

Detection, Identification and Use of Dark Matter Particles for a New Energy Source

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Abstract

Direct detection of dark matter (DM) particles has been achieved by the DAMA collaboration and was confirmed by measuring the annual modulation of the measured signal. Analysis of their procedure shows that they found *light* DM particles that collide with *electrons*, though it was generally believed that they are massive (WIMPs) and cause nuclear recoils. The Standard Model of particle physics is based on observations that apply only to ordinary matter. It does not account for DM, but it can be generalized by the theory of *Space-Time Quantization*. Instead of assuming that space and time should be continuous, it considers a finite limit for the smallest measurable distance. The value a of this “quantum of length” is unknown, but has to be a universal constant for any inertial frames, like c and h . This also yields a universally constant quantum of time a/c . The resulting generalization of Relativistic Quantum Mechanics allows us to distinguish all possible elementary particles from one another. They are characterized by a new type of quantum numbers, specifying modulations of wave functions and fields at the smallest possible scale. This also applies to DM particles. One type of them could be detected by means of NaI(Tl) and another type is adequate to ionize H_2 molecules. This process is confirmed by astrophysical observations and other observations revealed that this is the *energy source* of Unconventional Flying Objects. By explaining how it functions, we show that humanity could also develop this technology to get energy from freely available DM matter.

Keywords

Dark Matter, DAMA-LIBRA, Space-Time Quantization, Standard Model of Elementary Particles, UFOs, Ionization of Hydrogen Molecules, Central Molecular Zone, Energy Source

1. Introduction

The concept of DM was initially advanced by the Swiss astronomer Fritz Zwicky [1]. He measured the redshift of spectral lines in the Coma cluster and concluded in 1933 that the resulting velocities require the existence of invisible matter. The average density of this unknown “dark matter” would there even be about 400 times greater than justified by luminous matter. This proposition raised skepticism, though it was based on measurements. However, when the young American astronomer Vera Rubin and her collaborator determined the velocity of stars in the Andromeda galaxy, she also found that they move more rapidly than expected for visible matter [2]. She confirmed that even for over 60 spiral galaxies, the rotation curves were flat instead of decreasing. This was thus a general property and could be attributed to a large spherical halo of DM, which is denser at the center of spiral galaxies.

These considerations were based on Newton’s law for gravitational forces, decreasing like $1/r^2$. Their infinite range would imply the existence of gravitons that have zero rest-mass, like photons for Coulomb forces. Nevertheless, it seemed to be less shocking to modify Newton’s law than to accept the idea of a great amount of unknown matter in our universe. The Israeli physicist Milgrom [3] proposed a modification of Newton’s law of gravity for very small orbital velocities and radial accelerations at great distances from the center of galaxies. This also led to controversies [4], since “modified gravity” could describe what had been observed for spiral galaxies [5], but there were anomalies for galaxy clusters, gravitational lensing effect and wide binary stars. The scientific community remained thus divided in this regard. To exclude the existence of gravitational force carriers that have no rest-mass would also require a theoretical justification. Moreover, there are measurements and cosmological indications that only about 5% of the total mass-energy content of our universe is due to normal matter, while about 27% is dark matter and about 68% is “dark energy” (Wikipedia). It causes the accelerated expansion of our universe, but we do not yet know its origin and real nature. There are thus several unsolved problems of fundamental importance.

We know at least that DM particles must have some mass, since they are subjected to gravitational interactions. However, they are electrically neutral, because of the total lack of interactions with EM fields. Astronomers thought that DM is composed *Massive Compact Halo Objects* (MACHOs), like black holes, neutron stars, or invisible dwarf stars. When this hypothesis was excluded, the concept of *Weakly Interacting Massive Particles* (WIMPs) became fashionable. These hypothetical particles have no precise definition (Wikipedia) and thus allow for various assumptions. Imagination was not lacking in this regard. An overview was provided in 2010 by Katherine Garrett [6]. Since even quite exotic candidates have been proposed to account for DM particles, their detection would be of prominent importance to learn more about the “fundamental order of the universe.”

WIMPs were assumed to have a mass of the order of $100 \text{ GeV}/c^2$ and to interact sometimes with ordinary matter by means of weak nuclear forces. Since these hypotheses were not confirmed by several attempts to detect these effects, the range of possible masses was widely enlarged [7]. The reason was to be openminded, but tenacious, since “deciphering the nature of dark matter... is one of the most foremost open questions in fundamental science today.” Nevertheless, there is only one team of experimental physicists that can claim to have detected DM particles. They did use NaI(Tl) scintillators and their apparatus was installed deep underground in the Gran Sasso National Laboratory in Italy. It was not only protected against cosmic rays, but utmost care was also taken to use only radiopure materials. The signal/noise ratio was thus optimized and stability was constantly controlled. The criterium for successful detection was indeed that the measured signal should disclose a small *annual modulation*. It results from the motion of the Earth with respect to the galactic DM halo.

The experiment was planned in 1990 and the Italian-Chinese “DAMA/NaI collaboration” did effectively observe 7 annual cycles (1995-2002). Moreover, the experiment continued after two significant upgrades, under the name DAMA/LIBRA phase 1 (2003-2010) and phase 2, which is still going on. The acronym DAMA stands for dark matter. In 2008, instruments and procedures were extensively described [8] and first results were also presented [9]. They were confirmed in 2021, after considerable improvements of the whole system [10]. The DAMA project had then detected 14 annual cycles in a perfectly consistent way. Though a confidence level of 13.7σ had already been reached, it is normal in science that important experimental discoveries have to be confirmed by independent measurements. In spite of enormous creativity, competence and financial aids, all other attempts to detect DM particles failed to replicate the modulation signature. This led to controversies [11]. They are even taking historical proportions because of the enormous importance of DM detection and the suspicion that the DAMA collaboration could be erroneous.

A critical review article [12] mentioned that DM particles might “interact even more weakly than previously thought, making them incredibly hard to detect”. Another possibility could be that something is missing or wrong in our theoretical framework. “Maybe our understanding of *particle physics* needs an upgrade.” Usually, a puzzle can be solved in physics, because there is a “clear indication where to search for its solution. Now it looks as though it is not the case for dark matter anymore.” It is therefore “necessary to start rethinking the Universe.” This could involve the concepts of WIMPs or even cosmology [13].

Incidentally, we considered already in the 1970th that the foundations of physics should be enlarged for a fundamental reason. Newtonian mechanics was based on adopting some “principia”. They could not be proved, but seemed to be obvious since they did result from an extrapolation of known facts. It was thus assumed that velocities can be arbitrarily great and that energies have to vary in a continuous way. These assumptions turned out to be false, because of the discovery of two

universal constants: the light velocity c and Planck's constant h . They have finite values and classical physics is only valid for velocities $v \ll c$ and energy changes $\Delta E \gg h\nu$, where ν is any physically possible frequency. Though Galileo Galilei said that "the book of nature is written in the language of mathematics" it is not necessarily easy to decipher it. Since we are confronted with such a problem, it may be useful to recall that even well-established experimental observations are not sufficient, to understand their meaning. The required explanations are not immediately obvious.

The discovery of light waves by interference phenomena (Young, 1800) led to the idea that they could be similar to sound waves, propagating in a medium that fills the whole universe. The Michelson-Morely experiment (1887) tried to prove the existence of this "ether", by measuring the velocity of the Earth with respect to this hypothetical medium. The result was negative and very puzzling. Maxwell dared to think that light waves could result from electric and magnetic effects. He reformulated therefore already in the 1860th all empirically discovered laws for possible variations of these fields at macroscopic scales by means of differential equations. They should be valid at microscopic scales, but it turned out that these equations were only logically consistent by adding a term for rapidly varying electric fields. Maxwell succeeded thus to discover a new physical law by "thinking" and could even conclude that light waves are EM phenomena. The existence of EM waves was experimentally confirmed by Heinrich Hertz, in 1887.

Hendrik Anton Lorentz tried to make sense of these results by maintaining the popular concept of an invisible ether. If this medium were at rest in the whole universe, it would account indeed for the mysterious existence of "inertial frames". Newton postulated indeed that there are privileged frames, where any material body is only accelerated when it is subjected to real interactions with other bodies. All inertial frames are moving with constant velocities relative to one another and thus also with respect to ether. To account for Michelson's result, it was necessary to assume that the results of space and time measurements are related to one another when they are performed in different inertial frames in such a way that the speed c of light waves is the same in all inertial frames. The final version of this "Lorentz transformation" was published in 1904. Since inertial frames can move at any velocity v with respect to one another, it requires a parameter $v/c \leq 1$.

Albert Einstein saw that it is not necessary to postulate the existence of an ether, since it is sufficient that the speed c is a universal constant like Planck's constant h and to generalize Galilei's principle of relativity. This led in 1905 to the theory of special relativity and then to the concept of photons. The development of quantum mechanics also required new concepts, which did not immediately emerge from experiments. We should thus also expect that elucidation of the nature of DM does not simply result from experimental evidence. Even DAMA's procedure requires a specific analysis. Moreover, it is necessary to generalize Relativistic

Quantum Mechanics to justify the present version of the Standard Model of elementary particle physics and to identify DM particles.

The basic problem is, indeed, that we continue to believe that space and time are continuous. This means that it should be possible to measure *arbitrarily small* intervals of space and time, but that is merely an assumption. It allows us to express even quantum-mechanical laws of motion by means of differential equations. It could happen, however, that the concept of “infinitely small” intervals of space and time is merely valid as an approximation at usual scales. To find out if that is possible or not, we considered the existence of a “quantum of length”, defining the smallest measurable distance. Its value a is unknown and could be extremely small, but it would have to be a universal constant in inertial frames, like c and h . There would then also exist a universally constant quantum of time a/c . We therefore replaced all basic differential equations by finite-difference equations to find out if they would lead somewhere to inconsistencies. That was the reason to construct a theory of *Space-Time Quantization* (STQ). It turned out that it is logically consistent.

As soon as we tried to verify if STQ is physically relevant, by applying it to elementary particles, there appeared something that was unexpected, but very important. It led indeed to the conclusion that the existence of elementary particles is due to STQ [14]. Actually, we wondered why elementary particles can be distinguished from one another, though they are merely single points. This results from a set of quantum numbers that define possible variations of their wave functions or fields at the smallest possible scale in space and time. This assertion was confirmed for all known types of elementary particles that constitute ordinary matter. It did even account for elementary DM particles. In spite of their elusive nature, they can now be identified.

It happens that an energy source of a radically new type has been discovered. It is based on using freely available DM, but as far as we know, its functioning has not yet been explained. Actually, it is the energy source of *Unconventional Flying Objects*. They were often observed, but most scientists are still convinced that the UFO phenomenon does result from misperceptions, media hype and Science Fiction. The scientific community is not informed about the reality of UFOs and their specific characteristics, since superpowers are retrieving crashed UFOs and examining them to acquire knowledge about their propulsion system. These activities are “above top secret”, since their purpose is to produce superweapons. As for the development of nuclear arms, it is assumed that a monopoly could be maintained by secrecy, though the basic facts result from physical processes. They have to be unraveled, but are everywhere accessible on Earth.

The origin of UFOs is unknown, but it is possible to analyze what could be observed. This led us progressively to a rational explanation of their propulsion system. It requires a very strong magnetic field that is oscillating at low frequencies. This does also yield an electric field by Faraday induction. Both fields act together on charged particles, produced by ionization of surrounding air or water.

This yields the needed reaction force near the surface of the Earth [15]. Elsewhere, charged particle can be collected at large scales. We knew that such a propulsion system would require superconducting surface materials, but we could only recently explain why that is possible. This research led to the discovery that magnesium metals allow for a state of *Very High-Temperature Superconductivity* (VHTS). They are then also extremely tough. These facts were confirmed by many witnesses who examined debris and even by measurements. They are important for fundamental and applied science. This is not simply an unverifiable hypothesis, since we indicated how it can be tested.

We present here also information about the discovery of a new type of energy source. Essential information in this regard emerged from the Wright-Patterson Air Base, where retrieved UFOs were immediately scrutinized. Scientists are invited to read the book of Carrey and Schmitt [16] before pronouncing any judgment. Thomas Carrey is a U.S. Air Force veteran who held a Top Secret/Crypto security clearance. Crypto concerns special cryptographic materials, requiring verified “need to know” and access control beyond top-secret clearance. Donald Schmitt was the co-director of special investigations at the Hyneck Center for UFO Studies in Chicago. Professor J. Allen Hyneck was the astronomer who served the USAF for more than 20 years, but did then denounce its truth-distorting methods [17].

The structure of this article results from concentrating on the following problems: 1) Why did only the DAMA cooperation succeed to detect a particular type of DM particles? 2) Is it really possible to generalize the Standard Model of elementary physics and to identify DM particles? 3) Can the functioning of the energy source of UFOs be explained?

2. Detection of DM Particles by Means of Scintillators

2.1. The DAMA Experiment

It was based on the idea that for direct detection of DM particles on Earth, it is essential to have a criterion for deciding whether it succeeds or not. The experimental procedure should thus be “model independent” instead of adopting some hypothesis or preconception concerning the nature of DM. **Figure 1(a)** shows that the velocity of incident DM particles results from the motion of the Earth around the Sun and the motion of the Sun with respect to the galactic halo of DM particles. Since the orbit of the Earth is inclined by about 60° with respect to the galactic plane, it encounters a DM wind, characterized by an annually modulated velocity:

$$V(t) = V_o (1 + \alpha \cos \omega t) \quad \text{where} \quad V_o = 232 \text{ km/s} \quad \text{and} \quad \alpha = \frac{30}{232} \cos 60^\circ \approx 0.065 \quad (1)$$

The flux of incident DM particles is maximal on about June 2 and could be represented by a cosine function. **Figure 1(b)** represents the DAMA detection system. It is an array of 25 big and highly radiopure NaI(Tl) scintillators, specially

prepared by the Saint Gobain Crystals and Detector company. Every one of them is connected by light guides to 2 photomultiplier tubes (PMTs). They are situated on the front side and rear side of this figure.

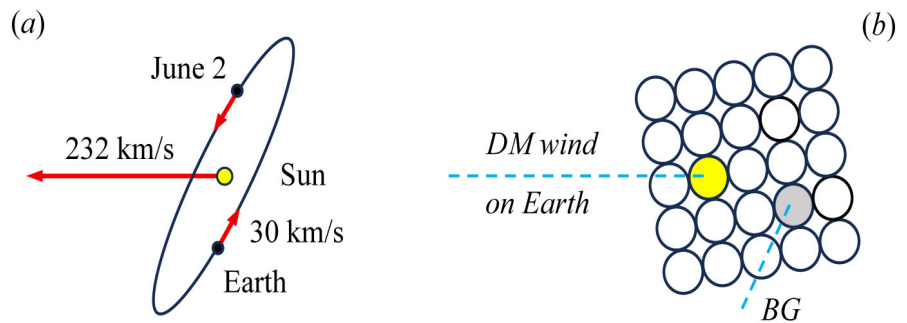


Figure 1. (a) Motions of the Sun and the Earth with respect to the galactic dark matter halo. (b) Array of NaI(Tl) scintillators for detection of DM particles.

The apparatus was installed deep underground in the Gran Sasso mountain (Italy) and protected by multiple shields. Moreover, all materials were highly radio-pure. To reduce the detection of background (BG) radiation, the two PMTs of every scintillator had to fire in coincidence and in anticoincidence with all other ones. The chance of simultaneous detection of DM particles in two different crystals was thus assumed to be small. The validity of this hypothesis was verified later on. The DAMA collaboration chose NaI(Tl) scintillators, since they are good detectors of gamma rays in nuclear physics. They liberate electrons by Compton scattering or the photoelectric effect for atomic electron clouds. These electrons can then be detected by scintillation processes, but it is not certain if this would also happen for DM particles. The attempt to detect them by this method was thus courageous, but prepared and executed with utmost care. Other types of detectors might be better, but the first results were already impressive [18], since individual data points could be fitted to yield 7 cycles of annular modulations. Actually, the measured signal $S(t)$ had a constant component S_o and a harmonically varying one. It was defined by the residual rate

$$R(t) = S(t) - S_o = A \cos \omega t \quad (2)$$

The amplitude A of the annual modulation was found to depend on the energy E of the incident DM particles. Its value was determined by pulse-height discrimination and A was found to increase when the chosen energy interval is as low as possible. After significant improvements of their apparatus [8], the DAMA/LIBRA collaboration obtained again results that were in perfect agreement with the previous ones [9]. **Figure 2** shows the steady annual modulation for 16 new cycles [19]. The indication 2 - 6 keV designates the size of the chosen energy range in *electron equivalent* keV. They are defined by the energy of neutral particles (neutrons or gamma ray photons) that would produce the same luminosity in NaI(Tl) scintillators.

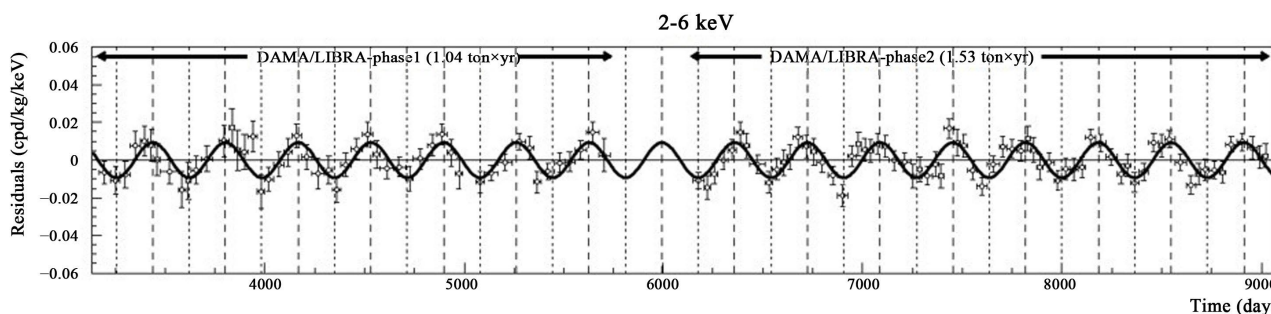


Figure 2. Annual modulation for single hit residuals, measured by the DAMA/LIBRA collaboration over 16 cycles, in spite of an interruption for instrumental upgrading.

It is amazing that the annual modulation remained consistent over so many cycles with the adequate phase. However, these results were not confirmed by other collaborations, though they deployed considerable precautions to reduce perturbing BG radiation. This created tension. The DAMA collaboration answered by providing more information [20]. The oscillations remained stable over 22 annual cycles and the same annual modulation was detected by every one of the 25 detectors. Moreover, all perturbations that might simulate an annual variation were controlled and excluded. Fourier analysis confirmed the annual modulation, but it was only present below 6 keV. Moreover, the amplitude A increased in a systematic way for lower energies. It was 0.0191 ± 0.0020 for 1 - 3 keV, but only 0.00933 ± 0.00094 for 2 - 6 keV. Modifications were made to reach 0.75 keV. The amplitude was slightly lower, but it was announced in 2025 that new results are foreseen in the near future [21].

2.2. Detection of a Particular Type of DM Particles by Means of NaI(Tl) Scintillators

The DAMA collaboration had strong reasons to be confident that they had really detected DM particles. However, it is normal in science that discoveries have to be confirmed by independent experiments. That was done, but so far, all these attempts failed to detect the annual modulation. Whatever the reason may be, it has to be attributed to the fact that we knew nearly nothing about DM particles. “Their exact nature remains one of the biggest mysteries in physics” [22], but we will try to understand why the DAMA collaboration was successful.

The main cause of disappointing results was the general belief that DM particles are WIMPs and thus able to collide with nuclei. Their recoil would then liberate electrons (Migdal effect) and they would be sufficiently numerous to be detectable by *any* scintillator. Since we cannot presume that the galactic halo of the Milky Way contains merely one type of DM particles, the DAMA team may have been lucky. We have thus to find out why it could detect a particular type of these mysterious particles by means of NaI(Tl) scintillators. The essential point is that a relatively light DM particle could then excite a single electron from the valence band (VB) to the conduction band (CB) in NaI(Tl) scintillators, as shown in **Fig-**

Figure 3(a). The DM particle does then not have to be annihilated, but could be stopped by communicating its whole kinetic energy E to one electron. This would even be normal for elastic (energy and momentum conserving) collisions between particles of nearly equal masses.

Since alkali-halides are ionic crystals, they are insulators and for NaI, the energy gap is $E_g = 5.89$ eV (Wikipedia). An excitation process would thus require that $E \geq E_g$ and the collision would be *inelastic*, since the electron was initially bound, but becomes free to move in the CB. The momentum conservation law has then to be replaced by the need to provide the required impulse. It is defined by the energy conservation law. In NaI(Tl) crystals, some Na^+ ions can be replaced by Tl^+ ions, which yield local energy levels inside the band gap. An excited electron can thus migrate and be attracted by a nearby Tl^+ ion. Since this is also true for the electron-hole in the valence band, this process facilitates the emission of a photon by the activated luminescence center. The DAMA team insisted [8] that their PMTs were not only radiopure, but also very efficient: “The threshold of each PMT was at a single photoelectron level.”

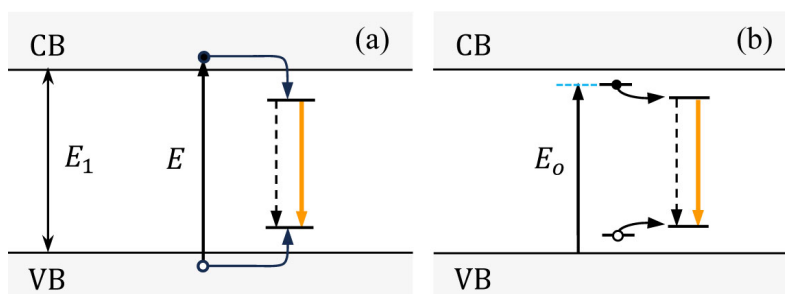


Figure 3. (a) The normal excitation process, activating luminescence in NaI(Tl) scintillators. (b) Facilitated activation by creating associated excitons.

The energy levels of Tl^+ ions are represented here in a simplified way, since slightly modifiable positions of the substituted nucleus will lead to potential wells. The configurational diagram allows then also for a non-radiative transition, indicated by a dashed arrow. Since it requires some thermal agitation, this effect is usually negligible. For efficient gamma ray detection, it is sufficient to replace about 1/1000 Na^+ ions by Tl^+ ions, but this proportion can be increased. It leads then to *exciton assisted luminescence*, represented in **Figure 3(b)**. Excitons are bound electron and electron-hole pairs that can migrate. They are even quite stable entities, but when the density of Tl^+ ions is sufficiently high, excitons are attracted and trapped by luminescence centers. Their association with self-trapped excitons requires only an excitation energy $E_o \approx 5.3$ eV [23].

Since the DAMA collaboration mentioned that they did use very efficient NaI(Tl) scintillators of Saint Gobain [8], they had to contain more Tl^+ ions than usual ones to allow for a lower detection threshold. The difference is only about 0.6 eV, but could be decisive for success or failure. The kinetic energy of the detected DM particles is determined by their mass m_χ and their average velocity

V_o . Though the value of m_χ is unknown, the resulting average kinetic energy X would allow for exciton-assisted luminescence, so that

$$X = \frac{1}{2} m_\chi V_o^2 \approx E_o \quad \text{and} \quad m_\chi / m \approx 2X / m V_o^2 \approx 36 \quad (3)$$

The mass m_χ can be compared, indeed, to the mass m of an electron. The DAMA collaboration would then have detected DM particles of mass $m_\chi \approx 18 \text{ MeV}/c^2$. This value is much lower than the usually assumed mass of WIMPs. This result is very important, but the success of the DAMA experiment can only be understood by analyzing the detection process in more detail.

2.3. Condition for Detecting the Annual Modulation

It results from (1) that the time-dependent mean value of the kinetic energy of incident DM particles on Earth is

$$E_m(t) = X(1 + \alpha \cos \omega t)^2 = X + \varepsilon(t) \quad \text{where} \quad \varepsilon(t) = 2\alpha X \cos \omega t \ll X \quad (4)$$

If DM particles were able to collide with one another, we would expect a Maxwell-Boltzmann energy distribution, but V_o is so great that thermal perturbations are small. We consider thus only a normal (Gaussian) probability distribution for possible kinetic energies E with respect to their mean value. This yields the symmetric and normalized function

$$P(x, \sigma, t) = \frac{1}{\sigma\sqrt{2\pi}} e^{-x^2/2\sigma^2} \quad \text{where} \quad x = E - E_m(t) \quad (5)$$

The parameter σ determines the width (2.355σ) of the peak at half height. $P(x, \sigma, t) \rightarrow \delta(E - E_m)$ when $\sigma \rightarrow 0$, but this approximation cannot be physically justified. It follows from (4) and (5) that

$$P(x, \sigma, t) = P(x, \sigma) - \varepsilon(t) P'(x, \sigma) \quad \text{when} \quad x = E - X \quad (6)$$

The function $P'(x, \sigma)$ is the derivative of $P(x, \sigma)$ with respect to x . This yields a positive peak for the increasing part of $P(x, \sigma)$ and a negative peak for its decreasing part. The measured signal $S(t)$ depends also on the detectability $D(E)$ of DM particles of kinetic energy E , since

$$S(t) = N_o \int_a^b D(E) P(E - X, \sigma, t) dE = S_o + S_m \varepsilon(t)$$

where

$$S_o = N_o \int_a^b D(E) P(E - X, \sigma) dE \quad \text{and} \quad S_m = -N_o \int_a^b D(E) P'(E - X, \sigma) dE \quad (7)$$

The parameter $N_o = Nns$, when N is the flux of incident DM particles (number per unit surface in a time interval that is adequate for statistical analysis), while n is the number of assembled scintillators and s defines the average cross section. The values of a and b are defined by the limits of the selected energy domain, determined by pulse-height discrimination. Shape-dependent discrimination could be added to distinguish between fast and slow scintillation processes. Since the DAMA experiment was performed so that the value of S_o was constant

when it was averaged over reasonable time intervals, the residual signal (2) was determined by

$$R(t) = -S_m \varepsilon(t) = A \cos \omega t$$

It was empirically found that the amplitude A is positive, since $R(t)$ was maximal at about June 2, like the incident DM wind (1). It is thus necessary that S_m is negative and this is true when the average kinetic energy X of the incident DM particles is lower than the threshold E_o , as in **Figure 4(a)**.

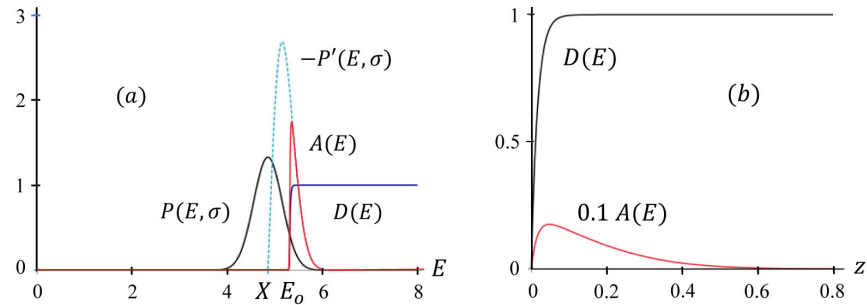


Figure 4. (a) An assumed Gaussian distribution $P(E, \sigma)$ of the kinetic energy E of incident DM particles. A rapid increase of the detectability $D(E)$ would then yield an amplitude $A(E)$ for narrow energy bins. (b) The energy distribution of the resulting amplitude $A(E)$ of the annual modulation would then reproduce DAMA's result by adjusting the assumed flux of DM particles.

To the best of our knowledge, the detectability $D(E)$ of DM particles has never been determined for low energies of *single electrons* in eV. It was measured for gamma rays in keV and did yield functions for NaI(Tl) scintillators of different providers [24]. They had the same shape, defined by

$$D(E) = H(z) \left(1 - e^{-\beta z}\right) e^{-\gamma z} \hat{D} \quad \text{when } z = E - E_o$$

The Heaviside step function $H(z) = 0$ for $z < 0$ and $H(z) = 1$ for $z > 0$. It accounts here for the lowest possible threshold E_o of NaI(Tl) scintillators. A small value of β would yield a rapid rise of the detectability above the threshold $z = 0$. Moreover, $e^{-\gamma z} \approx 1$ for energies that are relevant for detecting DM particles. There remains thus only an increasing function, which reaches a plateau of height $\hat{D}$. This behavior was confirmed by other measurements [25]-[27]. Such a function is represented in **Figure 4(a)** as well as a possible function $P(E, \sigma)$ and its derivative, when its sign is modified to yield a positive function. The resulting amplitude of the annual modulation would then be the function $A(E)$. It is represented by the red curve and defined by

$$A(E) = -N_{oo} H(E - E_o) \left(1 - e^{-\beta(E - E_o)}\right) P'(E - X, \sigma)$$

$N_{oo} = 2\alpha \hat{D} N_o$ and $N_o = Nns$. The DM flux N is unknown, but when we compute $A(E)$ for $N_{oo} = 1$, $E_o = 5.3$ eV, $X = 4.85$ eV, $\sigma = 0.3$ eV and $\beta = 60(\text{eV})^{-1}$, we get the red curve of **Figure 4(a)**. It is also represented in **Figure**

4(b), but the relevant energy domain has there been expanded and $A(E)$ was reduced to yield a function that is similar to the observed one. This means that the DM flux N is smaller than presumed in Figure 4(a).

The aim of this analysis was to make the detection process more transparent and to realize *why* the DAMA collaboration found the expected annual modulation by means of NaI(Tl) scintillators, though that was doubted by unsuccessful competitors. The essential point was that the detected DM particles were light and did interact with single electrons. The generally accepted *paradigm* of heavy WIMPs that collide with nuclei was not correct. Moreover, the experiment was carried out in a way that increased the detectability and reduced any kind of background radiation. This required NaI(Tl) scintillators where the density of TI^+ ions was increased to favor exciton-activated luminescence. The detectability $D(E)$ was also increased by using 25 scintillators and the constancy of the average signal S_o was carefully monitored. The experimental procedure is now transparent and the cause of success of the DAMA collaboration is obvious.

Though the flux N of incident DM particles and the mass m_χ of the detected type of DM particles were not previsible, the DAMA experiment was successful, since the average kinetic energy X of these DM particles was very close to the energy threshold E_o . Our first estimation was based on the assumption that $X \approx E_o$. This did yield $m_\chi \approx 36m$ because of (3), but $m_\chi \approx 33m \approx 16.5 \text{ MeV}/c^2$ is more realistic, since it is necessary that $X < E_o$ and we assumed that the kinetic energy dispersion σ is small, to get a sufficiently great annual modulation of the detected signal. This assumption was confirmed by other experiments. They seemed to be unsuccessful, but every experiment is equivalent to a question asked to Nature. Even a negative answer can be useful, especially when the cause of failure is clarified. This is possible indeed when we examine what happened in other attempts.

2.4. Direct Detection of DM Particles Is Not Easy

It was reasonable that the *Korean Invisible Matter Search* (KIMS) used CsI(Tl) instead of NaI(Tl) scintillators, since they are less hygroscopic and it was impossible to know already the actual mass m_χ of the type of DM particle that might be detected. The South Korean experiment was installed in the YangYang underground laboratory and carefully prepared, but CsI crystals have a larger band gap than NaI. It is 6.3 instead of 5.9 eV [28]. Exciton-assisted luminescence would allow for excitation energies of about 4.4 eV and 3.2 eV. Excitons have several excited states and for CsI crystals, the band gap is large enough to allow for two visible excited states [29]. That was confirmed by optical measurements [30], but these threshold energies are too low with respect to the average kinetic energy X to yield a detectable annual modulation, while the band gap is too large. The difference with respect to NaI was only 0.4 eV and therefore sufficient to assume that $\sigma = 0.3 \text{ eV}$. The first results of KIMS were said to “partially exclude” the DAMA signal [31]. There were fluctuations, indeed, but they were ambiguous. In 2014, it

was clear that “no significant evidence of a WIMP signal” was found [32]. The belief that DM particles are WIMPs was maintained, but it was clear that the measured fluctuations were then not compatible with an annual modulation. They resulted from BG radiation.

The popular paradigm that DM particles are WIMPs that collide with nuclei and release many electrons led even to the conviction that any type of scintillators could be used. That was the reason for installing also a liquid Xenon (LXe) scintillator in the underground Gran Sasso laboratory. Its goal was not only to test the validity of the DAMA result. It might also yield more information concerning DM-nucleon collisions and the resulting electrons. It was possible, indeed, to localize these events in liquid xenon by means of PMTs, but the released electrons would drift upwards, because of an applied electric field. When these electrons reached the gaseous layer of xenon atoms in a closed container, they could there be detected and localized by other scintillators. Even the depth of the place where a WIMP collided with a nucleus could be determined by timing, since the electrons were drifting upwards at a controllable speed.

This method was so ingenious that it was progressively scaled up in different parts of the world. More liquid xenon should offer a greater chance to detect the elusive DM particles. The initial Gran Sasso version used only ~15 kg of LXe (2006-2007). It was followed by ~160 kg (2008-2016) and ~3.2 tons (2015-2018) and ~8.6 tons (in the 2020th) in other underground laboratories. Even 180 scientists from 27 institutions in 11 countries did belong to XENON collaborations. Since Xe atoms are only found as trace elements in the terrestrial atmosphere, LXe is very expensive, but “the DM quest is a golden channel for the search of new physics beyond the Standard Model” [29].

In China, a novel system (PandaX) was installed in the very deep Jiming Underground Laboratory. PandaX-I provided first results in 2015 with ~37 kg of LXe. Results of PandaX-4T were published in 2025. Actually, it did use ~5.6 tons of LXe, since the effective volume is always smaller than the whole container. Preparation of a “next-generation experiment” was already published in 2023. It concerned the PandaX-30T project and required the solution of enormous technical problems for storing LXe at relatively low temperature and high pressure without losses or contamination of the precious liquid [33]. The US Large Underground Xenon experiment (LUX) and other ones are now participating in the international race for direct detection of DM.

So far, the annual modulation was never found, in spite of the tremendous XENON program. This could become a proof of the danger of hazardous beliefs, even when they are shared by many scientists, as for the WIMP paradigm. When most DM particles are relatively light and do interact with electrons, they may not be detectable by means of LXe scintillators. This would require, indeed, that their mass is adequate to excite Xe atoms. Measurements were performed for dual phase Xe experiments, but their results were expressed in keV for electron equivalent energies and nuclear recoil energies [34]. A recent measurement [35] of the

average electron excitation energy of Xe atoms in their liquid phase did yield a value that was close to 11.5 eV. Failure of detecting the annual modulation by means of LXe scintillators would thus mean that there are no DM particles that have kinetic energies for in this energy region.

It is astonishing, however, that even attempts to reproduce the DAMA experiment by means of NaI(Tl) scintillators were negative. The reason was that the signal/noise ratio was not optimal. The ANAIS collaboration, based in Spain, found in 2014 that the contamination of their NaI crystals by ^{40}K radioactivity was indeed too high [36]. In 2018, the international COSINE-100 collaboration, led by the department of physics of Seoul, presented their experiment with NaI(Tl) scintillators [37]. It was installed in the YangYang underground laboratory, but their NaI crystals contained radioactive ^{40}K and ^{210}Pb , which have quite short lifetimes. Two of eight detectors were even eliminated because of excessive noise levels. A more detailed report [38] was published in 2023, but it assumed that the DAMA experiments had to be perturbed by the same radioactive contamination. They would then also detect an exponentially decreasing signal. If it was simply divided in annual periods to compute average values, the residual signal would seem to oscillate in a systematic way.

That was a rather desperate or particularly skeptical reaction to DAMAs claim that they had found an annual modulation, since the constancy of the average values had been carefully controlled. Fortunately, the next-generation COSINE-200 experiment may restore truth. It was already prepared in 2023, by producing “ultra-pure NaI (Tl) scintillators”. K and Pb impurities were reduced by chemical purification of the raw NaI powder and its crystallization was realized in South Korean Institutions [39]. We hope that the new experiment will confirm the correctness of DAMAs results and that both teams will harvest merited acknowledgment.

3. Identification of DM Particles

3.1. The Need of Space-Time Quantization

We mentioned already in the introduction that is necessary to generalize Relativistic Quantum Mechanics to justify the present version of the *Standard Model* of elementary particle physics and to identify elementary DM particles. The basic problem results from the appearance of new degrees of freedom. Their existence can be experimentally discovered, but that is not sufficient to perceive their cause. A well-known example is the concept of *spin*. It appeared already in atomic physics to account for more energy levels than expected. Initially, it was assumed by analogy with planetary motions, that an electron can rotate around an intrinsic axis. This hypothesis was not compatible with the concept of elementary particles, since they are merely points. Actually, it was possible to generalize the concept of angular momenta in terms of periodic wave functions.

Nuclear physics raised new problems, since neutrons and protons seemed to be related to one another by means of up and down components of an *isospin* vector.

Then it appeared that nuclei and cosmic rays are constituted of unknown elementary particles. This situation led in 1954 to the creation of CERN (Conseil Européen pour la Recherche Nucléaire). Its function was to produce accelerators for probing more deeply into these mysteries. This problem is of fundamental importance and did eventually lead to the construction of the Standard Model of elementary particle physics. It emerged in a progressive way, by analyzing more and more experimental data, but did only *describe* what had been observed. That was done by giving names to distinctive properties, without knowing their cause.

There was even a more fundamental problem, since elementary particles have no parts or specific size and shape. Nevertheless, they can be distinguished from one another. String theories tried to explain that. They did account for new degrees of freedom, but that contradicted the very concept of elementary particles. We have to expect that elementary particles should be characterized by different possible modulation of their wave functions or fields, but that could not be justified in the conceptual framework of Relativistic Quantum Mechanics. However, we considered that this theory has to be generalized anyway. Since there are two universal constants (c and $\hbar$), which impose restrictions on possible results of measurements, there could also exist a *quantum of length*. Its value (a) could be extremely small, but has to be a universal constant for any inertial frame and any arbitrarily chosen spatial reference axis in such a frame. This avoids the assumption of atoms of space or a rigid lattice.

There would then also exist a quantum of time a/c and all differential equations would have to be replaced by *finite-difference equations*. The generalized Gordon-Klein equation led then to the conclusion that the highest possible energy is $\hbar c/2a$. This means that the total energy content of our universe is finite and relates the definition of inertial frames to the Big Bang. In regard to elementary particles, the key question was: what are the possible values of the coordinate x along a given spatial axis in inertial frames? They are subjected to two conditions: 1) any precisely measured length Δx has to be an integer multiple of the quantum of length a and 2) it has to be possible to reverse the orientation of this axis. When a particular point on this axis has been chosen to define the origin $x = 0$, it is thus necessary that every possible position x of a point-particle implies that $-x$ is also possible. It follows that $2x = na$, where n is an integer number, which can be even or odd. Thus,

$$x = 0, \pm a, \pm 2a, \dots \text{ or } x = \pm a/2, \pm 3a/2, \dots$$

There are thus two lattices of lattice constant a . The “normal lattice” includes the origin $x = 0$ and corresponds to the usual idea that distances are measured with respect to this point. There does also exist an “intercalated lattice”, but wave function $\varphi(x)$ have to be defined on both lattices, to ensure that the resulting probability distribution $P(x) = |\varphi(x)|^2$ is single valued. There should be no ambiguity, indeed. This implies that $\varphi(x)$ can be modulated by a phase factor

$$e^{iu\pi} = \pm 1 \text{ where } u = 0, \pm 1, \pm 2, \dots \quad (8)$$

This means simply that $\varphi(x+a) = \pm \varphi(x)$, but the value of the quantum num-

ber u has to be everywhere the same for a given type of elementary particles. This applies to every (x, y, z) spatial axes in inertial frames. We can also consider a u quantum number for the ct -axis. However, the time axis cannot be reversed. There is thus only one possible lattice for this axis, but even this restriction would allow for $u_{ct} = 0, \pm 2, \pm 4, \dots$. It follows that every possible elementary particle is characterized by a specific set of (u_x, u_y, u_z, u_{ct}) quantum numbers. Their values are identical everywhere in the whole universe for any arbitrarily chosen inertial reference frame. However, $u_{ct} = 0$ for all common elementary particles. We can thus specify different elementary particle states by means of three spatial (u_x, u_y, u_z) quantum numbers for any choice of spatial reference axes in any inertial frame. These values are identical everywhere in the whole universe, but permutations of the spatial quantum numbers are irrelevant for the definition of different *types* of elementary particles. The names given to the chosen reference axes are arbitrary, indeed.

We consider therefore that the possible existence of elementary particles of different types results from Space-Time Quantization [14]. It should be noted that, in general, we have to consider wave packets to account for possible motions because of Heisenberg's uncertainty relations. It is therefore not realistic to assume that elementary particles have a sharply defined position (x, y, z) . It is therefore necessary to consider *two lattices* for every chosen reference axis.

3.2. Beyond the Standard Model of Particle Physics

Its present version resulted from semi-empirical considerations. It appeared, indeed, that neutrons and protons are constituted of 3 elementary particles. They were called “quarks” for arbitrary reasons, but there had to exist 2 types of them. They got the names *up* (u) and *down* (d) by analogy with spin states for a given z -axis. However, their electric charge had to be $+2/3$ for u and $-1/3$ for d when the quantum of charge $e = 1$. Neutrons and protons would then respectively be (d, d, u) and (u, u, d) particles. Since they are spin 1/2 fermions, Pauli's exclusion principle requires that every quark has 3 possible states. They were said to correspond to “colors” by analogy with trichromatic color vision. These quarks had to be very strongly bound to one another by exchanging bosons. Moreover, these “gluons” should have the capacity to change the color of up and down quarks. This condition could be fulfilled if they were assumed to have a color and an anticolor.

When other types of elementary fermions were discovered, it appeared that some of them constitute similar families. Nevertheless, they could be distinguished from one another. They were thus assumed to be “generations” that have a different “flavor”. This procedure was based on phenomenologically defined concepts. It appeared already by comparison with known elementary particles that the electric charge Q is the average value of the algebraic sum of the 3 spatial u quantum numbers. This can be justified by generalizing Dirac's equation for finite-differences. The charge Q is conserved for permutations of the spatial u -quantum numbers and well-defined for a particular type of particles.

Table 1 provides a classification of known elementary particles that are spin 1/2 fermions in terms of u quantum numbers. This table accounts also for *elementary DM particles*. Since they can be viewed as being neutral quarks, we called them “narks”. Antiparticles are not included in **Table 1**, since they require only to change the sign of all u quantum numbers. It is now obvious that the domain of elementary particles is unlimited, but it is only necessary to understand the underlying physical principles. The essential result is that *the existence of elementary particles is due to STQ*. Moreover, this is not anymore, a purely hypothetical theory. It is justified by experimental facts and provides an enlarged foundation of physics. There are different “generations” of elementary particles, which can be viewed as being excited states of a basic one. For the first generation, the values of u are 0 or ± 1 . The second and third generations allow respectively that one of the u quantum numbers is 2 or 3. Equivalent triads, like $(-1, 1, -1)$ for $(-2, 1, 0)$, are also possible. Composite particles are characterized by u quantum numbers, which are the algebraic sum of the u quantum numbers of their components.

Table 1. Classification of spin 1/2 elementary fermions by Space-Time Quantization.

Gen.	Name	Identity	Q	$m_0 c^2$ MeV
I	electron (e^-)	$(-1, -1, -1)$	-1	0.511
	electron neutrino (ν_e)	$(0, 0, 0)$	0	$<8 \cdot 10^{-7}$
	up-quark (u)	$(1, 1, 0) (1, 0, 1) (0, 1, 1)$	2/3	2.16
	down-quark (d)	$(-1, 0, 0) (0, -1, 0) (0, 0, -1)$	-1/3	4.7
	electron nark (n_e)	$(0, 0, 0) (1, -1, 0) (1, 0, -1) (0, 1, -1)$	0	~ 18
II	muon (μ)	$(-2, 1, 0)$	-1	105.66
	muon neutrino (ν_μ)	$(0, 0, 0)$	0	<0.17
	charm quark (c)	$(2, 0, 0) (0, 2, 0) (0, 0, 2)$	2/3	$1.27 \cdot 10^3$
	strange quark (s)	$(-2, 1, 0) (-2, 0, 1) (0, -2, 1)$	-1/3	93.5
	muon nark (n_μ)	$(0, 0, 0) (2, -2, 0) (2, 0, -2) (0, 2, -2)$	0	?
III	tau (τ)	$(-3, 2, 0)$	-1	$1.78 \cdot 10^3$
	tau neutrino (ν_τ)	$(0, 0, 0)$	0	<18.2
	top quark (t)	$(3, -1, 0) (0, 3, -1) (0, 3, -1)$	2/3	$172.6 \cdot 10^3$
	bottom quark (b)	$(-3, 2, 0) (-3, 0, 2) (0, -3, 2)$	-1/3	$<4.18 \cdot 10^3$
	tau nark (n_τ)	$(0, 0, 0) (3, -3, 0) (3, 0, -3) (0, 3, -3)$	0	?

Table 2 shows the classification of presently know bosons in terms of 3 spatial u quantum numbers. Since their possible values are also $0, \pm 1, \pm 2, \dots$, we distinguish elementary bosons from elementary fermions by means of brackets instead of parentheses. It is also possible to account for transformations of elementary particles. They are subjected to a selection rule, since transformations are only possible when they yield the same modulation of wave functions or fields for the initial and final states for the same group of elementary particle states. Quarks and

narks can thus be bound to one another by creating and annihilating gluons:

$$(1,1,0)+[0,-1,1]=(1,0,1) \quad \text{and} \quad (-1,0,0)+[1,0,-1]=(0,0,-1)$$

These processes account for so-called “color changes” of up and down quarks. They are also possible for colored narks, since $(1,-1,0)+[-1,0,1]=(0,-1,1)$, etc.

Table 2. Classification of elementary bosons by Space-Time Quantization.

Spin	Name	Identity	Charge	$m_0 c^2$ MeV
1	photon (γ)	$[0, 0, 0]$	0	0
	Z boson (Z)	$[0, 0, 0]$	0	$91.2 \cdot 10^3$
	W boson (W^+)	$[1, 1, 1]$	+1	$80.4 \cdot 10^3$
	gluon (g)	$[0, 0, 0] [1, -1, 0] [1, 0, -1] [0, 1, -1]$	0	4.7
0	higgs (H)	$[0, 0, 0]$	0	$125.2 \cdot 10^3$
2	graviton	$[0, 0, 0]$	0	0

There are several types of $(0, 0, 0)$ and $[0, 0, 0]$ elementary particles, but they are different, since they interact only with specific types of other elementary particles. Virtual photons allow for EM interactions, Z and W bosons for weak interactions and gluons for strong interactions. Possible states of known fermions and narks can also be graphically represented by means of lattice points in the quantized (u_x, u_y, u_z) space [14]. The existence of groups for particular values of the electric charge Q becomes then more intuitive.

3.3. Simple and Composite DM Particles

We can now mentally “see” what was hidden in darkness, since narks that are in the *colorless* $(0,0,0)$ state do not have to be bound to other types of elementary DM particles. They reconstitute themselves by $(0,0,0)+[0,0,0]=(0,0,0)$ processes. We called them N_1 DM particles [40]. The 3 narks, which are in *colored* $(1, -1, 0)$, $(1, 0, -1)$ and $(0, 1, -1)$ states will be bound to one another by exchanging gluons of type $[1, -1, 0]$ $[1, 0, -1]$ or $[0, 1, -1]$. This yields composite DM particles that are similar to nucleons. We called them *neutralons*. They are N_3 particles, but there are also N_2 DM particles. They are constituted of a nark and an antinark of the same or some other generation of narks. More composite DM particles are possible [14], but N_1 and N_3 DM particles are expected to be the most numerous ones in our universe, because of their low energy content.

It is therefore reasonable to assume that the DAMA collaboration detected N_1 particles of the first generation, since they are present in the galactic halo and the DM wind on Earth. We can also expect that there are many neutralons. These composite N_3 DM particles have a mass that is about 3 times greater than the mass of single narks. They can thus communicate more energy to electrons. This leads to a highly remarkable and useful property that we discovered by scientific curiosity in regard to the *Unconventional Flying Objects*. They have often been

observed, but are still mysterious. Even if there were only a small probability that they are signs of the presence and technical capacities of ET civilizations that are much older and more advanced than humanity, they would deserve to be studied in a normal scientific way.

4. Discovery and Explanation of a DM Energy Source

4.1. The Energy Source of UFOs Was Shown to a Policeman

Some governments decided to disinform populations and scientists, since they want to keep what they were able (or hope) to learn about a superior technology under the cover of utmost secrecy. However, they could not prevent that some information did surface, because of whistle blowers or special events that escaped their control. In this and the following section, we will present two examples of facts that have to be studied and call for explanations, instead of simply declaring that this cannot be true.

Incidentally, we became aware of an event that happened on December 3, 1967. The policeman Herbert Schirmer was patrolling on Highway 63, near Ashland, Nebraska. He saw at about 2.30 AM a flashing red light on the side of the road and thought that it was a truck in difficulty. He wanted to help, but saw then a flying saucer. However, he remembered only when he was driving to his police station, that this object rose from the ground and did rapidly disappear. Arriving there, he felt nauseated, but noted in the logbook: “I saw at UFO at junction 6 and 63. Believe it or not.” He had also a painful headache and felt hot. When he saw on the wall-clock that it was about 20 minutes later than it should have been, he was very surprised. What did happen during that time?

The following nights, he woke up because of nightmares and asked then for a polygraph test to find out if his memory of the incident was correct or not. According to a Nebraska newspaper, the Ashland police chief Wlaschin said: “He is a good policeman. He never reported anything that wasn’t the way he saw it... If he says it was a flying saucer, well, it was a flying saucer” [41]. Journalists did also report that Wlaschin said to an investigator of the US Air Force that “a Geiger counter showed evidence of radiation in the area where Schirmer reported the sighting”. Because of our investigation of the propulsion system of UFOs [15], we have to mention that it requires beams of ionizing radiation and a surface material which allows for Very High-Temperature Superconductivity. It produces very intense surface currents that create a global magnetic field that is oscillating at low frequencies. It does thus also produce an oscillating electric field, because of Faraday’s induction law. Both fields act together on charged particles, produced by modifiable beams of the ionizing radiation [15]. Geiger counters are then able to detect remanent ionized molecules on the ground, without requiring radioactive UFOs and nuclear processes.

Wlaschin organized himself the lie detector test that Herbert Schirmer wanted. He also reported the result: there was “no indication that Schirmer was deceptive” [42]. Since the US Air Force organized in 1968 a “Scientific Study of Unidentified

Flying Objects” that was headed by Professor Edward Condon, this Committee was asked by some ufologists to also examine this case. However, Condon’s mission was to tell scientists that “further extensive study of UFOs... cannot be justified in the expectation that science will be advanced thereby”. That is what he wrote already on page 1 of his voluminous report [43]. The Condon Commission asked Prof. Leo Sprinkle to perform a hypnotic regression. “During this session, new information was added to the trouper’s account of his UFO experience.” Instead of providing the result, we are told that “the lack of any [material] evidence and interviews with the patrol man left project staff with no confidence that the trooper’s reported UFO experience was physically real.” If the staff had really wanted to investigate UFO phenomena, it would have discovered that abductions by aliens are often accompanied by memory losses [44].

Whether this is true or not, the policeman Schirmer did still want to know what really happened during that night where he saw a UFO and remembered only its departure. He had the impression that “it’s down somewhere in my mind. I just can’t get it out.” Searching who could help, he discovered Loring Williams, a professional hypnotist in Iowa. He met him the first time on June 8, 1968. All sessions were tape recorded and a transcript has been published [45]. We reproduce here only some essential passages of what the policeman is vividly re-experiencing.

Instead of a truck with a flat tire, he sees an object with flashing lights. “It is made of metal and shaped like an elongated football [or disc-like object, seen from the side]. Three legs are “shooting out” and it settles on the ground. The radio, engine and lights of the police car are not working, but two human-like beings are coming out the craft. “I am prevented from drawing my revolver.” The one in front of the car has in his hands something that emits a bright green mist. Schirmer is paralyzed and then unconscious. When he reopens his eyes, the other being grabs him and touches his neck just below his left ear [perhaps to attach something for facilitating communications]. The crew leader asks: “are you the watchman of this town? You can come on board for a few minutes.” Schirmer does not want, but is unable to refuse. The leader is about 1.5 m tall and has normal human features, but his skin is grey-white and his eyes are not blinking. His mouth is merely a slit and does not move when he is talking. His voice comes from a computer, but he is also communicating mind to mind. Schirmer is aware of these messages, though he does not understand them.

Once the memory block is broken, he remembers more details, which is usual in hypnotic regressions. His nearly human-looking guide is dressed in a close-fitting metallic costume. This is a general feature for ufonauts and protects them from magnetic effects on moving electric charges in their brain, while Schirmer felt aftereffects. Actually, he is “floated” with his guide into the lower part of the craft. It is a circular room, with “a lot of cylinders” along the wall. When he points to these cylinders and asks what it is, his guide tells him: “this is how our craft operates” [46]. The cylinders are about 4 feet (120 cm) high and 2 feet (60 cm) wide. Schirmer’s meticulous drawing, reproduced in **Figure 5(c)**, shows that they

are connected by 2 wires, as if they were batteries. A big conical structure is situated at its center. [It might produce the electric current and magnetic field of modifiable low frequency, which is needed for UFO propulsion]. Schirmer's guide does not explain the functioning of this energy source, but he says that "the ship is operated through reversible electro-magnetism". He adds that it results from "reversing electric and magnetic energy".

We explained [15] that UFOs produce an unusually intense *magneto-electric* field by means of superconductivity and Faraday's law, while customary electro-magnetic fields result from Maxwell's law at higher frequencies. The alien says that "all their ships are made from 100% pure magnesium". This was precisely what we showed to allow for Very High-Temperature Superconductivity [15]. When the hypnotist asks Schirmer if there is any defense against UFOs, the police officer answers with hesitation: "ships have been knocked out of the air by radar, because of ionization." That is also understandable, since powerful radar beams can cause UFO crashes by perturbing the rhythm of ionization of the surrounding air [15]. We deduced that from other observations, already before we knew anything about Schirmer's case.

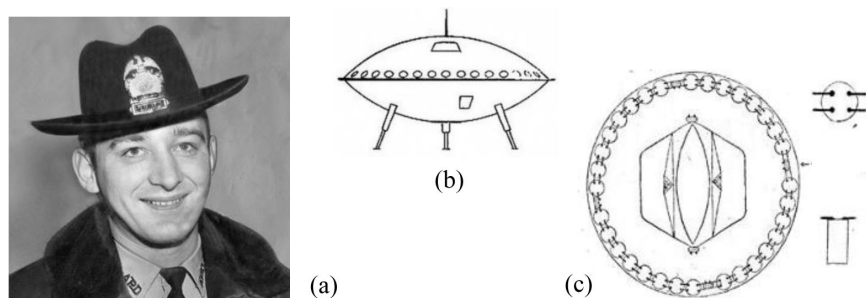


Figure 5. (a) The policeman Herbert Schirmer. (b) His drawing of the landed UFO. (c) His graphical representation of the cylinders and the central structure in its lowest room.

The policeman is then floated with his guide to the middle and upper floors of this craft. There are many computers and some ufonauts are looking at screens. Schirmer can see himself what is happening outside the craft, but is warned by the crew leader that "to a certain extend... we are trying to confuse the public's mind." His demonstration of energy extraction from terrestrial electricity distribution lines provides a concrete example of this behavior. Schirmer is also told that they had "picked up cows, dead bodies of animals and some people... for a program of breeding analysis." The phenomenon of animal mutilations has been documented [47]. They are performed with highly efficient instruments for surgical extraction of specific organs, without bleeding. Moreover, men and women have been abducted to generate human/alien hybrids that have the capacity of "telepathic" communications [48] [49]. Human mutilations are very rare, but were recorded on Internet. Moreover, one of them happened perhaps in Russia, since it left also evidence of missing organs (eyes and tongue). The Dyatlov Pass incident of January 1959 is very mysterious, but has been attributed to Ball Lightning [50]. Maybe

that is true, but we explained its mechanism (see reference [35] in [15]). It is due to plasma oscillations, which increase the lifetime of ball lightning by collecting electrons and positive ions that are present in the surrounding medium. This process accounts for observed effects of various types, but not for beams like those, which are produced by UFOs. Preconceived adverse ideas about the UFO phenomenon are not sufficient to discard this hypothesis.

Henning-Kuersten did a very respectable work, but had to recognize that some of the last photos, taken by the group of 9 scientifically oriented students of the Ural Polytechnic Institute in Sverdlovsk were withheld by Russian authorities. This applies also to some extracts of diaries, in spite of the insistence of relatives and friends. Why did that happen and why were autopsy reports on the missing organs cryptically evasive? Even several attempted, but purely speculative explanations cannot fill the gap. The basic problem is that experienced mountaineers left their tent in panic and did not return to it to save their lives. This uncontested fact remains mysterious.

A short description of Schirmer's case [51] shows already that it was important. We can even hear how the police officer Herbert Schirmer described himself what happened [52]. His opinion about UFO occupants was that "they are very smart about the brain and how to change it". Nobody knows what these alien visitors are really looking for, but Governments of superpowers behave as if the whole UFO phenomenon were unreal or unimportant, while they are retrieving crashed UFOs and study them in utmost secrecy. Nevertheless, these procedures are not totally watertight.

4.2. The Report of General Nathan Twining on Roswell's UFO

Schirmer saw a row of cylinders and thought that they were batteries, but he could not describe what was inside these cylinders. It is thus fortunate that complementary information is available because of the UFO crash near Roswell in June 1947. We presented detailed information about the properties of UFO debris that were found there [15]. The military could not immediately localize the crashed UFO, but when the wreckage was found and recovered, it was rushed by plane to the Air Materials Command (AMC) at Wright Field. It is now called Wrigt-Patterson Air Force Base [16]. The craft was immediately scrutinized by top technicians and engineers. General Nathan Twining, who headed the AMC, wrote already on July 16, 1947 a report to the *Headquarters Army Airforce*. It has been leaked by a whistleblower. Some words were unreadable in the hastily copied document [53], but Leonard Stringfield's status report VII [54] provides a retyped copy.

The General mentioned essential facts: "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 propellor 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 possi-

ble to conceive a more sophisticated energy source. What was actually found? General Twinning wrote that the description of the power room is as follows: “A doughnut shaped tube, approximately thirty-five feet (10 m) in diameter, made of what appears to be plastic material surrounding a central core. This tube appeared to be filled with a clear substance... A large rod, centered inside the tube, was wrapped in a coil of what appears to be copper material ran through the circumference of the tube.” The General states that the clear substance inside the tube might be heavy water and that its internal structures could be the reactor control mechanism or a storage battery. The central rod and the toroidal coil suggested indeed an “activation of an electrical potential”.

Since the propulsion system of UFOs requires an electric current, we think that the central rod and the helicoidal wire were electrodes. A potential difference is needed, indeed, to produce the electric current density on the external surface. Though it is superconducting and avoids inefficient heating, it has to provide energy for the powerful propulsion system of UFOs. General Twinning provided precious information concerning the constitution of this energy source, but how it functions was unknown. He noted even that the “only theory at present” is that mass can be converted into energy. This is achieved by nuclear fission or fusion processes, which can be terribly explosive.

4.3. The Energy Source of UFOs Is Dark Matter

The DAMA experiment revealed the existence of DM particles of mass m_χ by means of the energy conservation law (3). It was a light DM particle and could even be identified with a single elementary DM particle in the (0,0,0) state. This nark survives alone, without having to be bound to other narks, while N_3 DM particles are similar to nucleons, but electrically neutral. These neutralons have a greater mass M_χ and thus a greater kinetic energy when they are intercepted on Earth. By analogy with electron excitations in NaI(Tl) scintillators, we thought that N_3 DM particles could ionize H_2 molecules. The large circular tube, mentioned by General Twinning, could contain compressed hydrogen gas, indeed. These molecules are abundant in our universe and the gas would be transparent. Since the required ionization energy would then be $I = 15.43$ eV, the average kinetic energy of these DM particles is

$$X' = \frac{1}{2} M_\chi V_o^2 \approx I \quad \text{and} \quad M_\chi / m_\chi \approx I / X' \approx 2.9 < 3 \quad (9)$$

This result is compatible with the requirement that N_3 contains 3 narks that are bound to one another. It is also acceptable that $M_\chi \approx 53 \text{ MeV}/c^2$, since DM particle do not have to be WIMPs. Moreover, both types of DM particles can interact with electrons. This is shown by the Feynman diagrams of **Figure 6(a)** and **Figure 6(b)**. The arrows indicate that electrons carry an electric charge, while DM particles are neutral. The interactions occur by means of weak interactions, involving Z bosons, because of the conservation laws

$$(0, 0, 0) + [0, 0, 0] = (0, 0, 0) \quad \text{and} \quad (1, -1, 0) + [0, 0, 0] = (1, -1, 0) \quad \text{etc.}$$

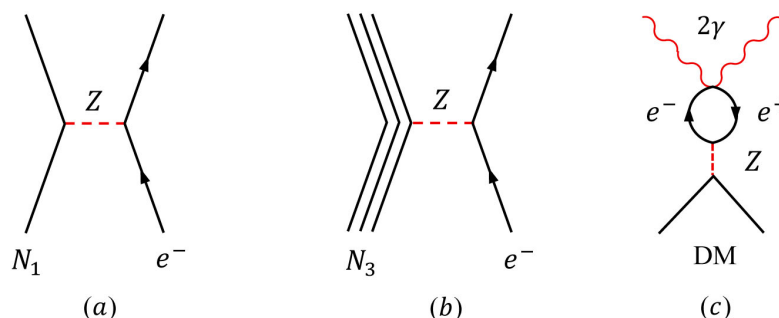


Figure 6. (a) Interaction of an N_1 DM particle with an electron, detected by the DAMA collaboration. (b) Interaction of an N_3 DM particle with a single electron in H_2 molecules. (c) Astrophysical creation of electron-positron pairs and gamma rays.

The policeman Schirmer made us attentive to a strange energy source, which seemed to produce additive potential differences, like batteries. General Twinning, his top technicians and consulted scientists did not solve the riddle of its functioning, but they provided information about the internal structure of a single battery with two central electrodes. Since we analyzed the detection process of DM particles by the DAMA collaboration, Twinning's report suggested that this energy source is due to the energy conservation law (9). Neutralons would not be split, but their whole kinetic energy could be transferred to a quite strongly bound electron. By ionizing hydrogen molecules ($H_2 \rightarrow H_2^+ + e^-$), DM would create a plasma, but how could positive ions and electrons be separated from one another?

In usual batteries, there are two electrodes that have different affinities for electrons and ions, but General Twinning mentioned only that the transparent tube contained two cylindrical wires of different radius. Could that be sufficient? We saw only one possibility: *image forces*. The basic mechanism is well known. When a point charge q is situated near the surface of a metal, it attracts conduction electron when it is positive and repels them when it is negative. This creates a surface charge which does always attract the charge q . It acts even as if a point charge $-q$ were situated inside the metal at the same distance x from its surface as the external charge. This results from the fact that the real external point-charge and the virtual internal point-charge create electrostatic potentials in such a way that the median plane is an equipotential surface. A plane metal surface acts thus like a plane mirror and the external charge is attracted by the Coulomb force

$$F(x) = \frac{q^2}{(2x)^2} \quad \text{when } 4\pi\epsilon_0 = 1$$

This method can easily be adapted for a metallic sphere or a locally spherical metal surface. That allowed us to explain the phenomena of cold nuclear fusion and biotransmutations [55]. They were declared to be impossible, since it was believed that there was no theory that could explain these observations, but that is not true. In the present case, we had to consider what happens when a point-

charge q is situated at a distance d from the axis of a cylindrical wire of radius r . This is a much more complicated problem that has only recently been solved [56]. It requires unlimited series of Bessel functions, but the final result is that the image force is

$$F(d, r) = q^2 \frac{\varphi(\delta)}{r^2} \quad \text{where } \delta = \frac{d}{r} \quad \text{and} \quad \varphi(\delta) = \frac{\pi}{4 \ln(\delta) \delta^2}$$

Figure 7 represents the magnitude of this force versus the radius r of the cylinder for some particular values of the relative distance δ . These graphs apply to $q = \pm 1$ and the attractive force F becomes always infinite when $\delta \rightarrow 0$, but it is stronger for a cylinder of small radius. Charge separation can thus be achieved by means of two cylindrical wires of different radius. Their optimal values are determined by the condition that electrical neutrality should be preserved inside the plasma. The greater mass of the ions requires a stronger force and thus a smaller radius. This accounts for the thin wire and the bigger central rod.

The result is related to the fact that a uniformly charged wire is surrounded by a “logarithmic potential”. This effect is applied in Geiger counters, since they contain an inert gas (helium, neon or argon), which can be ionized. A central wire attracts positive ions, while electrons are attracted by a metallic cylinder near the surface of the tube. These electrodes do separately collect ions and electrons. The system described by the General is more efficient, since there are two wires, which are close to one another. Since they have to be very rigid, it is probable that they also made of a metal that is in a VHTS state and therefore very tough [15].

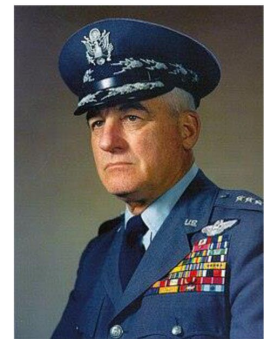
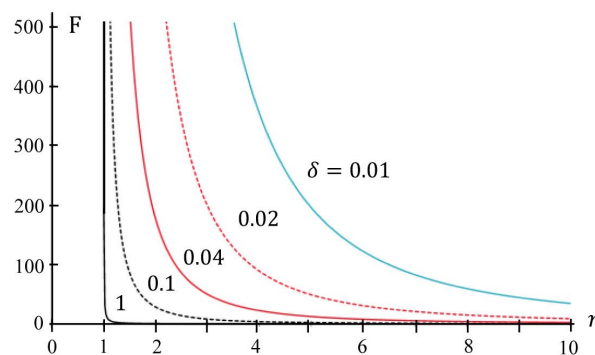


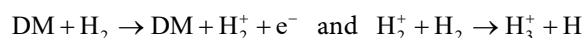
Figure 7. Calculated image force F for a cylindrical metal wire of radius r , when an external point charge is situated at a distance d from its surface and $\delta = d/r$. General Nathan Twining contributed to the solution of this tricky problem by describing the observed energy source.

General Twining became Chief of Staff of the US Air Force in 1953 and Chairman of the Joint Chiefs of Staff in 1957. We want to stress that he was an honest member of an institution where lying to the Nation, the scientific community and the whole World was vigorously imposed. He wrote already on September 23, 1947 a memo [57], which was not top secret. It declared that the opinion of the AMC about Flying Discs was that “the phenomenon reported is something real

and not visionary or fictious.” Scientist should thus have investigated it themselves, instead of blindly believing what they were told.

4.4. Astrophysical Confirmation of Ionization of H₂ Molecules by DM Particles

We have already presented evidence in 2017 of the presence of DM particles in our Solar system, without considering UFOs [58]. Though properties of DM particles have been extensively reviewed in 2024, their direct detection by the DAMA/LIBRA collaboration was still treated with utmost prudence or outspoken skepticism [59]. That DM could yield an energy source for UFOs, which was totally unknown. It was recently discovered, however, that ionization of hydrogen molecules by DM particles is occurring near the center of our galaxy [60]. The rate of ionization of hydrogen molecules is there even so high that is cannot be explained by impact of cosmic rays. This idea had already been expressed in 1990 by Sciamma [61], but at that time it seemed too speculative that DM particles might cause ionization of hydrogen molecules in the Central Molecular Zone (CMZ) of galaxies. The density of H₂ and DM particles is there very high and the density of H₃⁺ can easily be detected by infrared spectroscopy [62]. These observations were eventually attributed to the following reactions:



In this case, the DM particles are merely scattered and not stopped, since their kinetic energies are very high. It was shown in 2023 that this process indicates also that the WIMP hypothesis is inadequate for DM [63]. This conceptual revolution was confirmed in 2025 and attention was attracted on the still mysterious detection of 511 keV gamma rays in the CMZ [60]. Since DM particles interact with electrons, we propose the mechanism of **Figure 6(c)**. It is well-known, indeed, that the required gamma rays are produced by electron-positron annihilation. NASA stressed the importance of the recent discovery of *light* DM particle in the Milky Way’s Core by means a video [64]. It is also remarkable that H₃⁺ ions could be detected in Jupiter’s atmosphere by means Casini’s spectroscopic data and that their presence was attributed to ionization of hydrogen molecules by DM particles [65].

4.5. Black Holes Contain Condensed Dark Matter

Albert Einstein related gravitational fields to a modified space-time metric. Though he did use differential equations, curvatures can be viewed as resulting from a modified density of invariant quanta of length on both sides of curved lines. Replacing continuous trajectories by a sequence of possible positions opens a way to “quantum gravity”, which could not yet be developed. However, the concept of black holes resulted already from Schwarzschild’s solution of Einstein’s equations of general relativity for a point mass M , situated in free space. The gravitational force exerted by this mass would then not only become infinite at this

point as for Newton's theory, but also on the surface of a surrounding sphere of radius

$$R_s = \frac{2GM}{c^2}$$

This applies to any given mass M , whether it is small or great. Einstein's theory of gravity led thus to a new singularity, since the surface of the Schwarzschild sphere becomes an "event horizon" when it is approached from the outside. Because of extreme time dilatation, an external observer gets no signal from inside the sphere of radius R_s . Space and time are thus disconnected outside and inside this sphere. From a physical point of view, it is more useful to say that the gravitational pull is so strong inside this sphere that nothing can come out. The escape velocity of a particle of mass $m \ll M$ would be too great [66]. Since even light cannot come out of this sphere, it is called a "black hole", but that does not mean that it is empty. It can even contain an enormous amount of matter by attracting more and more ordinary and dark matter from its surrounding. It will be set in spiraling motion, as for a drain. Since it is electrically charged, it produces a powerful magnetic field and two polar jets, which can be very long.

We are more concerned with the kind of matter that could exist inside black holes. Neutron stars are already very dense, but this density remains limited by Pauli's exclusion principle. Inside a black hole, protons and electrons have not only to be combined to get neutrons. They were transformed into DM particles. Though we cannot observe what happens inside the Schwarzschild sphere, we can use the conservation laws, which results from the theory of STQ. They account for transformations of elementary and composite particles of any type. Even protons and electrons can thus annihilate one another to yield marks by processes of the following type:

$$(1,1,1) + (-1,-1,-1) = (0,0,0) \quad \text{or}$$

$$(1,1,1) + (-1,-1,-1) + [1,-1,0] = (1,-1,0) \quad \text{for instance.}$$

It has to be expected that black holes evolve, since their average density.

$$\rho = \frac{M}{V} \propto \frac{1}{M^2}$$

Dark matter could thus be crushed more and more, until there remains only one extremely dense DM entity at its center. However, there is also *dark energy*, which is constantly created to allow for the accelerated expansion of our universe. This process is still mysterious, but could result from transformations of DM particles, which were created in great quantities by the Big Bang [67]. It might even account for the matter-antimatter dissymmetry, if expanding space could be viewed as resulting from a hypersphere of increasing radius. The Big Bang could then have produced a segregation of matter and antimatter in two expanding hyperspheres of different radius.

5. Summary and Outlook

Direct detection of DM particles on Earth is of fundamental importance, but so far, only the DAMA collaboration has succeeded by means of NaI(Tl) scintillators. It insisted on a model-independent approach, though it was generally believed that DM particles are massive (WIMPs) and collide with nuclei. Nuclear recoils would then liberate many electrons. The DAMA experiment was conceived without excluding this possibility, but interactions of light DM particles with single electrons were also possible. Anyway, there was a criterium to verify if detection of DM was real or not, since there should be an annual modulation of the detected signal. That turned out to be true, but had to be explained.

Our analysis of the detection process revealed that it resulted from light DM particles of specific mass m_χ . It is only about 33 times greater than the mass m of an electron. The DAMA team was lucky, but that is normal for any hunt or scientific discovery. The decisive factor was therefore that the experiment was planned and carried out to optimize chances of detection and to exclude possible perturbations. Even the use of NaI(Tl) scintillators is not sufficient when they are not highly radio-pure. Since the new South Korean COSINE-200 experiment has been greatly improved in this regard, we wish success and common praise, since the remarkable result of the DAMA experiment should eventually be recognized by the scientific community. At present, an international competition has started to detect DM particle by means liquid Xe scintillators. So far, no annual modulation could be detected by this method, but that is also meaningful in regard to possible DM particles.

Identification of elementary DM particles was not possible by means of the Standard Model of particle physics, which accounts only for a phenomenological description of properties of ordinary matter. It was even impossible to understand why elementary particles can be distinguished from one another, since they are merely points. Characteristic properties have to be inscribed in their wavefunctions or fields, but that was not compatible with the usual concept of a space-time continuum. It can and has to be generalized, however, since past discoveries told us that Nature can impose restrictions on possible results of measurements. This was due to the discovery of two universal constants: c and h . Nevertheless, we continue to believe that it should be possible to measure *infinitely small* intervals of space and time. That is merely a postulate, suggested by the classical concept of continuously existing material particles. In quantum mechanics, it is possible to describe motions by means of probability distributions, which allow for the existence of a “quantum of length”. Its value a is unknown, but has to be a universal constant for all inertial frames, like c and h .

This concept led to the development of theory of Space-Time Quantization (STQ). Since usual differential equations had to be replaced by finite-difference equations, it appeared that the value of a depends on the total energy content ($hc/2a$) of our universe. Moreover, there are *two lattices* for measurable values of coordinates (x, y, z) along 3 arbitrarily chosen reference axes in inertial frames. The normal lattice includes the chosen origin, but there are also intercalated lat-

tices of lattice constant a . The probability distribution for moving particles has to be unique, but that allows for modulations of probability amplitudes at the smallest possible scale. It follows that all elementary particles are characterized by 3 new quantum numbers. Their values are $0, \pm 1, \pm 2, \dots$ as well for bosons as for fermions. The essential conclusion is therefore that the existence of different types of elementary particles is due STQ [14].

The Standard Model of particle physics is not only justified, but also generalized. So-called anomalies can be solved and DM particles can be identified. There are even selection rules for physically possible annihilation and creation processes. The DAMA/LIBRA collaboration detected elementary DM particles (N_1), but there are also composite DM particles (N_3). They are similar to nucleons and can ionize hydrogen molecules. This happens in the Central Molecular Zone of galaxies and constitutes the energy source of UFOs. These Unconventional Flying Objects have often been observed and the USAF discovered their energy source in 1947, but could not explain its functioning. We do that in terms of freely available DM particles and image forces.

It is a pity that the scientific community did not examine the UFO phenomenon, independently of official claims. This phenomenon is not only real, but also a sign of the existence of ET civilizations that are much older and technically more advanced than the human one. They can perform interstellar space travel, because of their DM energy source. They are able to produce materials that can be in a state of Very High-Temperature Superconductivity (VHTS). These materials are needed to produce magneto-electric (ME) fields for a very efficient and flexible propulsion system. Moreover, these materials are light, but extremely tough.

There are many challenges for the scientific community in this domain. We intend to improve the method that we used to show that VHTS result from Coulomb forces and nearly perfect lattice structures [15]. We will also insist that UFOs use ME waves instead of EM waves for communication and some other purposes. This could explain why the Search of Extraterrestrial Intelligence (SETI) remained ineffective. It is also important to understand why interstellar space travel is possible and does involve relativistic effects. Retrievals of crashed UFOs did also occur in Russia. It would thus again be a tragic illusion to believe (as for the nuclear arms race) that secrets can be kept for phenomena that belong to Nature. We will show that ufonauts can also produce beneficial effects, resembling wonders.

The most urgent task for the scientific community is to develop a new energy source using freely available DM. It would be decisive for long-term survival of humanity. Especially in regard to contact with ET civilizations, it is urgent to modify human relations at the scale of our planet, by *learning to live in peace*. This concerns not only politicians and the military-industrial complex, but also the scientific community, since it has its own ethics and responsibilities.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Major Acronyms

DM	Dark Matter
BG	background radiation
PMT	photomultiplier tubes
SM	Standard Model of elementary particle physics
STQ	space-Time-Quantization
UFO	Unconventional Flying Object
ME and EM	magnetoelectric and electromagnetic (fields or waves)
SETI	Search for Extraterrestrial Intelligence
