that alloys of hydrogen with group IV atoms might be adequate at lower pressures [8]. In 2019, superconductivity was indeed reported for LaH_{10} in Germany [9] and the USA [10], but only up to about 250 K and at pressures that are comparable to those at the center of the Earth [11]. This type of superconductors had thus no practical relevance. It was even concluded that "the mechanism driving superconductivity at high temperature, remains shrouded in mystery and controversy" [12].

The discovery of materials that are at least superconducting at room temperature and normal atmospheric pressure would thus be very interesting and useful. We will show that this goal can be reached by combining simple theoretical reasoning with already known observations. They have been neglected, since they result from UFO phenomena, which have thus also to be clarified. Moreover, normal Mg metals are only superconducting at temperatures below 0.0002 K [13], but that is due to their polycrystalline lattice structure, which allows only for the BCS mechanism. VHTS results from long-range Coulomb forces. It requires therefore not only high purity, but also a nearly perfect lattice structure. This proposition is justified by generalizing Bohr's model for H_2 molecules. We had been surprised, indeed, that his simplified version of quantum mechanics did already account for the formation of an electron-pair between two protons [14].

The structure of this article is determined by the following questions. 1) Is

Bohr's model really sufficient to understand why Mg metals can be exceptionally efficient superconductors? 2) Is this proposition already confirmed by observations and measurements? 3) Are more moderate forms of high temperature superconductivity also due to Coulomb forces?

2. Strongly Bound Electron-Pairs in Mg Metals

2.1. Crystallographic Data and the Hard Sphere Model

Detailed study of lattice structures became possible in 1912, since von Laue and Ewald realized that a beam of X-rays leads to interference of scattered waves. Bragg facilitated their interpretation by considering waves that are reflected by equally spaced lattice planes. These methods revealed that Mg metals have a hexagonal close-packed (hcp) lattice structure and suggested that Mg atoms are hard spheres that attract one another. Their mutual attraction is so strong that they constitute lattice planes, where every atom is in contact with 6 other ones, as shown in Figure 1(a). Though Figure 1(b) and Figure 1(c) indicate that there are two possible ways to superpose lattice planes, the strong mutual attraction of Mg atoms in the lower and upper lattice planes leads to the shortest possible separations.

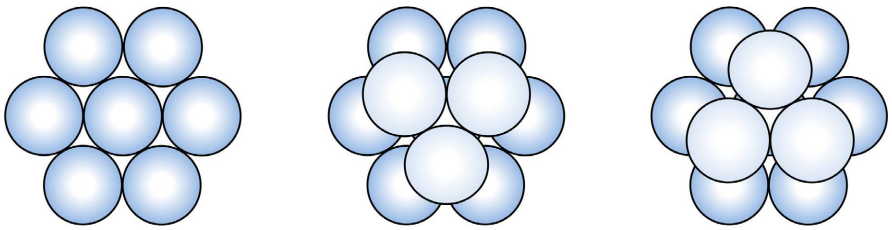


Figure 1. (a) Compact hexagonal arrangement of identical spheres in a lattice plane. (b) and (c) represent two possible arrangements for Mg atoms in adjacent lattice planes.

The proof of this assertion is provided by Figure 2(a) and crystallographic measurements. Close packing of spheres would require that $(c/a)^2 = 8/3$ and therefore that $c/a = 1.633$. Since $a = 321\,\text{pm}$ and $c = 521\,\text{pm}$ for Mg metals, the ratio $c/a = 1.62$. It is smaller (1.58) for beryllium metals, but neutral Be atoms contain only 4 electrons. Since they are attracted by nuclei that contain only 4 protons, the electron cloud is too weak to resist flattening. Mg atoms contain 12 electrons, which are more strongly bound and justify the hard sphere model. The radius of Mg atoms $r_o = a/2 \approx 160\,\text{pm}$. Figure 2(b) determines the separation of two neighboring nuclei in the upper and lower lattice plane. Since the radius of the circle inscribed in an equilateral triangle of side a is $b = a\sqrt{3}/6$, the ratio $b/a = 0.289$ for magnesium metals. This result allows to account for interactions of an electron-pair with other ions and electrons than in merely one row of Mg atoms.

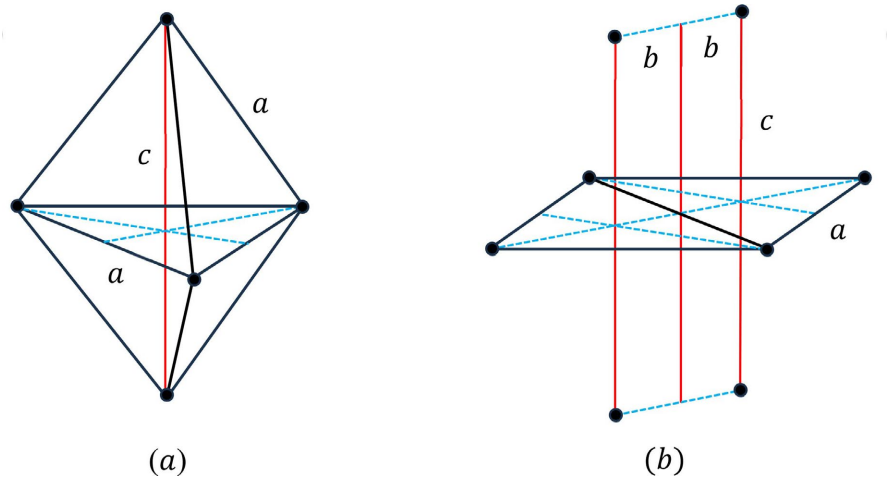


Figure 2. (a) Relative positions of the centers of 5 spheres that touch one another. (b) Positions of the centers of atomic spheres in adjacent lattice planes.

2.2. New Description of the Electron Cloud of Mg^{2+} Ions

Because of quantum mechanics, the electronic structure of Mg atoms is $[1s^2 2s^2 2p^6]3s^2$. In old quantum mechanics it could only be stated that there are 3 shells, respectively filled by 2, 8 and 2 electrons. Quantum mechanics yields a more detailed description, but allows also to consider that the peripheral electrons are moving on a circular orbit inside the Mg^{2+} ion core. The probability that one electron is situated in a very thin spherical shell of radius r is proportional to r^2 and to the square of the amplitude of the relevant wave functions. They are exponentially decreasing, but the electrons in the 1 s state are so near to the nucleus of charge $Z=12$ when $e=1$, that we can set

$$P_1(r)=\frac{12^3}{2}r^2\exp(-12r) \quad \text{while} \quad P_2(\alpha,r)=\frac{\alpha^5}{4!}r^4\exp(-\alpha r) \tag{1}$$

These probability distributions are normalized for one electron in hydrogen-like atoms. Though the value of alpha is not yet known, we can define the average electron density $\rho(\alpha,r)$ of the Mg^{2+} ion core and its effective charge $Z(\alpha,r)$ at any distance r from is center, by setting

$$\rho(\alpha,r)=2P_1(r)+8P_2(\alpha,r) \tag{2}$$

The functions P_n are probability distributions and $Z(\alpha,r)\to 2$ when $r\to\infty$ for any value of α. To determine this value, we adopt Bohr's model for the peripheral electrons. Figure 3(a) represents the expected radial density $\rho(\alpha,r)$ for the electron cloud of Mg^{2+} ions and the quantized orbit of radius $r=r_3$. Every one of the two orbiting electrons is attracted towards the nucleus according to the effective charge $Z(\alpha,r)$. Since these electrons repel one another and have to be in dynamical equilibrium, we get for every one of them the same equation:

$$\frac{Z(\alpha,r)e^2}{r^2}-\frac{e^2}{(2r)^2}=\frac{mv^2}{r} \tag{3}$$

Coulomb forces are expressed in natural units ($4\pi\varepsilon_o = 1$), while m is the mass of an electrons and v is its orbital velocity. The total energy of this system is defined by the sum of the potential energies of both electrons and their kinetic energies. It can be simplified, because of (3) and Bohr's quantization rule, which is equivalent to de Broglie's and Schrödinger's conditions for stationary waves. Thus

$$2\pi r = n\lambda \quad \text{where} \quad \lambda = \frac{h}{mv} \quad \text{or} \quad 2\pi rmv = nh \quad \text{where} \quad n = 1,2,3,\cdots$$

Since $rmv = n\hbar$, possible quantized energies are

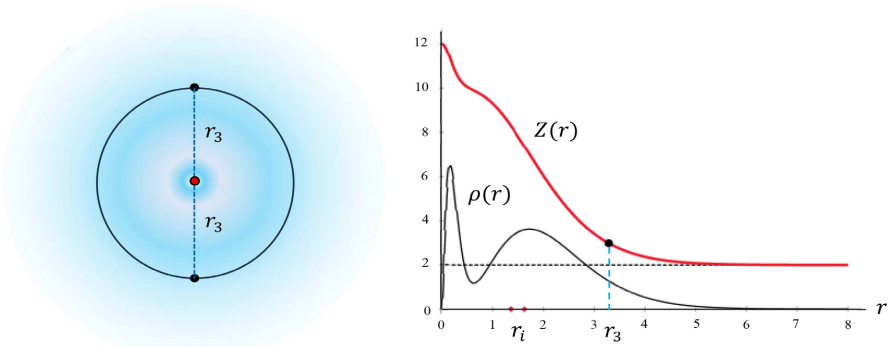
$$E = \frac{-2Z(\alpha,r)e^2}{r} + \frac{e^2}{2r} + mv^2 = -mv^2 = -\frac{n^2}{r^2}\frac{e^2}{a_o} = -B \tag{4}$$

$$a_o = \frac{\hbar^2}{me^2} = 52.918 \text{ pm} \quad \text{and} \quad E_H = \frac{e^2}{a_o} = 27.211 \text{ eV}.$$

In atomic units ($e = m = \hbar = 1$), the Bohr radius $a_o = 1$ and $E_H = 1$ (Hartree). The binding energy B of the electron-pair in the state $n = 3$ is known, since it is the sum of the measured first and second ionization energies of Mg atoms [15]. It follows that $B = 22.6815 \text{ eV} = 0.8335$. Thus

$$Z(\alpha,r) - \frac{1}{4} = \frac{9}{r} \quad \text{and} \quad B = \frac{9}{r^2} \quad \text{or} \quad r_3 = 3.286 \quad \text{and} \quad Z(\alpha,r_3) = 2.989 \tag{5}$$

Because of (1) and (2), we get $\alpha = 2.319$. We can thus determine the radial distribution of the electron density $\rho(r) = \rho(\alpha,r)$ for Mg^{2+} ion cores and their effective charge $Z(\alpha,r) = Z(r)$ for any value of r . **Figure 3(b)** represents these functions and provides the orbital radius $r = r_3$. This value is close to the measured atomic radius $r_o = a/2 \approx 3$. The ionic radius r_i of Mg^{2+} ion cores has been determined by crystallographic measurements for ionic crystals MgX. Since the lattice constants depend then on the chosen type of X atoms, the radius r_i was estimated to be 72 pm [16] or 86 pm [17]. Ion cores are thus strongly compressed in ionic crystals, but not in isolated Mg atoms.



(a) (b)

Figure 3. (a) Model of the electron cloud of Mg^{2+} ion cores and the Bohr orbit of the relevant electron-pair in isolated Mg atoms. (b) Electron density $\rho(r)$ and effective charge $Z(r)$ of the ion core. The black dot results from measurements.

2.3. Improvement of the Thomas-Fermi Model

The computed function $Z(r)$ can be compared with the function that was proposed in 1927 by Thomas and Fermi for the electron cloud of multi-electron atoms. They assumed that the electron cloud can be treated as if it were a gas, where electrons are attracted by the nucleus and repel one another. Screening effects and the Pauli's exclusion principle were also considered, but not the quantum-mechanical shell structures. It turned out that the effective charge $Z(r)$ would then be determined by a universal function $y(x)$, since

$$Z(r) = Z \cdot y\left(\frac{r}{\mu}\right) \quad \text{where} \quad \mu = \frac{0.885}{Z^3} a_o$$

$$y''(x) = \frac{y(x)^{3/2}}{x^{1/3}} \quad \text{with} \quad y(0) = 1 \quad \text{and} \quad y(\infty) = 0 .$$

This differential equation is nonlinear and has thus no analytical solutions. Numerous articles were devoted to solving it by means of series expansions. A table of numerically computed values [18] yields the points of **Figure 4(a)**. Fermi found that $y(x) = 1 - bx$, where $b = 1.588$ when $x \to 0$. This approximation does only determine the line F in **Figure 4(b)**. Majorana succeeded in getting 11 terms for a power expansion, where all coefficients depend only on the value of b. This approximation is represented by the blue curve (M). However, we will need an analytical approximation of the whole curve. It can be defined by setting

$$u(x) = A\mathrm{e}^{-\alpha x} + B\mathrm{e}^{-\beta x} + (1 - A - B)\mathrm{e}^{-\gamma x} = y(x) \quad \text{for} \quad x = 0.5, 1, 2, 3, 4$$

These equations yield $A = 0.377$, $B = 0.484$ and $\alpha = 0.322$, $\beta = 1.195$, $\gamma = 4.337$ and the red curve. Since Mg^{2+} ions contain 10 electrons and a nucleus of greater charge, Fermi's approach would yield the effective charge function

$$Z_F(r) = 2 + 10u(r/\mu) \quad \text{where} \quad \mu = 0.441 a_o .$$

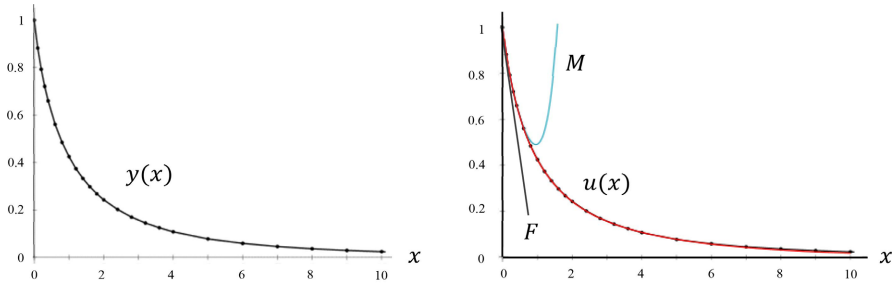


Figure 4. (a) Computed data points for the universal Thomas-Fermi function. (b) Analytical approximations of Fermi (F), Majorana (M) and the new red curve.

Figure 5(a) shows that Fermi's function $Z_F(r)$ decreases more rapidly than the effective charge function $Z(r)$ that we computed by means of Bohr's quantum-mechanical treatment and two measured ionization energies. The function $Z(r)$ is more realistic for Mg atoms, since Landau mentioned that the Thomas-

Fermi model is only adequate for atoms where the number of electrons is neither too small nor too great [19]. For the 37 electrons of neutral Rb atoms, the Fermi model yields adequate average values, indeed, when the shell structure is neglected [19], but not for 12 electrons.

Since the ion cores are spherically symmetric, they behave like point particles of charge $Z(r)$. **Figure 5(b)** represents thus the Coulomb potential $V(R)$ for the mutual repulsion of two Mg^{2+} ion cores when their centers are separated by the distance *R*. However, the ion cores cannot be superposed, because of Pauli's exclusion principle. We account for this effect by means of the Lennard-Jones empirical analysis of the scattering of rare gas atoms. They have also closed shells, but attract one another by the van der Waals force, which results from second order quantum effects. Mg^{2+} ion cores do thus not behave like charged rigid spheres of radius $R_o = a/2 = 3.03$, but as if these spheres were slightly compressible. We get then an additional repulsive term, so that

$$V(R) = \frac{Z^2(R)}{R} \quad \text{and} \quad U(R) \approx V(R) + \left(\frac{R_o}{R}\right)^{12} \tag{6}$$

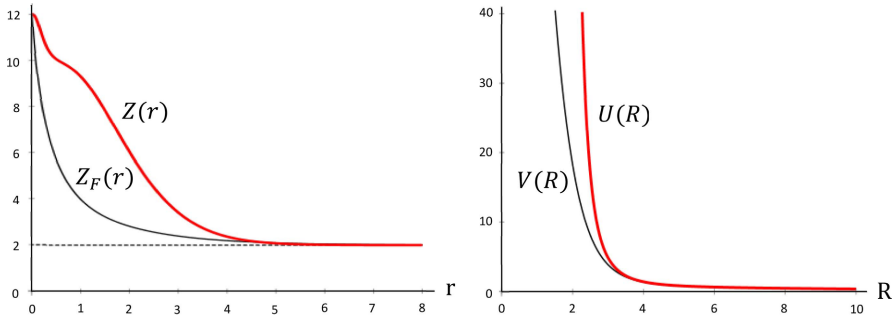


Figure 5. (a) Bohr's model yields a more realistic effective charge distribution for Mg^{2+} ion than the Thomas-Fermi model. (b) The mutual repulsion of Mg^{2+} ion cores is determined by the Coulomb potential $V(R)$ and $U(R)$.

2.4. Strongly Bound Electron-Pairs in a Row of Mg Atoms

Since every magnesium atom contains a weakly bound electron-pair, an infinite row of Mg atoms can be viewed as being constituted of Mg^{2+} ion cores that are bound to one another by intermediate electron-pairs. The orbits of electron-pairs in single Mg atoms are thus displaced and their radius is modified. This treatment of interatomic bonds simplifies wave mechanical ones by generalizing Bohr's model for H_2 molecules. However, every electron-pair is subjected to Coulomb forces exerted by many ion cores and other electron-pairs. **Figure 6** represents a piece of such a row. The red dots represent the centers of Mg^{2+} ion cores and the smaller black dots the positions of electrons at a particular instant. They are orbiting in median planes and constitute strongly bound electron-pairs.

We consider now a particular electron-pair to calculate its orbital radius by

grouping the effects of positive and negative charges inside identical boxes. The orbits are quantized, but all electrons repel one another. They have thus to be separated as much as possible for all neighboring orbits. However, every electron is also attracted by ion cores, according to their effective charge for the relevant separation. Since the charge of the ion cores is notably greater than the charge of protons in H_2 molecules, all electron-pairs will be strongly bound. Moreover, every electron is not only attracted by the closest ion cores, but also by distant ones. To improve convergence, we group point-charges in different boxes on both sides of the selected electron-pair as shown in Figure 6. Such a box will only appear as being electrically neutral at large distances.

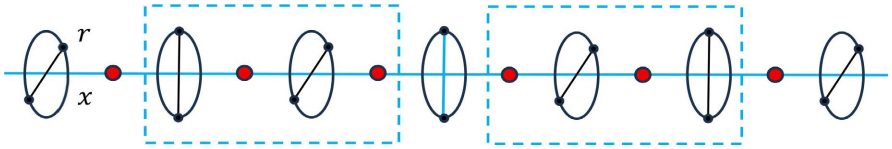


Figure 6. One row of Mg atoms, constituted of ion cores and Bohr's electron-pairs.

The structure of this chain is determined by two parameters: the separation $2x$ of the centers of neighboring ion cores and the orbital radius r of electron-pairs. These values determine the distance d between any pair of charged particles in terms of (x,r) and two integer numbers (u,κ), since

$$d(u,\kappa,x,r)^2=(ux)^2+\kappa r^2 .$$

Using natural (Gauss) units for Coulomb forces and atomic units for distances, the magnitude of the centripetal force exerted on one electron of the central pair is determined by the following expression:

$$F=2r\sum_{s=0}^{N}C(s,x,r)-\frac{1}{4r^2}=\frac{mv^2}{r}=\frac{n^2}{r^3}\quad\text{since}\quad rmv=n\hbar \tag{7}$$

$$C(s,x,r)=\frac{Z\left[d(1+4s,1,x,r)\right]}{d(1+4s,1,x,r)^3}+\frac{Z\left[d(3+4s,1,x,r)\right]}{d(3+4s,1,x,r)^3}-\frac{2}{d(2+4s,2,x,r)^3}-\frac{1}{d(4+4s,4,x,r)^3}$$

These relations determine the radius $r=r_n$ for quantized orbits. Because of the denominators, we get rapid convergence. It is thus sufficient to consider only $N=10$ terms when the required precision is limited to 3 decimals. However, the binding energy of the central electron-pair is

$$E(n,x,r)=\frac{1}{2r}-4\sum_{s=0}^{M}K(s,x,r)+\frac{n^2}{r^2}\quad\text{where} \tag{8}$$

$$K(s,x,r)=\frac{Z\left(d(1+4s,1,x,r)\right)}{d(1+4s,1,x,r)}+\frac{Z\left(d(3+4s,1,x,r)\right)}{d(3+4s,1,x,r)}-\frac{2}{d(2+4s,2,x,r)}-\frac{1}{d(4+4s,0,x,r)}-\frac{1}{d(4+4s,4,x,r)}$$

These denominators yield slower convergence. The value of M is thus very large for a totally perfect chain. This would increase bonding, but there are imperfections. Even for a Mg metal of extremely high purity (99.98%), there would be 2.10^{-4} defects per Mg atom in a cubic volume. Voids, dislocation lines and grain boundaries produce additional lattice defects. For a linear chain in a 3D metal, we can thus only expect intact pieces where $M \approx 10$ on both sides of a particular electron-pair. Since the effective charge of Mg^{2+} ions has been determined by **Figure 5(a)**, we can compute the binding energy for any given value of the quantum number n.

We consider only $n=1$, since all electron-pairs in a single row of Mg atoms should at least to be strongly bound for this value. It results from (8) that the energy $E(1,x,r)=E_1(R)$. This function is represented by the blue curve in **Figure 7(a)**. The chain would collapse ($R \to 0$), but this is prevented by the mutual repulsion of neighboring ion cores, defined by (6). The actual energy $E(R)$ would therefore be represented by the red curve in **Figure 7(a)**. Equilibrium would thus be reached when $R \approx 2.2a_o$. This value is significantly smaller than the separation $a \approx 6a_o$ of neighboring nuclei in *normal* Mg metals, but we are considering another ground state. It would allow for VHTS, since electron-pairs are bosons. For $n=1$, the lattice structure is very compact and the binding energy per electron-pair would be immense, since $B_1 \approx 255E_H = 6.9$ keV.

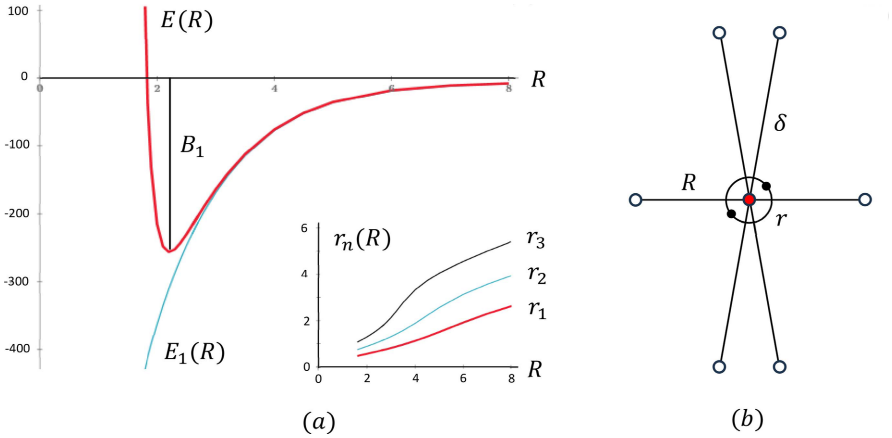


Figure 7. (a) Energy per electron-pair in the ground state of one row of Mg atoms versus the separation *R* of their centers (red curve). Energies and distances are expressed in atomic units. Insert: orbital radius r_n versus *R*. (b) Relative positions of nearest parallel rows and the orbit of the selected electron-pair when *r* is the radius of its orbit.

The potential well implies flexibility, but also strong restoring forces after imposed deformations. The chain can thus be elongated, compressed or bend by applied forces, but it will recover its shape and equilibrium length when these forces are removed. The insert of **Figure 7(a)** represents the dependence of the radius r_n of quantized orbits on the value of *R*, because of (7). At equilibrium, the radius $r_1 \approx 0.7$. This value is very small, because of the attraction exerted by all ion cores. The generalization of Bohr's model has the advantage of providing physical in-

sight and clarifies what is essential for VHTS of Mg metals. They should be very pure and have a nearly perfect lattice structure. For $n = 3$, the electron-pairs will be less strongly bound, but the method of calculation is the same.

In three-dimensional magnesium metals, the selected electron-pair is also subjected to Coulomb forces that are exerted by other rows of Mg atoms. **Figure 7(b)** represents the positions of the 6 closest parallel rows by means of white dots. Their axes are perpendicular to the orbit of the selected electron-pair. We have then to consider 3 structural parameters (r, R and δ). The values of δ is determined by means of **Figure 2(b)**. It is thus possible to evaluate the binding energy per electron-pair in a more precise way, but that is not necessary at this stage. It is more important, indeed, to find out if VHTS is possible or not. This can be experimentally checked by producing thin films. Evaporation and condensation have then to be slow enough to allow for migration and long enough to produce a continuous film instead of islands. However, we can also use already known facts.

3. Unconventional Flying Objects

3.1. Basic Concepts and Facts

When we were asked in 1972 if flying saucers are real, we knew only that newspapers reported in 1954 that "mysterious aerial objects" were often observed in France. That was puzzling, but did cease. Searching for more information, we found the book of Edward Ruppelt [20]. He was an officer of the US Air Force and presented in 1956 a report of his investigations. They seemed to be objective and Ruppelt mentioned even in the foreword that "the report has been difficult to write because it involves something that doesn't officially exist". He introduced the term "Unidentified Flying Object" since his actual task was to explain as much observations as possible in terms of known processes. He found, however, that a remarkable great proportion of observations reported in 1952 could not be attributed to normal causes. His report and other known facts led us to the following conclusions:

There does exist an *unsolved* problem that concerns fundamental and applied science. It calls thus for research.

It is not correct to speak of *Unidentified* Flying Objects, since they have known properties. Any plant, animal or microbe that has been described in terms of its specific appearance and properties, is said to be identified. It does not matter whether we understand the reason or not.

From a purely scientific point of view, UFOs are *Unconventional Flying Objects*. We ignore from where they come, but they have no wings, no tail and no apparent motor or jet engines. These facts are highly remarkable and require a physical explanation. We became thus interested in trying to understand how the propulsion system of UFOs might function.

It allows them to produce lift when they are hovering or rising, without needing the usual pressure difference above and below slightly curved wings. Moreover, they are able to control their motions without any visible parts for flight control.

They can move slowly or very rapidly, display tremendous accelerations and even make right angle turns. Usually, that happens in complete silence. Since their propulsion system does also function in water, there are even *Unconventional Submarine Objects* (USOs). All these facts are of tremendous importance, since humanity has never been faced with this type of phenomena or been conscious of their possible consequences.

Let us try to summarize some events, which are not necessarily familiar to the scientific community. There was a UFO flap over the whole territory of the USA in the summer of l947, but the press was mainly interested in the account of Kenneth Arnold. He was an experienced pilot and saw from his own plane on June 24, 1947 in the State of Washington a row of 9 objects. He could determine their speed by timing and known reference points as being about 1900 km/h. Nothing was able to fly so fast at that time. According to the historian Dolan [21], these objects displayed oscillatory motions like speed boats on rough water or like a saucer would if you skipped it across water. Since round disk-like objects had already been observed in the sky, they were said to be "flying saucers".

That was a pretty and nonfrightening term, but the US Government, secret services and military were concerned by other aspects of this phenomenon. It implied the appearance of intruders with unknown intentions and happened even shortly after the beginning of the Cold War, justified by the "Truman Doctrine of containment of communism". It was officially declared on March 12, 1947 that it should determine US foreign policy. Actually, it had already been the reason for Truman's decision to drop atomic bombs on Hiroshima and Nagasaki on August 6 and 9, 1945. This happened even in spite of the Franck Report [22], where top scientists warned in June 1945 that if an atomic bomb were used against Japan, it would immediately trigger a catastrophic arms race. They proposed therefore to organize a demonstration for representatives of cooperating nations in an uninhabited area and asked for immediate establishment of efficient International Control.

Increasing "red scare" became thus prominent in the summer of 1947, but incidentally or not, there appeared also flying objects of unknown origin over US territory. They have often manifested special interest in nuclear installations [23], but appeared already in 1945 over the Hanford nuclear site, where plutonium bombs were prepared. These objects had outstanding technical capacities. Nevertheless, they were surprisingly vulnerable. The UFO crash near Roswell on July 3, 1947 provided even the opportunity to retrieve one of them. Because of the previous Manhattan Project and the accelerated arms race, it was immediately decided that this crashed UFOs should be retrieved and examined in total secrecy. The aim was to acquire knowledge for the construction of superweapons. General Twining, who was the chief of the headquarters of the *Air Material Command*, recognized on Sept 23, 1947 that "the phenomenon reported is something real and not visionary or fictitious" [24]. He mentioned also that these "flying discs" have unusual "operating characteristics...under high performance conditions".

This context explains why the US Government and the Pentagon mislead the population and the scientific community. Nevertheless, there were civil and military witnesses who described the characteristic properties of discovered material. They are essential for us, since they will allow us to show that UFO propulsion depends on VHTS. There are thus two related problem, which are both of enormous scientific importance, but how were they treated?

Project Sign was created at the end of 1947 to investigate UFO reports. It was inconclusive to preserve secrecy. *Project Grudge*, established in 1949, should even persuade the public that UFOs constitute nothing unusual or extraordinary. The UFO flap of 1952, which included the Washington incidents from July 12 to 29, arose an unprecedented outbreak of media attention. The USAF had already created *Project Blue Book* in March1952 to examine reports of observations. It was headed by Cpt. Edward Ruppelt, who should demonstrate or at least suggest that these observations had no serious implications. He mentioned in his book [20] that a panel of experts had been convened by the hierarchy in January 1953 to pronounce a "judgment on the UFO". This was the so-called Robertson panel. Since Ruppelt had done his job in an honest way, he candidly told that ATIC had received reports since 1947, but estimated that they did only represent about 10 percent of the UFO sightings that were made in the United States. Only 36% of this small sample had been analyzed. Nevertheless, there remained 27% of observations that could not even probably or possibly be identified.

That was not what the Central Intelligence Agency (CIA) and the National Security Council (NSC) wanted. Their creation resulted from the *National Security Act*, established by President Truman on July 29, 1947. It was directly related to the Roswell event of July 3, 1947 and restructured the US military and intelligence agencies. Even a top secret group of experts (called MJ-12) was created for the study of crashed UFOs. The official mission of the Robertson panel was merely to determine if UFOs constitute a threat for national security. Actually, the scientists should agree to the launching of a "public education campaign". It was a program for resolute debunking of UFO observations [25]. Mass media such as television, motion pictures, and popular articles, should present case histories, which had been puzzling at first, but could be explained. Lying and ridiculing citizens was institutionalized [26]. This strategy should be presented as having the stamp of scientific approval.

The members of the Roberton panel did sign a report that proclaimed: "We firmly believe…that there is no evidence that the phenomena indicate a need for the revision of current scientific concepts." To find out if that is true or not is one of the objectives of this article, since we consider that the UFO phenomenon involves VHTS. The CIA wanted to reduce public interest in UFOs, but they continued to appear and people did believe that they are real [27]. Since that could endanger the program of secret retrieval of crashed UFOs and the hope to acquire superweapons for national security by supremacy, the CIA corrected Ruppelt's results. He got a temporary assignment in February 1953 and when he returned a

few months later, his staff was reduced from l0 to 2 collaborators. Ruppelt resigned (Wikipedia, the free encyclopedia). The new chief of Blue Book received 778 reports in 1956, but only 0.02% of them were declared to be unknowns. Though Ruppelt was allowed to write his report, published in 1956, a second version appeared in 1960. It contained 3 added chapters, ending with the statement that UFOs are a myth [28]. The same year, Cpt. Ruppelt died from a "heart attack" at the age of 37. After his death, his wife said that "the Air Force had personally expressed its displeasure to him over his book" [29]. He had thus been subjected to stress, but we cannot exclude more than that, since his honesty could endanger Secret Services.

The greatest risk for their program of concealment was, of course, that independent scientists might begin to study the UFO phenomenon. The USAF organized thus in 1968 a so-called *Scientific Study of Unidentified Flying Objects*, headed by Professor Edward Condon. This renowned specialist of quantum mechanics had lost his security clearance during World War II. General Groves who directed the Manhattan project suspected, indeed, that he might communicate atomic secrets to communist scientists (Wikipedia). Condon had thus a motivation to restore his credibility in regard to military secrets, but could also be convinced himself that UFOs are merely products of imagination. Anyway, he declared already in 1969 that the study of the UFO phenomenon should not be left to pseudo-science organizations [30]. They were merely private organizations that did collect information, but that was hindering indoctrination.

Condon's essential mission was to dissuade scientists from engaging in research on the real nature of UFOs. He wrote therefore already on page l of his report [31]: "Careful consideration of the record as it is available to us leads us to conclude that further extensive study of UFOs probably cannot be justified in the expectation that science will be advanced thereby". These formulations seem to be prudent, but recognize that Condon could not guarantee that his statements were definitely valid. Nevertheless, he insisted: "UFO phenomena do not offer a fruitful field in which to look for major scientific discoveries." For the USAF, scientific curiosity had to be quenched by making it academically unserious. It would then even jeopardize careers. The USAF invested over 500,000$ to reach this goal [32]. Some scientists, who had been engaged for Condon's study discovered even documents, proving that the contract was already biased when it started [33].

It is also noteworthy that Congressman Steve Schiff of New Mexico was asked in the 1990th by residents of his state if he could find out what happened at Roswell in 1947. He tried, but was "pretty upset" by the lack of responsiveness of the Defense Department. His position allowed him to ask the United States General Accounting Office to search for documents concerning the Roswell mystery. In 1995, the press reported the stunning answer: "The Roswell base's administrative records from March 1945 through December 1949 and its outgoing messages from October 1946 through December 1949 were destroyed. Senator Schiff commented: "My understanding is that these were permanent records which should not have

been destroyed" [34]. The USAF presented then a new unbelievable theory under the significant title: *The Roswell Report*: *Case Closed*.

3.2. On the Nature of UAPs and the Evolution of Physical Theories

Those who were merely preoccupied by concealment knew that the choice of words does orient thinking. It was thus decided that the term Unidentified Flying Object (UFO) should be replaced by Unidentified Aerial Phenomena (UAP). Instead of considering technological objects, people should believe that what had been observed could be ball lightning, for instance. It is true that ball lightning is also an intriguing luminous phenomenon, but it is plasma. It can appear at ground level in partially ionized air or water and has then a well-defined shape. It can be ball-like or cylindrical, but the real mystery is its surprisingly long lifetime. Since it contains electrons and positive ions, light emission results from recombination processes, but why do they not lead to rapid extinction? We solved this puzzle by considering plasma oscillations [35]. They are possible in a membrane, where all electrons oscillate together with respect to the heavier ions. Since the external surface is then alternatively positive and negative, this allows to extract electrons and positive ions from the ambient medium. It does even amplify the collective oscillations of electrons, because of a special nonlinear effect. Ball lightning does actually move by being attracted towards higher densities of charged particles. If there are not enough or too much of them, this will respectively lead to silent extinction or violent explosion.

Another type of luminous plasma entities can appear in the *thermosphere*. It extends from about 100 to 1000 km above the Earth, where air density is so low that oxygen molecules are dissociated by solar radiation. This leads to thermal agitation and ionization. Electrons and positive ions can even constitute luminous *plasmoids*. They have no stable form and survive only during short time intervals. These effects result from complicated processes, involving the magnetic field of the Earth and EM fields, generated by the moving charged particles. Localized, fleeting luminosities have been observed from inside the International Space Station, circulating at about 400 km above sea level. This phenomenon was extensively documented by Rhawn Joseph and collaborators [36] [37]. They raised questions and advanced several hypotheses. They believe even that "it is highly likely that plasmas and plasmoids account for many…observations of UAPs over the centuries." They recognized, however, that "plasmoids cannot account for all UAP sightings, at least some of which may be extraterrestrial spacecraft from other worlds". These declarations call for some comments.

The UFO phenomenon concerns material objects, but occasional ambiguities are not excluded. We are therefore glad that plasmoids could account for some rare, but puzzling observations. The book of Allen Hynek and Jacques Valée [38] provides an excellent overview of different types of observations, but insists on unexplained aspects. The introduction states, for instance, that some UFOs "can change shape before your eyes". They can even suddenly "materialize" or seem to "melt". Obser-

vations of this type merit more detailed studies, especially in regard to the estimated altitude. It is also true that there are so-called "psychic effects" which might be related to the UFO phenomenon. Perhaps, they are caused by aliens to test our reactions and should thus also be examined. However, this book did mainly present evidence of physically real UFOs. They have well-defined shapes and peculiar properties, but the conclusion was that "we stand at the edge of reality".

The authors explained that this does not mean that reality is comparable to a plate or geometrical figure with a boundary, but that *our knowledge of reality* is limited. "Beyond this edge is another science and another knowledge." We fully agree. That is even notoriously true for scientific theories. Since Newtonian mechanics was logically coherent and experimentally confirmed, it was assumed that it can be extrapolated *ad infinitum*, but it is only valid in a limited domain. It is an approximation of more general theories: quantum mechanics and the theory of relativity. The basic reason was the discovery of two universal constants: the light velocity c and Planck's constant h. They are respectively very great and very small, but in classical mechanics it had been implicitly assumed that $c=\infty$ and $h=0$. Galilei and Newton were not aware of the existence of these constants and their finite values. Fortunately, their postulates or principles were valid in a large domain. Nevertheless, it was limited with unsharp transitions from the initial to new theories.

This situation is comparable to the fact that we can see what is around us up to the horizon. This domain is limited, since we are living on planet, but a higher standpoint is not excluded. There does also exist a "mental horizon" and there could be unsuspected realities beyond this limit, but also some still unclear signs of it. It is the duty of scientists to pay attention to such signs, since their task is to explore reality as it is and not as we may wish.

Because of the past evolution of physics, we wondered if it is possible to generalize relativistic quantum mechanics by considering a third restriction on possible results of measurements. At present, we assume that space-time is continuous, but there could exist a limit a for the smallest measurable length and a limit a/c for the smallest measurable time interval. The "quantum of length" has to be extremely small, but could be finite. It has then to be a universal constant. We developed thus a theory of "Space-Time Quantization", which takes into account the existence of three universal constants (c, h and a). It concerns the foundations of physics [39] since it explains why all possible elementary particles can be distinguished from one another [40]. They are merely points, but are characterized by quantum numbers, which can only be justified when $a\neq 0$. This generalization concerns also the nature of dark matter.

Initially, we became interested in UFOs since they are observable, but enigmatic. They could be signs of something that is situated beyond our present mental horizon. We tried therefore to see what was not yet clearly perceptible, but had been reported without trying to understand it by means of established physical theories and rational reasoning. Not only the results, but also the way to get there might be useful.

3.3. UFO Propulsion Requires VHTS

Numerous observations were made by trustable witnesses and sometimes confirmed by instrumental means, in spite of great efforts to hide the truth. We tried to decode these messages by concentrating on data concerning the mysterious propulsion system. The first hint was that UFOs were often seen to produce pulsating lights. This requires low frequencies, but higher ones are also possible. Surrounding air seems then to be continuously luminous and very brilliant. The size and shape of observed UFOs is variable, but until about 1970, there were two preferred forms: disc-like or cigar-like objects. Both of them have a symmetry axis. Spherical UFOs have also been observed, but their internal structure could be horizontally layered and thus define a symmetry axis. Moreover, it had been reported quite often that UFOs can produce so-called "electromagnetic effects". That meant that lights of cars and radio communications could be shutoff. Car engines ceased to function and sometimes the car was even levitated and transported without touching the road, as long as a UFO stayed above its roof. These facts require an explanation. Some theories had already been proposed, but we realized that none of them was physically acceptable.

This led to our first publication on this subject [41]. Our objective was merely to show that the problem of UFO propulsion can be tackled by normal scientific methods. The basic idea was that UFOs have to act on something else to produce a reaction force. This is possible when UFOs ionize surrounding air, since they could then exert forces on the resulting charged particles. It was then necessary, however, that UFOs produce an electric *and* a magnetic field to exert forces on electrons and ions that are oriented the same way. These fields can oscillate, but the magnetic field has to be very strong. Trying to find out if such a propulsion system is realistic or not, we found that pilots were stunned when they saw that the needle of the magnetic compass was rotating when a UFO did accompany their plane. Rotations, instead of simple inversions were astonishing, but we could experimentally reproduce this effect and then explain that it results from a nonlinear effect [42]. We continued thus to search useful information.

This led to 3 communications at the *Progress in Electromagnetics Research Symposium* (PIERS) of 2012 in Moscow. The first one [43] established the basic theory. It required only the assumption that the smooth surface of UFOs is made of a superconducting material. We ignored how the needed VHTS could be achieved, but this hypothesis was sufficient to verify if it is logically acceptable or not. To avoid secondary complications, we considered a sphere. It allows for an analytical treatment in spherical coordinates. The surface current density $\boldsymbol{J}$ could then be proportional to $\sin(\theta)$, where θ is the polar angle for a vertical axis. **Figure 8(a)** shows some flow lines to indicate that their intensity is maximal at the equator and does vanish at the poles. The shadowing suggests its continuous variation. Direct currents would produce a static magnetic field $\boldsymbol{B}$, but only outside the sphere because of the Meissner effect. If the current density $\boldsymbol{J}$ were oscillating at some low angular frequency ω, is would also produce an induced

electric field $\boldsymbol{E}$. This results from Faraday's law, discovered already in 1831.

It followed thus from well-known physical laws that when a current density $\boldsymbol{J}$ is flowing on the surface of a spherical UFO and is oscillating, it will not only produce an oscillating magnetic field, but also an oscillating electric field. Figure 8(b) shows that the magnetic field $\boldsymbol{B}$ is a vector that is situated in a meridional plane and has two components (B_r and B_θ).

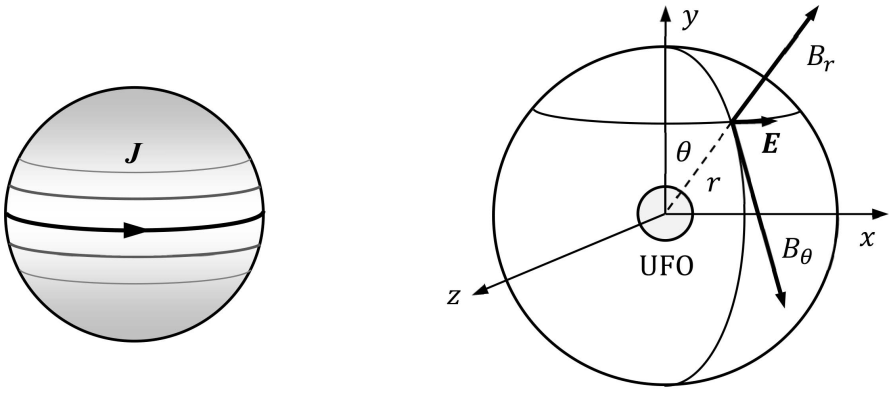


Figure 8. (a) Sphere with a superconducting surface material and a current density $\boldsymbol{J}$ around a vertical symmetry axis. (b) Components of the resulting magnetic field $\boldsymbol{B}$ and the induced electric field $\boldsymbol{E}$ when the current density $\boldsymbol{J}$ is oscillating.

The vector $\boldsymbol{B}$ is great, while the induced electric field $\boldsymbol{E}$ is small. We can even be more specific.

The value of M is the magnetic moment of a minute current loop that would be situated at the center of the UFO, but produce the same effects outside this sphere as the oscillating current on its surface. We are accustomed to *electromagnetic* (EM) fields, resulting from oscillating electric dipoles, but *magnetoelectric* (ME) fields are also possible.

This model can be generalized for prolate and oblate ellipsoids and even for disc-like UFOs with a rim to increase the equatorial current density. Cylindrical or cigar-like UFOs would allow for strong circular currents around the whole length of the symmetry axis. It creates a more intense ME field, needed for greater UFOs that might harbor smaller ones. However, for our purpose it was sufficient to consider a sphere and to assume that its external surface is made of some superconducting material. When a particle of electric charge $\pm q$ is moving at a velocity $\boldsymbol{v}$ and is subjected to an electric field $\boldsymbol{E}$ and a magnetic field $\boldsymbol{B}$, they exert on this particle the so-called Lorentz force. It is defined by

$$\boldsymbol{F} = \pm q\left(\boldsymbol{E} + \boldsymbol{v}\times\boldsymbol{B}\right) + \cdots \approx q^2\eta\left(\boldsymbol{E}\times\boldsymbol{B}\right) \tag{9}$$

The symbol × indicates that we have to consider the vector product. It yields another vector, which is perpendicular to the vectors $\boldsymbol{v}$ and $\boldsymbol{B}$. It has also a well-defined orientation (right hand rule). The added force accounts for friction. The magnetic field has to be more intense than the induced electric field to get a

magnetoelectric (ME) field that oscillates at low frequencies. More familiar electromagnetic (EM) fields require a sufficiently high frequency, since they result from Maxwell's equations. They are produced by an oscillating electric dipole, instead of an oscillating magnetic dipole. We ignored how extremely intense magnetic fields might be produced. However, it followed from (10) that when particles of charge $\pm q$ are suddenly created by ionization, they are instantly set in spiraling motion by the Lorentz force. They are slowed down by collisions and the charged particles will progressively disappear by recombination, but the resulting equation can be solved. The result is equivalent to a simpler law, which accounts for the fact that the average velocity $\boldsymbol{v}$ is proportional to $\pm q\boldsymbol{E}$. The force $\boldsymbol{F}$ is therefore proportional to q^2, while η depend on possible collisions of the charged particles and their lifetime. Since electrons are more easily accelerated than positive ions, they could usually be sufficient for UFO propulsion, but positive ions can also be set in motion by a more intense ME field. This would increase the total propulsive force. Such a propulsion system would function in water as well as in air, but we have to face another problem.

Figure 9 shows (in black) the orientations of the forces $\boldsymbol{F}$ exerted on charged particles at selected points, if these particles were created there at the same instant. These forces would be opposite above and below, as well as on the right and left side of the object. However, it is sufficient to ionize the surrounding medium in an alternative way above and below the UFO, to double the lift force because of reversed forces (indicated in green). This is also true for horizontal motions. Since the UFO is always subjected to the total reaction force, we get an extremely flexible and efficient propulsion system by combining the global oscillating ME field with adequately oriented and pulsed beams of ionizing radiation. This reasoning was confirmed by observations where UFOs produced light that was pulsed at low frequencies. The light sources seemed to go on and off. This was often interpreted as being due to sequentially illuminated portholes or assumed to be due to a rotating object. Actually, it does optimize the forces exerted on charged particles during their whole lifetime. At more than about 24 images per second, the light pulses cannot be resolved anymore by human eyes. The color of the emitted light depends on its spectral composition and was sometimes described as being very beautiful.

This model is adequate to account for all motions, when we consider that these objects emit beams of ionizing radiation of modifiable orientation. This assumption is justified by the fact that USOs were sometimes instrumentally observed to move at incredibly high speeds. There are even cases where beams of rotating lights were seen at sea [44]. The luminous trace is then curved, since the light emitting particles are increasingly slowed down at greater distances. UFOs reduce friction of the surrounding fluid and do not produce a sonic boom, since the solid body is not in contact with motionless air. The fluid is deviated in front of the object. However, UFOs can abruptly change their direction of motion, since previous motion will then be rapidly stopped by friction.

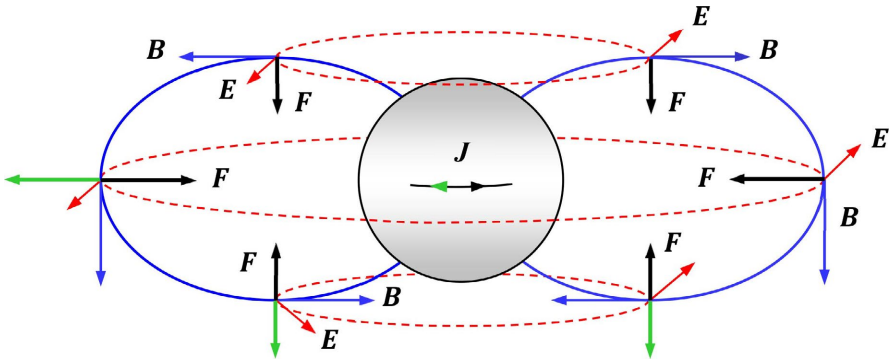


Figure 9. Representation of the magnetoelectric propulsion system for a spherical UFO with a superconducting surface material. Beams of ionizing or polarizing radiation are pulsed, but always alternatively for opposite directions.

We mentioned in Moscow two cases that did also confirm the proposed theory, because of remarkable mechanical effects on great water surfaces. The second communication [45] concerned evidence of magnetic effects of UFOs. They included the rotation of compass needles and Ray Stanford had even made magnetometer measurements. They revealed that the magnetic field is oscillating at low frequencies, which are easily modified. The third communication [46] detailed the proposed theory in terms of the vector potential, which determines the magnetic field outside the UFO with a small penetration depth in the superconductive surface material. It appeared that this magnetoelectric field constitutes itself a harmonic oscillator that has no resonance frequency like LC circuits. The mechanism is different, since magnetic and electric energy densities are converted everywhere into one another and not separately in a self and a capacity. The energy of the spatially distributed ME field can therefore be huge, but has to be controlled from inside the craft by means of an LC circuit. This clever and highly efficient system has a drawback, that we noted because of the following event.

3.4. The First Documented Case of a UFO Crash and Its Cause

Since UFO phenomena do not belong to the usual repertoire of scientists, observations that were made by witnesses may be viewed as being merely "anecdotal evidence". That is already better than no evidence at all. It is also used in courts of justice, but requires a rational analysis of data from different sources. Here is an example of such a case.

Reverend William Huffman, Baptist pastor of Cape Girardeau, Missouri, was asked in the evening of April 22, 1941 to accompany his neighbor to a rural place. As Justice of Peace, he had been informed that a terrifying fireball was sighted near a farm. He thought that it had to be a plane crash and that the pastor could administer last rites. They rode together, but had to walk to the farmhouse where the accident had happened. Firemen and other persons were already there and a newspaper man took photos with a flash. Instead of a crashed plane, there was indeed a strange disc-like object. It had a smooth and seamless metallic surface, but a gap allowed to see a small chair at the command post. Numerous grayish-

silver debris were also signs of an explosion. Searching the pilot and other occupants, the pastor found 3 dead victims outside the craft. They looked like children, since they were only about 120 cm tall, but they had a grayish skin, a big head and long arms. Moreover, they were unusually slender and did wear tight-fitting silver-gray flight suits. The most remarkable feature was that they had very great eyes. These beings were not injured, but dead or dying. The pastor was deeply shocked, since they were not human, but he did what he came for, as if they were human beings.

Suddenly, a group of uniformed members of the US Army appeared on the scene. They came in trucks and several automobiles. They took immediately over, as if they had been prepared for such a case. An officer said to all witnesses that "this is a matter of national security". He declared in a harsh and commanding tone: "This did not happen, do you understand? You are to turn over all evidence of this incident, and never speak about it again to anyone, at any time." He added: "Give us all of that debris and step away from those bodies. Our orders are to take all physical evidence and reports from this area, and to have your patriotic assurances you'll remain silent for the good of our country". Though none of the witnesses had ever heard anything about UFOs, the orders came from some unknown authority, which knew that such a crash is possible and how to handle it.

The whole area was rapidly secured to prevent the arrival of more people. Reverend Huffman was isolated and "commanded to keep his mouth shut forever". All other witnesses were treated in the same way before they had to leave. Any piece of the debris, taken as souvenir, was confiscated and reports in journals were strictly forbidden "for patriotic reasons". The recovery of the craft, all metal pieces and the humanoid beings occurred then in complete secrecy. When the Preacher Huffman came home, he was awaited by his family. His wife Floy and his 24- and 22-year-old sons were worrying, since "his face was different". They insisted to tell them what made this accident so terrible. Eventually, he told them what he had seen, but insisted on keeping the secret. He passed away in l959 and never spoke of this incident again, but his family knew that he got a photograph from Fronabarger. He was a friend and an experienced press photographer. The film cassette of his normal camera had been seized, but he had also a small camera that he kept in his shirt pocket. He developed the film and offered one print to the Pastor, since he might want to keep it.

This summary of the strange incident is based on the books of Dudding [47] and Smith [48]. Important complementary information can be found in a book of Rayan Wood [49]. It reports 104 cases of UFO crashes and provides data that was leaked by whistleblowers and then carefully checked. In the present case, we are indebted to Charlette Mann, the granddaughter of William Huffman and his wife Floy. Her grandma had cancer and was on her deathbed in 1984 when Charlette tried to convince her that it was important to tell what happened many years ago. This was not easy, since she was still convinced that she had to preserve the secret. Floy did eventually agree to tell what she heard. This lasted several days, to get

more details and to verify consistency. Every evening, Charlette wrote down what she was told. The retrieved object was disc-shaped and "there was fire around it, but none of the entities has been burned and so grandfather did pray over them, giving them last rites".

Charlotte Mann knew that her father, Guy Huffman, had inherited the photograph and she had seen it on several occasions. It was so extraordinary that she memorized all details. The print showed "two police officers, and a dead alien being held between them". It was upright and only about 1.20 m tall, but the horizontally held arms were very long. Her drawing of this picture [50] reproduced also the head of the alien. It had unforgettable great and slanted eyes. There were barely traces of nose and mouth. Ryan Wood's article [51] concerning his own investigations on this important case tells us that Walter Fisk had borrowed the photographic document, but did not give it back. He refused also to hand it over to other investigators. That is suspicious, of course, since the intervention of the military at the crash site revealed already that they wanted to leave no trace or possible proof.

Rayan Wood mentioned also in his book [39] that the recovery team came from the Sikeston-based Missouri Institute of Aeronautics. It was merely situated at about 30 km from the crash site and a major flight training center at that time. There was even "a large contingent of British flight instructors". We have now to situate this fact in the context of the development of radar technologies [52]. The American SCR-270 radar did produce microwaves by means of two triodes, mounted as a push-pull resonator, but England had developed the 100 times more powerful *magnetron*. The British Tizzard Mission brought one to America in the Summer of 1940 to promote collaboration. Since England was under fierce aerial attack, Churchill wanted the aid of the USA as a powerful ally against Nazi Germany. It is therefore very probable that this type of radar was tested at the Institute of Sikeston in the Spring of 1941 and that it had detected the Cape Girardeau UFO.

It should be noted that the SCR-270 radar was already very efficient. It had been installed before the Pearl Harbor attack on the highest point at the northern tip of Oahu Island in the Pacific Ocean. On December 7, l941, it detected a great number of aircraft at a distance of 210 km. The operators never saw such a large formation on their screens and the supervising officer did not believe that the images were real. Unfortunately, he did not warn the US fleet on this island of a possible danger. The attack of Japanese planes began there 55 minutes later. Since the magnetron allowed for more powerful radar beams, it is logic that the new radar system was tested and already operational at Sikeston on April 21, 1941. The rapid intervention of the military and the fact that they had been given orders on what should be done is also significant. It confirms that UFO crash and recovery operations had already occurred, as mentioned by President Roosevelt [53].

It is now absolutely necessary to explain why UFOs can "fall from the sky". This results from the fact that the global ME field of UFOs constitutes itself an oscillator

and that its frequency is regulated from inside the craft. This implies that it is also possible to impose another frequency of oscillations from the outside. The global ME field of UFOs can oscillate at extra low frequencies (1 - 20 Hz), but also at higher frequencies. Radars operate with beams of EM waves at microwave frequencies (300 MHz - 300 GHz). They are pulsed at a relatively low frequency (300 - 500 Hz) to allow for detection of return signals. The oscillations of the ME field of UFOs can thus be perturbed, even by submultiples of this frequency. Since the beams of ionizing radiation emitted by the UFO have to be pulsed in a precisely matched way, their propulsion system can be deregulated by radar beams and cause crashes.

The answer was not retaliation, but a modification of the external form of UFOs. The flat underside of triangular or quadrilateral platforms did deviate radar beams. We were personally involved in establishing facts for the Belgian wave [54]. We interviewed several times both gendarmes who were very surprised when they saw 3 extremely luminous light beams shortly after sunset. These beams had sharp boundaries and illuminated a meadow. When the gendarmes parked their vehicle at the side of the road, the closest bright cercle was only separated from them by about 20 m. Then they realized that the light beams came from an object, hovering at about 120 m above the ground. We drew **Figure 10** according to the description of Hubert von Montigny. This was not a plasmoid, of course. Since the gendarmes thought that this object had to be a helicopter, they were stunned when they opened the window, since it was hovering in complete silence.

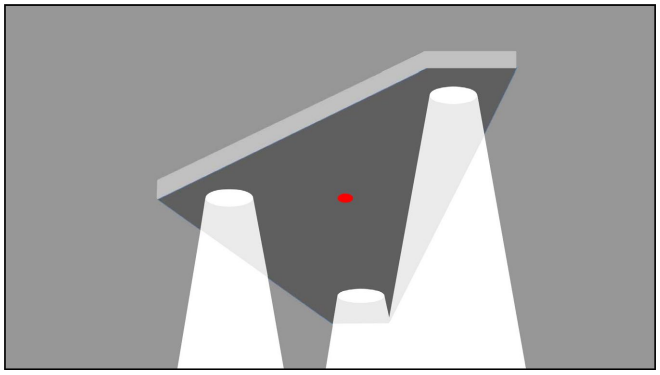


Figure 10. The triangular UFO and its luminous beams that the gendarmes von Montigny and Nicoll discovered near Eupen on November 29, 1989.

Since they had never seen or heard news about anything like that, they assumed that it was a new type of military contraptions. When it began to move, they drove rapidly in the same direction to observe its overflight, but it turned in midair by 180˚ and flew towards Eupen. The gendarmes followed and observed it from a parallel, but higher way. The strange object was also seen by other witnesses and few over Eupen's town hall, before turning towards the Gileppe barrage. It remained there stationary above an illuminated 78 m high tower and the gendarmes

continued to observe this object from a high position. They saw that it emitted two horizontal light beams at regular intervals. They were even clearly visible at a distance of about 4 km and their length was progressively modified. Then they were extinguished and the same procedure was repeated. This "show" lasted about one hour. From the beginning to the departure of this strange object, the gendarmes did observe it for about 2 hours, with only a short interruption to convince the dispatching colleague that this was not a joke [55].

Lack of space does not allow us to provide here more details on the light beams, but we know at present that they were *magnetoelectric* waves. Since numerous observation continued to be made, we wanted to find out what appeared on civil and military radar in Belgium. We got extensive access to all of them. However, no UFOs were detected by radar during the Belgian wave, with one very remarkable exception. During the flight of the F-16 jets, which had been scrambled to investigate unusual luminous effects, both military radar system detected a UFO in a consistent way, but with great difficulty. The nearby antenna of the national airport did not detect it at all. We found also that airborne and ground radar detected a rare weather phenomenon [56]. Triangular UFOs have also been observed elsewhere in the world [57], but only the Belgian wave did reveal that they were a simple, but astonishingly rapid response to powerful radar beams, causing UFO crashes. However, they provide also a proof of the proposed propulsion system and therefore of VHTS.

3.5. Extraordinary Properties of UFO Material

After the observation of Kenneth Arnold on June 24, 1947 there appeared many flying saucers over USA territory and also in New Mexico, which harbors especially important military installations. They had thus to be protected by powerful radars. White Sands got in 1946 two SCR-584 tacking radar systems [58]. They had a research mode that operated up to 70 km. Planes and missiles could even be automatically tracked up to 32 km. UFOs were of topmost interest, since they were intruding US air space. The Eglin Air Force Base at Valparaiso, Indiana, had also a powerful radar for the First Experimental Guided Missile Group. All radar beams could focus on a particular UFO and cause their crash. The most famous one occurred near Roswell, but the truth was concealed for 33 years. It was then extensively investigated, for instance by Carey and Schmitt [59]. We provide more details on this event, since it provided information on properties UFO materials that were related to VHTS.

The sheep herder Mack Brazel of the Foster ranch discovered on Thursday July 3, 1947 a great number of small debris of various types, spread over a trapezoidal area. It was about 900 m long and 60 to 90 m wide. There was also a 120 - 150 m long gouge, indicating that a flying object had touched the ground and then raised again. However, some materials had been scraped off its underside. Brazel was astonished that there were also pieces of very thin sheets of a gray metal, which could not be torn in smaller pieces. They were *very light*, *but extremely tough*.

Nevertheless, they could easily be wrinkled in one hand, but when it was opened, they did immediately recover their initial form. This material had thus *shape memory*.

Brazell showed some samples of this amazing material to his neighbors. They were also puzzled, since this metal was "thin like tinfoil in a pack of cigarettes and weighed practically nothing, but you could not tear or cut it. It was possible to flex this stuff back and forth, but you could not put a crease in it that would stay, nor could you dent it." It was something that no one had ever seen, but even without any chemical analysis, it was obvious that it had unusual properties. On Saturday, July 5, Brazel drove to Corona, situated at about 50 km north west of the foster ranch. He heard there that he might get a reward if these pieces of an unknown metal did belong to a flying saucer.

On Sunday July 6, he drove to Roswell, situated at about 120 km, south-west of his home. He had a box of debris and was advised to show this material to the county Sheriff. He informed Major Jesse Marcel, the Intelligence Officer of the Roswell Army Air Field (RAAF). He came over and went back to present the mysterious debris to Col. Blanchard, the commanding officer of this basis. It was the only one where superfortress bombers were stationed and ready to drop nuclear bombs, as they had already done in Japan. The Colonel ordered Jesse Marcel to drive to the debris field. Marcel asked Cpt. Cavitt of the Counter-Intelligence Corps to accompany him in another car. They spent the whole Monday with examining and collecting various types of pieces. Late in the evening, Jesse Marcel showed some of them to his family. According to his son, who became a medical doctor of the USAF, he was convinced that they were part of a flying saucer.

On Tuesday morning, there was a gathering in Col. Blanchard's office. It ended with the decision that Lt. Walter Haut, the Public Information Officer of the Air Field should issue a press release. The Roswell Daily Record published it on June 8, under the title: "RAAF Captures Flying Saucer on Ranch in Roswell Region". That was exaggerated, since there were only debris. Moreover, when the Roswell news station started to inform other press agencies, teletype transmissions were suddenly interrupted with the message: This is the FBI. Do not transmit this message. Stop communication immediately! At a higher level, it had thus been decided that this matter had now to be treated in another way. It is logical, indeed, that radar had not only detected the flying object, but also its disappearance. However, it took time to locate the crashed object and to be sure that no one had found it or could not be intimidated enough to keep silent. Since the pentagon and president Truman wanted to retrieve the wreckage in total secrecy, it was necessary to keep civil witnesses away from it.

As soon as the object had been found, Col. Blanchard was ordered by Gen. Ramey, Commander of the 8th Air Force, to issue a new version: the debris were now attributed to a weather balloon. That was impossible for local farmers, since they had often seen balloons that fell on the ground, but all retrieved material was

brought to the RAAF. From there, it was immediately flown to the Fort Worth Army Air Field for thorough analysis. Even the debris field was completely cleaned to leave no material proof. Many armed MP were rapidly sent to secure it and even instructed to shoot trespassers. The "troops spent more than two days picking up every last trace in the pasture, finishing with industrial vacuum cleaners". All pieces that farmers had retained as souvenir were also confiscated. A press conference was organized on June 8 by Brig. Gen. Ramey and his chief of staff Col. DuBose. While the general went with Jesse Marcel to the map room and asked him to locate the debris field, the real pieces were replaced in another room by ripped parts of a weather balloon. An often-shown photo was taken of Jesse Marcel, holding in his hand a large piece of a normal weather balloon. General Ramey had told him to say nothing. He followed orders and in December 1947, he was promoted lieutenant colonel [60]. Though the American press and the whole Nation were misled, truth cannot remain hidden forever when many witnesses were involved.

In 1980, Berlitz and Moore published a book that contained already a great amount of relevant data [61]. The actual investigator was William Moore, who did even interview Major Jesse Marcel in 1979. He was the most important witness, of course. The nuclear physicist Stanton Friedmann, who had taken the decision to work full-time on clarifying the UFO problem, did locate this officer. He was a top specialist and had very carefully examined the debris. He said: "I didn't know what it was, but it certainly wasn't anything built by us and it most certainly wasn't any weather balloon." He declared also to Leonard Stringfield and Bob Pratt [62] that "he was certain they were not from a balloon, aircraft, or rocket…I still believe it was nothing that came from Earth".

The Information officer Walter Haut consigned in 2002 a sealed affidavit, to be opened only after his death [63]. He certified that Col. Blanchard knew already on Tuesday morning, that the UFO did crash at a site that was situated at about 65 km north of Roswell. The plan, originating from the pentagon, was that attention needed to be diverted from this critical site. Col. Blanchard did even dictate himself the press release and somewhat later, he led Walter Haut to a hangar to show him "the object just recovered north of town... It was about 4 m in length and 1.5 m high, but egg shaped. The surface did appear metallic. No windows, portholes, wings, tail sections, or landing gear was visible." He saw also about 120 cm tall bodies of dead beings.

According to Randle and Schmitt [64], there were at least 3 dead aliens and a living one on the final crash site. These beings were skinny, with large heads and big oblique eyes. Autopsies of these humanoid beings, called *Extraterrestrial Biological Entities* (EBE) by the military, were performed at the RAAF. Other alien beings had already been discovered by Dee proctor, the son of Brazel's neighbor. He rode often with Mack Brazel and had probably been searching the craft, since it did only touch the ground. He told his friend that he had discovered bodies a few kilometers away. When Mack Brazel spoke on telephone with the announcer

of KGFL radio station on Monday 6, he was still profoundly traumatized by what he saw. He felt compassion with these "unfortunate little creatures", but was horrified since "they're not human!" We conclude that the bottom of the craft had been opened by the violent impact and sliding on the ground and that some occupants fell through this opening. The military did also discover them and brought these corpses to the RAAF.

It is very important to realize that the metal pieces found on the debris field were still in their superconducting state. This was the cause of their special properties, associated with VHTS. It does not have to be magnesium, but was characterized by a potential well, similar to that of **Figure 7(a)**. It is also essential to know that this UFO exploded. This results from another discovery, made by the New Mexico meteor expert Dr. La Paz. This scientist was hired by the USAF in September 1947 to determine the final speed and trajectory of the aerial object. That was not possible by radar, since it cannot detect what happens close to the ground and a fast-moving UFO could have bounced once more, as it did on the debris field. This happened, indeed.

La Paz was accompanied by Master Sgt. Rickett, who belonged to Cavitt's team and revealed later that they found there pieces of the same appearance as on the debris field, situated at about 8 km. However, they were startled that "the sand in this high-desert terrain had crystallized". This had to result from exposure to tremendous heat, since sand does only melt at 1700˚C. Because of our concept of VHTS, we deduce from this fact that the UFO pilots attempted to escape by increasing the intensity of the surface current. But when the applied electric field is too high, electron-pairs are dissociated. This led to instantaneous appearance of electric resistance, causing heating and the fatal explosion. We are thus led to conclude 1) that VHTS was at least possible up to 1700˚C for this material and 2) that it was not anymore in its superconducting state at the place where this UFO was retrieved.

Military scientists could thus identify this material, without becoming aware of its previous VHTS and its importance for UFO propulsion. Even moderate heigh temperature superconductivity was not yet known in 1947. General Nathan Twinning, who directed the Air Materials Command at Wright Field where this craft was immediately scrutinized, wrote already on 16 July 1947 a report to Headquarters Army Airforce [24]. The General mentioned that "the aircraft recovered by the army and air force units…is a circular, disc-shaped platform design". It has no "external propulsion system, power plant, intake, exhaust either for propeller or jet propulsion". However, "upon examination of the interior of the craft, a compartment exhibiting a *possible atomic engine* was discovered". In 1947, it was not yet possible to conceive a more sophisticated energy source. This document has been leaked. Some words were unreadable in the hastily copied document, but Leonard Stringfield's status report VII provides a retyped version [65]. To keep this article as short as possible, we will discuss the functioning of this energy source in another paper. However, we stress already that a new and very efficient

energy source is also for humanity of enormous importance.

It is now necessary to provide more information on the properties of materials found on the debris field, since they resulted from VHTS. Loretta Proctor, one of Brazel's neighbors, did tell investigators in 1900 that he brought some thin lightweight pieces. There were also some pieces like balsa. We attribute them to internal structures that were also made of lightweight and very tough material. It could not be cut with a knife and did not burn [66]. Even Jesse Marcel confirmed in 1979 that he did heat this material in a flame, but could not ignite it. Carey and Schmitt interviewed the son of Major Ellis Boldra of the engineering department in Roswell, who had found in 1952 a strange metal in a locked safe at the Engineer's Office. Since it was an unusually thin sheet, he decided to test it. It could not be cut, dented or scratched by any means. It was "incredibly strong". He tied thus to melt it with an acetylene torch, but it did not even glow. "The heat had somehow dissipated instantly, and amazingly, the item could be handled immediately after torching." He ignored, of course, that superconductivity requires electron-pairs, which are bosons and can thus be set in thermal motion without any friction. Because of the temperature of acetylene flames, we can now state that for this superconducting material, the critical temperature $T_c \geq 2200^{\circ}C$.

Other military experts who examined material from the debris field, noted also its extraordinary toughness. Randle and Schmitt interviewed Brigadier General Arthur Exon. He was at the Foreign Technology Division at Wright Field in 1947. He said that parts of the Roswell material were very thin, but "awfully strong and couldn't be dented with very heavy hammers." Commander Robert McLoughlin, Naval officer and rocket expert at White Sands Proving Ground, had published an article in TRUE magazine [67] concerning an ellipsoidal object. He and his team observed it with a theodolite during a balloon launch in 1949. Its altitude was about 90 km and its speed 8 km/s. This military scientist told his son that "while he was at White Sands, he was visited by an Army Major from the Roswell base…who arrived with a very strange piece of material…The Army Major asked to punch a hole in it…They took it to the workshop, where metallurgical technicians tried to make a hole in it with an advanced carbide drill, but "they couldn't even make a scratch" [68].

This metal had also shape memory. It could be reproduced by means of nickel-titanium (nitinol) alloys and this development was made public. If necessary, it could counter rumors that materials were found on the debris field that had this property, but it did not belong to weather balloons and would not explain why Brazel had been "taken into custody". He was detained during about a weak at the RAAF, brainwashed and bribed to say nothing anymore about what he saw. He "bitterly told his family that he felt as if he had been in jail". Sheriff Georges Wilcox had investigated himself and found dead aliens. He was told: "if you ever say anything you will be killed. And your entire family will be killed as well" [69]. From then on, he was a "broken man" and did not want any more to be sheriff.

3.6. Identification of Mg from an Exploded Flying Disk

This event is particularly important for several reasons, but mainly for providing fragments of UFO material that escaped confiscation and could be analyzed. The best account of initially observed facts is that of Olavo Fontes, MD and famous ufologist in Brazil [70]. The journalist Sued had received a letter that was published on September l4, 1957 in the newspaper O Globo. The writer stated that he did not believe anything concerning flying disk until he was forced to change his mind some days ago. He had been fishing with some friends near the town of Ubatuba, when they saw one that "approached the beach at an unbelievable speed". A crash into the sea seemed to be imminent, but "when it was almost striking the waters, it made a sharp turn upwards and climbed rapidly on a fantastic impulse. We followed the spectacle with our eyes, startled, when we saw the disk explode in flames. It disintegrated into thousands of fiery fragments, which fell sparkling with magnificent brightness. They looked like fireworks, despite the time of the accident, at noon, i.e. at midday. Most of these fragments fell into the sea. But a number of small pieces feel close to the beach and we picked up a large amount of this material, which was as light as paper. I am enclosing a small sample of it."

The author of this letter could not be identified by means of his signature, but he did ask that the material should be analyzed. Dr. Fontes met the journalist and got the 3 pieces that Sued had received. They were dull gray 3D pieces of a very light metal. The length of the biggest piece was about 2 cm. Initially, Fontes had some doubts, since such an event had never been reported, but the account was "simple, clear and concise". The writer did not behave like a hoaxer. Fontes went thus with sample 1 to the Mineral Production Laboratory of Brazil. It was established by means of a Hilger spectrograph that it was *pure magnesium*. Its degree of purity was even higher than for Mg samples that had been provided by the American Society for Testing and Materials. This was confirmed by another laboratory for samples 2 and 3. Fontes transmitted in 1957 his three samples to Jim and Coral Lorenzen in the USA. He asked for more detailed analyses and determination of the isotope ratios.

The Lorenzen's had founded the *Aerial Phenomena Research Organization* (APRO) and were careful investigators. Coral Lorenzen published the initial report of Fontes [70] with a postscript that added two important news. 1) No one of the witnesses of the explosion did answer invitations for interviews since they could fear to be harassed or ridiculed, but Olavo Fontes and Joao Martins did locate a fisherman who had met a group of excited vacationers. They told him of the incident and showed him pieces of a gray substance to support their story. Since the Ubatuba-Bay is a well-known fishing resort, it could attract prominent visitors from Rio de Janeiro, where the newspaper O Globo was edited. 2) Dr. Fontes was visited in 1958 by two members of the Brazilian intelligence agency. At first, "they made veiled threats as what might happen to him if he continued his inquiry into

matters that did not concern him". Since he did not accept to be silenced, they tried to convince him "to turn all his notes and the strange metal over to them". They knew thus what happened and tried to stop investigations.

We presume that this flying saucer (disco volador) had been detected by radar, since the small town of Ubatuba is only situated at about 200 km from Rio de Janeiro. Its International Airport was used since 1942 by military allies and in 1957, all Brazilian air traffic services were still managed by the Department of Airspace Control. The official mission of this military organization was to defend "Brazilian sovereign airspace". That does not exclude supervision by the USAF in regard to UFOs. Powerful radar beams could thus have disturbed the propulsion system of this UFO. There are even no hindering mountains between Rio de Janeiro and Ubatuba. Nevertheless, this UFO escaped radar detection at sea level, but when it rose to flee, the pilots increased the surface current too much. This led to the explosion and the crash. All retrieved material had lost their VHTS, but was still a precious source of information.

In 1958, the Lorenzen's contacted an Applied Research Laboratory. It detected some trace elements by means of photodetectors instead of photographic plates. It was astonishing that the detected impurities are not present in commercially available Mg. This result was confirmed by the Dow Corning Company. Its specialist was amazed that nearly pure Mg contained calcium (100 ppm), strontium (30 ppm) and barium (3 ppm), but this result is significant for us. Mg, Ca, Sr and Ba atoms contain indeed 2 peripheral electrons, respectively in 3s, 4s, 5s and 6s states. These atoms could thus have been intentionally added. It is also noteworthy that Mg is a light and abundantly available chemical element. It results from stellar nucleosynthesis, which favors fusion of already strongly bound alpha particles [71]. Violent explosions of massive stars yields therefore the sequence

$$^{4}\mathrm{He} \rightarrow {}^{12}\mathrm{C} \rightarrow {}^{16}\mathrm{O} \rightarrow {}^{20}\mathrm{Ne} \rightarrow {}^{24}\mathrm{Mg} \quad \text{or} \quad {}^{12}\mathrm{C} + {}^{12}\mathrm{C} \rightarrow {}^{24}\mathrm{Mg}\,.$$

Less violent explosions of intermediate-mass stars near the outskirts of our galaxy lead to slower dispersion of nuclei and allow for more neutron capture [72]. Since Mg nuclei contain 12 protons, there are only three stable isotopes, containing 12, 13 and 14 neutrons. On Earth, the relative isotopic ratios for Mg24, Mg25 and Mg26 are about 79/10/11 percent. It has often been assumed that if anomalous isotope ratios were found in UFO materials, they would prove an ET origin, but that is not justified for our galactic neighborhood. Nevertheless, measurements of isotopic ratios for Ubatuba magnesium turned out to be useful for another reason.

Condon's so-called "Scientific Study of UFOs" included an analysis of Ubatuba magnesium. It was organized by the physical chemist Dr. Roy Craig, who contacted Dr. Busk, research director at the Dow Chemical Company. Samples of ultrapure magnesium had there been produced by triple sublimation. Since they used neutron activation and gamma ray spectroscopy, they found that Ubatuba magnesium contained 8 types of previously undetected impurities. Sr and Ba atoms were again prevalent, but there were also Zn atoms, which contain a $4s^2$ electron-pair. In conformity with the objectives of the Condon report, Dr. Craig wrote

that "the claim of unusual purity of the magnesium fragments has been disproved". He added even that this material "cannot be used as valid evidence of the extra-terrestrial origin of a vehicle of which they are claimed to be a part".

His conclusion pleased the USAF, but missed the point. This results from an analysis of Ubatuba magnesium by two metallurgists: Dr. Walker and Dr. Johnson. Using high resolution microscopy, they discovered an unusual lattice structure. Their report had been written in 1987, but perhaps been refused by normal scientific journals. It was published 5 years later by Dr. Marc Rodeghier in the *International UFO Reporter* (IUR) of Hynek's Center for UFO Studies [73]. Dr. Michael Swords wrote the introduction and stressed the fact that "the structure of Ubatuba magnesium does approach mono-crystallinity". It was characterized, indeed, by "extremely large grain size" and even a "columnar structure". No terrestrial metallurgical process did ever produce this type of structures, since rapid cooling of molten metals yields polycrystalline lattice structures. They are sufficient for any normal use, but not for VHTS.

The metallurgists ignored that VHTS is possible for Mg metals and that they would then be extraordinarily strong. They were thus surprised that UFOs are made of Mg and measured the hardness and creep properties of Ubatuba Mg. The results were nearly identical to those of normal magnesium. Though this material had been more compact in its state of VHTS, the lattice structure was not modified. The metallurgists discovered thus a remarkable fact, without being aware of its importance. Moreover, we understand why the explosion led to the usual oxidation reaction: $2Mg + O_2 \rightarrow 2MgO$. It is very exothermic, since the peripheral electron-pairs of the magnesium atoms are transferred to oxygen atoms to get ionic bonds. In its superconducting state, Mg cannot be oxidized, since the electron-pairs are strongly bound.

Dr. Peter Sturrock of the Center of Space Science and Astrophysics of Stanford University devoted considerable time and effort to a detailed study of the samples of Ubatuba magnesium that he got from APRO. His results were published in 2001 in the Journal of Scientific Exploration [74]. The chemical composition was determined by Scanning Electron Microscopy and isotope ratios were measured by the method of Inductively Coupled Plasma Mass Spectroscopy. The values provided by NIST resulted from measurements that the Dow Chemical Company had performed on very pure magnesium. Since Sturrock's sample contained 77% of Mg24 instead of 79%, he attributed the difference to greater volatility of the lighter nuclei. We will explain why his statement was correct.

The analytical geochemist Pr. Robert Powell published new results in collaboration with 3 other scientists who knew very well the importance of this case [75]. He performed careful measurements of the chemical composition of Ubatuba Mg for samples that Sturrock had received and found a *very high* degree of purity (99.98%). Once again, there were only traces of Sr, Ca, Zn and Ba. We think that they did improve VHTS by being preferentially lodged at grain boundaries. Isotope ratios were measured in two different laboratories for Mg

and even for chemically isolated trace elements. The results for the percentage of Mg24, Mg25 and Mg26 isotopes are included in Table 1. It contains all presently known results for Ubatuba magnesium, even those for samples that were on display in the *Museo del OVNI* in Victoria, Argentina. The intrepid explorer Jacques Vallée went there in 2016 and got shards of two kinds of samples from Andrea Simondini for the measurement of isotope ratios. They were performed by Dr. Gary Nolan of Stanford University and Jacques Vallée presented in 2017 a preliminary report in Paris [76]. Two measurements had been performed on samples collected on the beach of Ubatuba. Their results were close to previous ones, but the samples that had been retrieved by military intervention did yield amazingly different results.

Table 1. Measured percentage of isotopes for Dow Corning magnesium and samples of Ubatuba magnesium. Red figures apply to those that were retrieved by military. A and B are average values for both types of samples. The differences will be explained.

Mg	Dow C.	Sturrock	Powell *et al.*		Vallée-Nolan			*A*	*B*
N_{24}	78.99	76.79	79.31	79.28	80	67	66	78.87	66.5
N_{25}	10.00	10.56	10.10	9.94	9	16	15	9.92	15.5
N_{26}	11.01	12.65	10.58	10.85	11	17	19	11.21	18.0

The columns A and B provide average values to reduce uncertainties. The astonishing results are indicated in red. The first column of Table 1 designates isotopes that contain x nucleons. Since the sum is 100%, there are only 2 independent variables. It is thus adequate to use a 2-dimensional graph for $Y = N_{26}/N_{24}$ versus $X = N_{25}/N_{24}$. Figure 11(a) shows the results of different measurements in graphical form. The doted line accounts for the average values A and B.

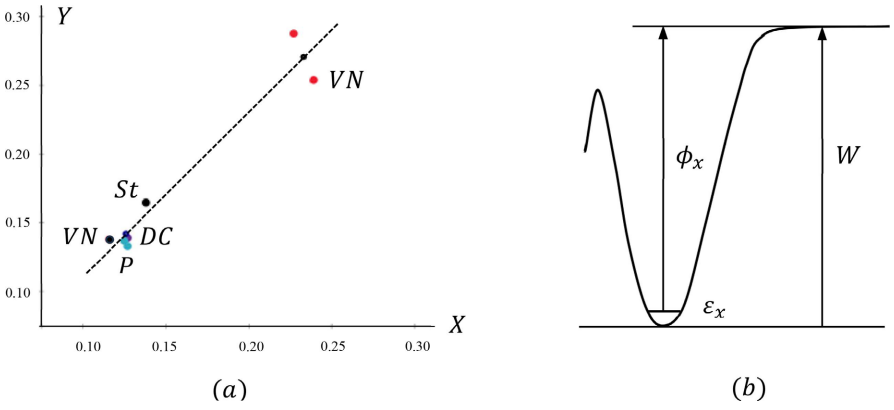


Figure 11. (a) Measured isotope ratios Y versus X for magnesium metals according to Dow Corning (DC), Sturrock (St) and Powell (P in blue). The results of Vallée and Nolan (VN) did yield a black and two red dots. (b) Proposed model for isotope losses.

Figure 11(b) explains why lighter isotopes are more easily evaporated. Since atoms that are situated at the surface can vibrate in a potential well, they can be

ejected when their thermal energy exceeds $\phi_x = W - \varepsilon_x$, where ε_x is the zero-point energy. It is proportional to the frequency of oscillation and thus inversely proportional to the nuclear mass. Light nuclei are thus more easily evaporated as long as the metal stays sufficiently hot. Since samples of type A were retrieved by the initial witnesses in shallow water, they were rapidly cooled, while samples of type B could have stayed longer hot after the explosion. Searching confirmations of this hypothesis, we found some information on internet [77]. Shortly after the explosion, fishermen saw at low tide and in clear water an *extended object* on the seafloor. Their nets were not strong enough to raise it to the surface, but "one morning while preparing their nets for fishing, local fishermen watched a ship approaching from the horizon. It belonged to the Brazilian navy. Sailors left this ship on boats and went to houses near the beach, to tell people that they were not permitted to go to the beach and could not leave their home until they were told they could. However, "some locals, taken by curiosity, came out through the bushes and watched the military's actions". They saw that there were several large ships. One of them belonged to the Brazilian navy, but another ship was unmarked. They could observe the removal of a cigar-shaped object [or a disk, seen from the side]. It was placed on the deck of one of the ships.

It was mentioned that *Edison Boaventura Jr.* did get fragments of Ubatuba magnesium. Since he is the president of the Guaruja Ufological Group in Brazil and a very active investigator, he got a letter with four metal fragments and a message. The sender wrote: "From an early age, I remembered that my father told me about the explosion of a disk, in Ubatuba…and showed me small fragments of metal, saying they were from the flying saucer." Being himself a military, he wrote that he had some pieces left, though other ones had been subjected to analyses at the Military Institute of Technology in Rio de Janeiro. These statements were so important that we contacted Edison Boaventura Jr. He did kindly answer and provided more information. He had received "four fragments of the UFO from an Army soldier's son." Mr. Edison Boaventura wrote also: "I have interviewed numerous witnesses in this case." The fisherman Virgilio Lopes saw in 1957 *two* Brazilian Navy ships and an American one. They did collect a larger piece of the exploded UFO from the bottom of the sea.

We asked thus for more details and Mr. Boaventura answered: "Virgilio said that one morning in 1957, he saw two Brazilian Navy ships and another foreign ship that had dropped their anchors. Then a small boat arrived at the beach." He and his family were told "to stay in the locked house, until they released him. However, Virgilio sneaked out the back door and climbed the mountain, from where he watched the military remove a somewhat elongated metal structure from the seabed." This object was raised with a crane and deposited on the deck of one of the Brazilian ships. There were also military that came in several small boats near the shore to retrieve small pieces in shallow water. Eventually, the military returned to the beach and told Virgilio and his family that they could again leave their home. The whole operation lasted about 1 hour under American surveillance

to get this UFO for secret analysis in a US military institution.

Nevertheless, we learned a lot about this material. It was magnesium, which is adequate for VHTS and UFO propulsion. We understand also why more light isotopes were evaporated from samples of type B. They could remain longer hot when they belonged to the craft. It should also be noted that Mg samples of different terrestrial origin do not have identical isotope ratios [78], since they had different thermal histories. There is thus no absolute reference at all for Mg isotope ratios [79]. Triply sublimated Mg of Dow Corning is not better than other ones in this regard.

4. Cuprate Superconductors

4.1. Electron-Pair Formation in Cuprates and MgB_2

Though the critical temperature T_c for cuprates is lower than room temperature, their superconductivity results also from Coulomb forces. **Figure 12(a)** shows one cell for a perfect lattice of layered copper oxide La_2CuO_4. Every copper atom (green) is there bound in an orthogonal configuration to 4 oxygen atoms (yellow). There are two lanthanum atoms (blue), but one of them or both can be replaced by barium, strontium or cerium atom. Their electronic structures are

$$\mathrm{La}:[\mathrm{Xe}]6s^2 5d^1.\quad \mathrm{Ba}:[\mathrm{Xe}]6s^2\quad \mathrm{Sr}:[\mathrm{Kr}]5s^2\quad \text{and}\quad \mathrm{Ce}:[\mathrm{Xe}]4f^1 5d^1 6s^2.$$

Since this kind of doping liberates a peripheral electron, it becomes energetically favorable to create an electron-pair in a void of the CuO_2 plane and thus an entity (+1, −2, +1) when $e=1$. **Figure 12(a)** includes the result of such a process. The lower part of this figure represents the orbiting electron-pair. An ensemble of bosons of this type can be set in motion by an applied electric field and continue to move without friction when this field is shut down. Cuprates are thus superconductors. Bednorz and Müller found that for $La_{2-x}Ba_xCuO_4$, $La_{2-x}Sr_xCuO_4$ and $La_{2-x}Ce_xCuO_4$ the critical temperatures T_c are respectively 30 K, 39 K and 27 K. Though these values are far below room temperature, they are higher than for the BCS mechanism. Since cuprates can be doped in various ways (Wikipedia), it is possible to reach higher critical temperatures at normal atmospheric pressure. At present the highest one is 134 K (−140˚C) for $Hg_1Ba_2Ca_2Cu_3O_{8+\delta}$. It is thus notably lower than room temperature.

To insist on the fact that even moderate HT superconductivity results from Coulomb forces, we consider also the case of magnesium diboride (MgB_2). Though it was discovered in 2001 that $T_c=39$ K, it has been assumed to result from electron-phonon coupling [79]. However, **Figure 12(b)** shows that electron-pair formation is possible by Coulomb forces. The Mg atoms constitute lattice planes as in **Figure 1(a)**, but in MgB_2, they are superposed with intercalated boron atoms. Since their electronic structure is $[He]2s^2 2p^1$, they tend to share their single peripheral electrons as in H_2 and B_2 molecules. The lattice structure of MgB_2 is usually represented by considering merely a ring of bore atoms between two layers of magnesium atoms. The opposite configuration would have been more inspiring.

Even stacking can then be insured, but lattice planes are separated in this figure for conceptional clarity.

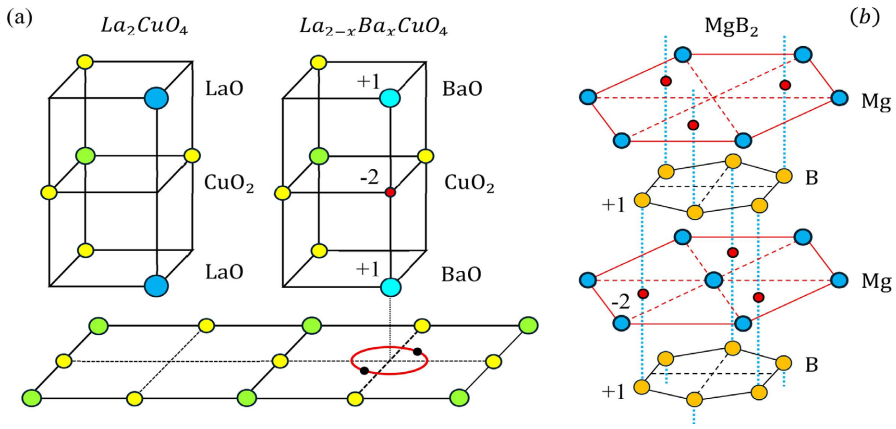


Figure 12. (a) Unit cell of layered copper oxides, where one or two La atoms can be replaced by a Ba atom, but an electron-pair is then formed in the void of the intermediate CO_2 plane. (b) MgB_2 crystals are also medium HT superconductors because of Coulomb forces.

4.2. Phase Diagram and Strange Metal State

The phase space for $La_{2-x}Sr_xCuO_4$ is shown in **Figure 13(a)**. The boundary of the domain where this cuprate is superconducting requires that the absolute temperature $T \le T_c(x)$. This curve has two maxima [80]. Between the antiferromagnetic (AF) insulator state and the normal metal state, the dissociated electron-pairs are in a "strange metal" state. The transitions are progressive, but indicated here in a schematic way. The two maxima for $T_c(x)$ result from the fact that electron-pairs are separated for low values of x, but tend to be associated for large values. As shown in **Figure 13(b)**, increased doping favors structures like (+1, −2, +1, −2, +1, -2, +l, ..., +1, −2, +1).

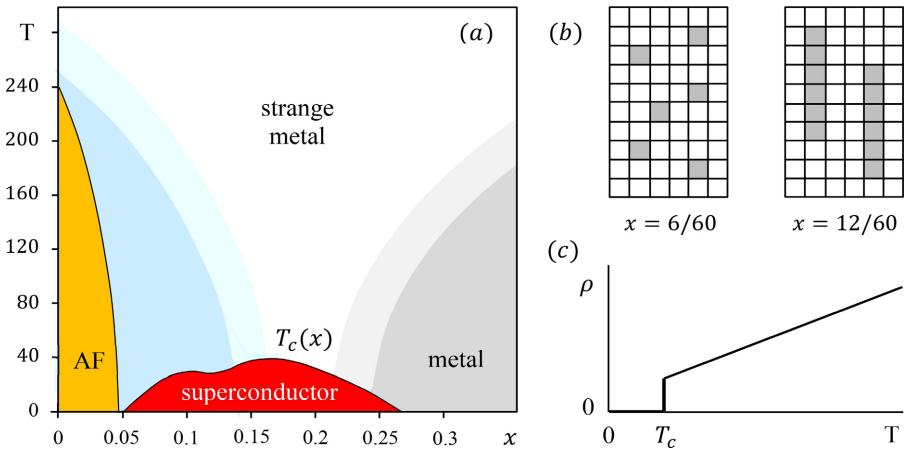


Figure 13. (a) Phase space for $La_{2-x}Sr_xCuO_4$ for different values of the absolute temperature T and doping x. The superconductive state is limited to the red domain. (b) There are two possible distributions of doped cells. (c) At about optimal doping, the electrical resistivity ρ increases in a linear way for increasing temperatures $T > T_c$.

Figure 13(c) defines the strange metal state in terms of the temperature dependence of the electrical resistivity. It should be noted that pairs of electron-holes are also bosons, but their charge is positive. Though phase diagrams are similar, they are not identical.

4.3. Explanation of the Strange Metal State

When electron-pairs are dissociated in cuprates, they yield an ensemble of single electrons. According to Drude's model, they should thus behave like conduction electrons in normal metals. Every one of these electrons was there assumed to be freely moving between collisions with small positive ions that constitute the lattice. When such an electron is subjected to a constant electric field $\boldsymbol{E}$, it is accelerated, but will be scattered in a random way. At this instant, the average velocity is reduced to $\boldsymbol{v}=0$, but the constantly applied electric field yields $\boldsymbol{v}=(q\tau/m)\boldsymbol{E}$, where $q=-e$ and τ is the average interval between successive collision. Since a metal contains n conduction electrons per unit volume, the current density is

$$\boldsymbol{J}=nq\boldsymbol{v}=\sigma\boldsymbol{E} \quad \text{where} \quad \sigma=\frac{ne^2}{m}\tau \quad \text{and} \quad \rho=\frac{1}{\sigma}\propto\frac{1}{\tau}.$$

The resistivity ρ is proportional to the collision probability $1/\tau$. Since the time interval τ decreases at higher absolute temperatures, the resistivity has to increase. However, experimental results show that for normal and strange metals, we get respectively

$$\rho=\rho_o+A_oT^2 \quad \text{and} \quad \rho=\rho_1+A_1(T-T_c) \quad \text{for} \quad T>T_c.$$

The first relation can be justified by Fermi-Dirac statistics and electron-phonon interactions. The energy of an electron is modified when it absorbs or emits a phonon, but produces heat by exciting lattice vibrations. For a strange metal at temperature T, the average energy increase $\Delta E\approx k_B\Delta T$, where k_B is Boltzmann's constant and $\Delta T=T-T_c$. Though the resistivity ρ is proportional to $1/\tau$, the average time interval between successive collisions cannot be arbitrarily small, since it is limited by Heisenberg's uncertainty relations:

$$\tau\approx\hbar/\Delta E \quad \text{thus} \quad \Delta\rho\propto\Delta T.$$

The mystery of strange metals did thus result from a quantum-mechanical effect. The concept of "Planckian dissipation" was introduced by Jan Zaanen [81] and then elaborated. In this regard, we want to stress the fact that usual physical laws are modified when Nature imposes limits to what is measurable. This can happen because of the finite values of Planck's constant h and the light velocity c. It is not sufficient, however, that a physical quantity is defined by a combination of universal constants to limit possible results of measurements. Planck defined a length ℓ in terms of the constant of gravity G and two other universal constants, since

$$\ell^2=\frac{G\hbar}{c^3} \quad \text{and} \quad \ell\sim10^{-35}\,\text{m}.$$

It has been assumed that ℓ is the smallest possible length, but it is only *a natural unit if length* for quantum-gravity, like the Bohr radius $a_o = \hbar^2/me^2$ or the Compton wave length $\hbar/m_o c^2$ for any particle of rest mass m_o. Only the "quantum length" a that we considered is the smallest possible length. We recall that the resulting theory of "space-time quantization" contains 3 fundamental universal constants (c, h, a) and accounts for all possible elementary particles, including those of Dark Matter [40].

5. Discussion and Conclusions

5.1. The Discovery of Very HT Superconductivity

We were amazed that Bohr could account for H_2 molecules by means of a simplified version of quantum mechanics. He considered that the two electrons are moving on a common orbit in the median plane of two protons. Its size is determined by the quantization rule, which is equivalent to requiring stationary waves. It is also important, however, that possible motions are determined by Coulomb forces. It is therefore conceptually easy and physically fruitful to generalize Bohr's model for atoms that contain electron-pairs in ns^2 states.

Single Mg atoms and Mg^{2+} ions have spherically symmetric electron distributions. The ionization energy for the 2 peripheral electrons is also known. That is sufficient to determine the radial electron distribution in Mg^{2+} ions, even by accounting for the shell structure. It is thus possible to compute the effective charge of Mg^{2+} ions at any distance from their center.

A row of Mg atoms can thus be viewed as being composed of spherical Mg^{2+} ion cores and electron-pairs that are orbiting in their median planes. It is then possible to compute the energy per electron-pair by accounting for all Coulomb forces and the quantization rule. We did that for the most strongly bound state ($n=1$) to verify if at least this state would does allow for VHTS. It appeared that their binding energy would then be enormous, but we found also that this is only true for very pure Mg metals with a nearly perfect lattice structure. This explains why Mg metals resulting from usual metallurgical procedures do not allow for VHTS. Instead of improving this model by considering peripheral electrons in the state $n=3$ and for three-dimensional lattices, we wanted to find out if VHTS does really exist or not. This can only be determined by means of observations and measurements.

This required to consider Unconventional Flying Objects (UFOs). Since this study of this phenomenon has been neglected by the scientific community, it was necessary to begin with explaining why this happened. Nevertheless, there are numerous observations that provide physically important information and allow for rational analysis. This happens in particular for the propulsion system of these objects, which is highly efficient and radically different from any known one on Earth. We had therefore to justify that it is of ET origin. That is neither unexpected, nor devoid of scientific interest. At present, humanity is even dedicating impressive technical creativity and enormous financial means to explore our planetary

system. This is justified by search for traces of past life and exploration of extra-solar planets, but we are also trying to answer the question "are we alone?" It is therefore paradoxical that the scientific community is not interested in studying the UFO phenomenon. Apparently, it does not even suspect that some authorities prevent this, since they are pursuing other objectives. The first necessary step is therefore to search and tell the truth in this regard.

It is amazing, for instance, that UFOs can fall from the sky in spite of their sophisticated propulsion system. We explained why it can be perturbed by powerful radar beams. This accounts for crashed and retrieved UFOs, but can also be prevented. The essential point for our study was, of course, that the study of UFO phenomena provides the proof that VHTS is possible. The claim that they "do not offer a fruitful field in which to look for major scientific discoveries" was not correct. We want also to stress that the truth results from the contributions of many persons. They are careful observers, honest reporters, serious associations, investigating writers and dedicated scientists, who did even perform measurements. Properties of UFO materials were particularly important. Sometimes these materials were still in their superconductive state and displayed therefore mechanical and thermal properties that are characteristic of VHTS. Even when magnesium samples, which escaped military confiscation ware not any more in this state, they kept their high purity and peculiar lattice structure. It was also possible to find out that Roswell material was superconducting with a critical temperature $T_c \geq 2200^{\circ}C$. This is essential for proving that VHTS is possible.

5.2. Outlook and Challenges

The results of this study call for more scientific interest in the study of UFO phenomena. There are many reasons. That it did reveal the existence of VHTS is one of them. In this regard, we have to insist that the proposed theory is verifiable or falsifiable by performing possible experiments. It is sufficient to produce thin continuous metal films and to perform measurements with technically available equipment. We hope that this occurs as soon as possible.

Personally, we intend to answer four questions, which are scientifically relevant. 1) *What is the energy source of UFOs*? It is highly efficient and allows even for interstellar space travel, but is also of tremendous importance for humanity. Moreover, it is based on using dark matter and does help us to understand its nature, which is still quite mysterious. 2) *Is it possible to improve Bohr's model presented here*? The objective is to estimate the binding energy of electron-pairs in a more realistic way, since we know at present that for the Roswell material, the critical temperature $T_c \geq 2200^{\circ}C$. 3) *Could other metals than Mg also allow for VHTS*? 4) Why are there *anomalous phenomena*? They are numerous, varied and often well-documented, but remain unexplained. Could it be that they are caused by aliens who are testing our belief systems? They are mysterious and perplexing, but should be examined, since they could involve "new physics". Perhaps they are also signs of something, which is still situated beyond our present mental horizon.

The most urgent but perhaps most difficult task concerns the improvement of

human relations, since we are still entangled tribal wars. A Prussian general defined *war* in his book of 1827 as being "an act of force to compel our enemy to do our will" [82]. After the horrors of World War II, people and statesmen recognized that "all human beings are born free and equal in dignity and rights" (United Nations, Universal Declaration of Human Rights, 1948) and that "the dignity of man is untouchable" (German Basic Law, 1949). The European Convention on Human Rights (1950) and other ones were also very explicit.

The author of this article had direct experience of Nazi propaganda and the dangerous slogan: *"Führer befiel, wir folgen dir"* (leader give orders, we follow you…where ever you want). Today, there are again dictators on our planet. They do also proclaim the "right of force" and apply it in a reckless way. This is directly related to the subject of this article, since the famous astrophysicist Stephen Hawking was worried that some astronomers are now trying to improve the *Search for Extraterrestrial Intelligence* (SETI) by making it "active". They are developing instruments to send signals, instead of merely listening to possible ones. Hawking [83] warned that this might attract attention and be dangerous, since "aliens might simply raid Earth for resources, then move on".

He did not exclude that they exist and could even be able to visit us, but he assumed that they would then behave like humans did, when they had more efficient weapons than those civilizations that they raided. Much older and technically more advanced ET civilizations would have superior weaponry, of course, but they may also have acquired more wisdom than humans. Moreover, they are already here. We ignore their real agenda, but they are observing us and providing signs of their presence and their dislike of nuclear weapons [23]. They are not stealing our resources, but are probably interested in examining the evolution of emerging societies and the most surprising natural development in our universe, which is the genetic code.

In this groundbreaking and profoundly challenging context, we believe that the role of science is not only to acquire more knowledge about reality and to share it, but also to pay attention to its use in a peaceful and constructive way. This requires to adopt and protect the principle that *cooperation is better than opposition*. It should also apply to future contact with ET civilizations. The adequate place for accomplishing this extremely important and unavoidable task can only be the United Nations. This international organization was founded to gather all nations of our planet, to discuss common problems and find shared solutions. The first step is to help it already now to fulfill its role in an efficient way. This is not merely a matter of politics, but also a matter of humanitarian organizations, objective international justice and responsible science. Obvious examples are the need to take care of climate change, health conditions, adequate use of resources and better understanding of the need of peace, instead of supremacy and egoism. This can be illustrated by the development of a new energy source, using freely available dark matter or the realization that ET civilization do probably use magnetoelectric waves, instead of EM waves for their communications. Even materials that allow for VHTS can be applied in a peaceful way, instead of creating superweap-

ons for dominating other peoples and producing mass destruction or perpetrating reckless murder.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper, but hopes that humanity will draw useful consequences.

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