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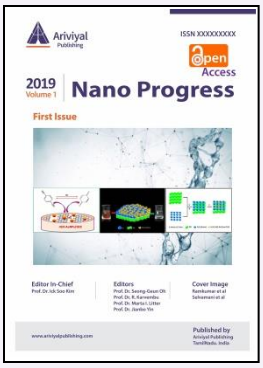

Four Types of Electrons and their Associated Finite Magnetic Fields

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Abstract: According to twin physics, based upon a complementary mathematical language, each magnetic or electric field is restricted to a finite space. By improving the structure of this theoretical model, more comprehension of the laws of Maxwell and so of the magnetic field is obtained. Magnetism seems to be crucial in understanding electric features in nano-physics and chemical bonds. The basic physical item is a unit of potential energy. To be able to consider large molecules, junction rules for the interaction between many units are defined. Using these rules, four types of electrons are described. Electrons of type 1 en 2, called the free electron and the ground electron, have mass and are supplied with a spin particle. Electrons of type 3 and 4, called the chemical electron and the plasma electron, have no mass and are supplied with a microspace, being a finite magnetized space. Of each electron the features and occurrence are considered, the way of transformation from one type into another and the possible bond with a proton. The plasma electron, having the largest microspace at the largest distance and so influencing the surrounding, seems to play a role in the contagiousness of viruses. Applying the obtained descriptions to a theoretical construction of carbon via hydrogen, helium and beryllium, an explanation is given for the difference in conductivity between diamond and graphene.

Keywords: twin physics; complementarity; laws of Maxwell; four types of electrons; magnetic fields; carbon; diamond; graphene

1. Introduction

Twin physics is a dualistic way of considering the physical world, using a complementary mathematical formalism. The basic concept is that determinate and indeterminate aspects of a phenomenon are mutually independent, and that they occur in nature in such a manner that one of both dominates an observation and the other occurs as a small disturbance. The basic physical item is a ***unit of potential energy***, supplied with attributes of time, space, charge and fields. By mutual ***interactions***, potential energy can be transformed into actual energy. In this way the laws of Maxwell, the basics of relativity theory and quantum mechanics are combined. All basic variables are organized in ***geometric*** modules, making applications of twin physics relatively easy to master; by combining them in a suitable way, insight is gained into the logic and intelligence of physical phenomena at any scale.

Two previous publications of Backerra provided descriptions of four distinct types of electrons, accompanied by a magnetic spin particle or a finite magnetized space.[5,6] The way in which these electrons could exist in materials and the influence of these magnetic items was not clear yet. In previous publications we focused mostly upon descriptions of time and space, instead of electric and magnetic details, to compare them with the known experimental reality. In this paper we will focus upon a better comprehension of electricity and magnetism.

The laws of Maxwell were presented in 1865 in a strictly mathematical way, assuming that fields were infinite, not taking into account that in reality, they could be ***finite***. At the time, mathematics was considered as being identical with physics. By contrast, in twin physics space has an independent, finite existence and consequently, electric and magnetic fields will be restricted to it. This is carried out mathematically by applying a transformaion operator to geometric items, for instance a 3-dimensional sphere, resulting in realistic physical descriptions.

The way in which twin physics is constructed from scratch is described extensively in Backerra,[1,2,4] so below we will sum up only the ***basic features*** of this theoretical model. (1) All phenomena are considered in a ***complementary*** way. (2) ***Space*** is considered as an independent entity (instead of as an absence of matter), having a potential equal to that of mass. (3) The ***Heisenberg principle*** is used in an extended way, suited for any scale and valid also in the opposite sense, so 'uncertainty' may also be dominant in a phenomenon, with 'certainty' as the disturbance. (4) A strict division between mathematics and physics is maintained; potential energy is considered as a mathematical concept which cannot be observed or measured. (5) A unit of potential energy is called a Heisenberg-unit (H-unit); this potential energy can be transformed into actual energy only by interaction with another H-unit. (6) Three-dimensional space and one-dimensional time is used. The reason why we don't use four-dimensional space-time, as introduced by Einstein, is discussed previously ([4], Section 2.9).

In Sections 2 through 4 we will present a new didactic way to describe space and time. Moreover, a previously incomplete theoretical step is added to the deductions, concerning the combination of small- and large-scale descriptions, by defining the ***coherence operator***. The Cartesian coordinates are changed into ***spherical coordinates***, which is more in line with the spherical geometric attributes of the H-units. This is not meant to be understood as a recapitulation of previous work, but as a preparatory exercise, to pick up electricity and magnetism in Section 5 in a more comprehensive way. The renewed details as mentioned above, will be used to derive the laws of Maxwell and, based on the obtained new insights, to consider electric and magnetic features more closely than is possible in the classical way. Except the summaries, they may be skipped if you just want to know the results.

This refreshed explanation is developed to give access to the approach which leads to the description of ***four types of electrons*** in Section 6, being an important addition to the known classical electrons, and to allow us to develop these insights still further. We prepared twin physics for more complicated applications, requiring more H-units than previously, to compose large atoms and molecules. This is realized in Section 7 by composing ***four junction rules***, based upon the geometric features of the generated objects. As a first step, in Section 8, the possible bonds between an electron and a proton are considered. As an example of their application in larger molecules, in Section 9 is shown how to compose a carbon atom. Two examples concerning ***electric conductivity*** are given, being diamond and graphene.

In the beginning of twin physics we had no idea about the possible relative sizes of the obtained physical items.[1] Since we obtained more insight in the relation between these objects and their eventual charges and fields, it became necessary to rename some of them. The previous 'macrospace' is renamed as (neutral) '***macrospace***'. The previous 'marked macrospace' is renamed as (magnetic) '***microspace***'. The previous 'microspace' is renamed as '***femtospace***'.

One of the time attributes, being the 'flash of time', was unjustifiably considered to be related to the time differential; this has been removed. The formulas have been elucidated by simplifying the descriptions of two major attributes; this was postponed until we were sure that this would not have unforeseen consequences. The concept of time has been changed drastically, without changing the formulations, making applications of the time zipper considerably easier. To reflect this, we renamed the 'set of time attributes' as the '***time tool kit***' containing ***time labels***.

It is very clear that twin physics deviates in many aspects from classical physics. However, the study of this theoretical model is not as difficult as it might seem, because of the used simple geometries instead of complicated algebra. The only problem is the required switch. Once you have managed to do this, it is a convenient physical method and applications are relatively easy, even concerning the deeper understanding of the laws of Maxwell.

2. Basic concepts and formulas

Below the minimum of mathematical definitions and formulas is given, to have at hand what we need in what follows. It is no problem if you cannot understand everything in such a short overview, as long as you grasp the basic ideas. In Sections 3 and 4 these basics will be elaborated for space and time, and two examples will be given. The development of twin physics and more explanations can be found in [4].

A ***mathematical stepping stone*** of twin physics is the ***definition of a complementary interpretation***, as suggested by Jammer,[12] in which uncertainty is tackled in a mathematical manner by conceiving complementarity ***from a logical perspective***. He stated this as follows: "A given theory admits a complementary interpretation if the following conditions are satisfied: (a) it contains (at least) two descriptions A and B of its substance-matter; (b) A and B refer to the same universe of discourse; (c) neither A nor B, if taken alone, accounts exhaustively for all phenomena of this universe; (d) A and B are mutually exclusive in the sense that their combination into a single description would lead to logical contradictions."

A simple example of a complementary process is the production of textile: if we take woof and weft for A and B, they refer to the same universe of discourse which is 'textile'; if taken alone, neither woof nor weft can produce textile and obviously they exclude each other.

In twin physics we take for A and B two mathematical items: $A = D_i$ and $B = U^i$, in which D_i is ***a determinate attribute***, written with a lower index, and U^i is ***an indeterminate attribute***, written with a higher index (the letter U stands for 'uncertainty', as an indication of indeterminism).

A ***physical stepping stone*** of twin physics is the ***Heisenberg uncertainty principle***,[10,11] a concept which has stimulated great progress in particle physics. The principle says that each ***certain*** time and space observation implies an amount of ***uncertainty*** at an atomic scale. We extend this with the opposite, so each ***uncertain*** time and space observation implies a small amount of ***certainty***. To express this, small-scale time and space items are described by two ***minor attributes*** d_i and u^i, being complementary with respect to each other and indicated in general by $\tilde{x}_i$. They are much smaller in size and have much less influence than the ***major attributes*** D_i and U^i, which in general are indicated by $\tilde{X}_i$, but they are related to them. The combination of these four attributes in one and the same formulation is possible by using set-theory, described by Kahn.[13] A set is defined as any collection of objects, even with different dimensions. Then the ***general set of attributes***, indicated by h_i, can in general be written as:

$$h_i = \{D_i, U^i, d_i, u^i\}. \tag{1}$$

Later we will use this set to describe three basic physical ***qualities*** separately, being three-dimensional ***space***, one-dimensional ***time*** and *mark*, written as $\mathbf{r}$, t and q. The last one is a precursor of charge, electric and magnetic fields; this will be considered in Section 5.

As the ***third feature*** of twin physics we use a ***unit of potential energy***, called the ***Heisenberg-unit*** and indicated by H-unit or H_i.

This unit is defined as a constant amount of potential energy, which can be converted into ***actual energy*** only by ***interaction*** with another H-unit H_j. The origin of the ***confusion*** between potential and actual energy can be found in Rankine;[15] at the time, mathematics was considered as an integral part of physics and so potential energy was conceived as a form of real energy, although it is only a ***mathematical tool*** to describe changes between distinct types of actual energy and so a medium of exchange.

Each H-unit is supplied with a set of space, a set of time and a set of mark attributes. An ***interaction*** between two H-units is in general written as $H_i * H_j$, described by ***combining*** all mathematical attributes of space, time or mark; they are supplied with a tilde (like in $\tilde{X}$) to indicate their mathematical character. In this way we can deal with all combinations of certainty and uncertainty, supposing that we don't have to know everything, if we just know enough.

The ***join operator*** $\bowtie$, connecting two arbitrary chosen attributes $\tilde{X}$ and $\tilde{y}$ of two H-units to the ***joined pair*** $\tilde{X} \bowtie \tilde{y}$, is defined in such a way that, after transformation into a physical space, these attributes occur combined in the described phenomenon. The ***link operator*** $\propto$, connecting two ***joined pairs*** $\tilde{X}_1 \bowtie \tilde{y}_1$ and $\tilde{X}_2 \bowtie \tilde{y}_2$ to the ***chain*** $(\tilde{X}_1 \bowtie \tilde{y}_1) \propto (\tilde{X}_2 \bowtie \tilde{y}_2)$, is defined in such a way that, after transformation into a physical space, these joined pairs occur combined in the described phenomenon.

With the eight attributes of two H-units, concerning one quality, an extremely large amount of chains can be put together. Fortunately this is reduced considerably by using the ***exclusion principle***, deduced from quantum mechanics, which says that two major attributes can never appear simultaneously, nor joined pairs containing them both. So D_i cannot appear together with U^i in any interaction, and neither can D_j with U^j. With the exclusion principle, the eight attributes can be combined to only ***four distinct chains***, each composed of only ***four joined pairs***. This is explained in an easy way by using large and small colored blocks (see [6], also on YouTube).

However, if this is applied to attributes of time, space or mark, each chain is reduced to an expression containing ***only minor*** attributes. To save the information given by the major attributes, we will also use four ***stripped chains***, obtained by dropping the minor attributes and thus having them contain ***only major*** attributes. A stripped chain and the original chain will be collected in a set of two elements, called a ***zip***, written as z_n, with $n \in \{1,2,3,4\}$. Thus each zip contains a large-scale and a small-scale element, written as:

$$z_n = \{[\tilde{X}_n], [\tilde{x}_n]\}. \tag{2}$$

The square brackets indicate the ***transformation operator***, indicating that the mathematical items still have to be transformed into physical ones. The element on the left is called a ***large-scale element***, the element on the right a ***small-scale element*** of the zip. The resulting four zips are collected in a set, called the ***zipper***, indicated by Z_{ij}, which contains ***all information*** about interaction $H_i * H_j$ for ***one quality*** (time, space or mark):

$$Z_{ij} = \begin{Bmatrix} \{[D_i \propto D_j], [(D_i \bowtie u^i) \propto (D_j \bowtie u^j) \propto (D_i \bowtie u^j) \propto (D_j \bowtie u^i)]\} \\ \{[U^i \propto U^j], [(U^i \bowtie d_i) \propto (U^j \bowtie d_j) \propto (U^i \bowtie d_j) \propto (U^j \bowtie d_i)]\} \\ \{[D_i \propto U^j], [(D_i \bowtie u^i) \propto (U^j \bowtie d_j) \propto (D_i \bowtie d_j) \propto (U^j \bowtie u^i)]\} \\ \{[D_j \propto U^i], [(D_j \bowtie u^j) \propto (U^i \bowtie d_i) \propto (D_j \bowtie d_i) \propto (U^i \bowtie u^j)]\} \end{Bmatrix} \tag{3}$$

Each zip (one horizontal line) represents ***one type of interaction***, on the left side showing the ***large-scale element***, on the right side the ***small-scale element***. The zippers for time, space and mark are subsequently written as $Z_{ij}(t)$, $Z_{ij}(\mathbf{r})$ and $Z_{ij}(q)$. The operation 'transformation from potential into actual energy' is necessary for the elements of ***space*** and ***mark*** zippers, because mathematics offers more freedom than physics does, as it does not have to meet the physical reality, so possibly a part of the mathematical description has to be dropped before the zips are usable in physics.

After transformation the tildes will be removed, in general indicated by $[\tilde{X}] = X$, with X being an item of space or mark. Most mathematical items can be transformed by simply removing the tildes; however, in some cases X might appear in a different form than $\tilde{X}$. Because time contains no energy, transformation is not necessary and so $\tilde{X}(t) = X(t)$ for the elements of $Z_{ij}(t)$; this will be considered in Section 4.1.

Then one zip of equation (3) can be written as:

$$z_n = \{X_n, x_n\}, \tag{4}$$

in which X_n is the large-scale element and x_n the small-scale one. ***For time and space***, these two physical expressions have to be ***reconciled*** to a single one. This is not possible for each combination of X_n and x_n, so we will introduce the ***coherence operator*** $<>$, combining X_n and x_n in an appropriate way. This operator will be defined in the next two sections. The result is called a ***time or space aspect*** of the phenomenon, written as:

$$\Omega_n = X_n <> x_n, \tag{5}$$

in which Ω_n is $\Omega_n(t)$ or $\Omega_n(\mathbf{r})$. Because X_n is the stripped version of x_n, we require that $X_n <> x_n$ is ***coherent***. If $x_n = \emptyset$ (being the empty set), then $X_n <> x_n$ is reduced to ***large-scale*** element X_n; then the extended Heisenberg principle, saying that each observation of X_n requires the observation of x_n (which is not the case), implies that the phenomenon cannot be observed. However, this principle does not rule out the ***existence*** of the phenomenon, so we suppose that a zip of the form $z_n = X_n$ describes a really existing, but in time and space ***non-observable*** aspect.

After transformation, the three aspects of one phenomenon, generated by two H-units, are collected in the set:

$$\Omega_n(t, \mathbf{r}, q) = \{\Omega_n(t), \Omega_n(\mathbf{r}), \Omega_n(q)\}, \tag{6}$$

which is called an ***H-event***. Time aspect $\Omega_n(t)$ is placed in front, as we suppose that $\Omega_n(t, \mathbf{r}, q)$ does not appear if $\Omega_n(t) = \emptyset$, so in that case it is not necessary to deduce $\Omega_n(\mathbf{r})$ and $\Omega_n(q)$. The four phenomena which might be generated by $H_i * H_j$, according to zipper (3), are collected in the ***set of H-events***:

$$\Omega_{ij}(t, \mathbf{r}, q) = \{\Omega_1(t, \mathbf{r}, q), \Omega_2(t, \mathbf{r}, q), \Omega_3(t, \mathbf{r}, q), \Omega_4(t, \mathbf{r}, q)\}. \tag{7}$$

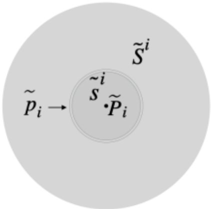

Fig. 1. Geometrical representation of the set of space attributes

A set of H-events contains at most two non-empty elements, which will be explained in Section 5; if indeed two phenomena are generated, they are called ***associated H-events***. Finally, to the obtained H-events ***actual energy*** will be ascribed to the space and mark aspects $\Omega_n(\mathbf{r})$ and $\Omega_n(\mathrm{q})$. Each time aspect $\Omega_n(t)$ supplies information about the static, dynamic or accelerated character of the generated object.

3. The zipper of space and its operators

After having considered the zipper and its four zips in general, we will consider the ***set of space attributes***. So, we have to define two major and two minor space attributes, being complementary two by two, and their operators. Inserting these in equation (3) will give the space zipper. In the general set of attributes (1) we will take for the major attributes: $D_i = \tilde{P}_i$, called a ***point of space***, and $U^i = \tilde{S}^i$, called the ***major space***, being a finite spherical space around this point. By definition, $\tilde{P}_i$ is excluded from $\tilde{S}^i$ and its border is open, so it is the three-dimensional version of an open interval (previously this was notated as $\tilde{S}^i \backslash \tilde{P}_i$). For the minor attributes, starting with the last one: $u^i = \tilde{s}^i$, called ***minor space***, being a tiny sphere around point $\tilde{P}_i$, and $d_i = \tilde{p}_i$, called ***pellicle***, being an infinitesimally thin layer upon the minor space. Then the ***set of space attributes*** $h_i(\tilde{\mathbf{r}})$ of H-unit H_i is:

$$h_i(\tilde{\mathbf{r}}) = \{\tilde{P}_i,\ \tilde{S}^i,\ \tilde{p}_i,\ \tilde{s}^i\}, \tag{8}$$

in which $\tilde{\mathbf{r}}$ indicates spherical coordinates. Fig. 1 is a geometrical representation of this set. Each attribute stores an amount of ***potential space energy*** proportional to its size. This implies that $\tilde{P}_i$, occupying no space, stores no potential space energy; in Section 5 we will show that instead, it may store potential mark energy.

The spherical coordinates are: radial distance r, polar angle ϑ (theta) and azimuthal angle φ (phi). If both r and ϑ are constant, then the object ***rotates*** around an axis. If both ϑ and φ are constant, then the object moves in a straight line ***towards or away from*** the chosen origin.

Inserting the space attributes and operators in equation (3), we obtain the general ***space zipper***, describing all possible information about the space interaction of $H_i * H_j$ as:

$$Z_{ij}(\mathrm{r}) = \left\{ \begin{array}{l} \{[\tilde{P}_i \cap \tilde{P}_j], [\tilde{s}^i \cap \tilde{s}^j \cap (\tilde{P}_i \bowtie \tilde{s}^j) \cap (\tilde{P}_j \bowtie \tilde{s}^i)]\} \\ \{[\tilde{S}^i \cap \tilde{S}^j], [\tilde{p}_i \cap \tilde{p}_j \cap (\tilde{S}^i \bowtie \tilde{p}_j) \cap (\tilde{S}^j \bowtie \tilde{p}_i)]\} \\ \{[\tilde{P}_i \cap \tilde{S}^j], [\tilde{s}^i \cap \tilde{p}_j \cap (\tilde{P}_i \bowtie \tilde{p}_j) \cap (\tilde{S}^j \bowtie \tilde{s}^i)]\} \\ \{[\tilde{P}_j \cap \tilde{S}^i], [\tilde{s}^j \cap \tilde{p}_i \cap (\tilde{P}_j \bowtie \tilde{p}_i) \cap (\tilde{S}^i \bowtie \tilde{s}^j)]\} \end{array} \right\}. \tag{9}$$

The space zipper is completely determined by the ***relative distance*** between the points of space $\tilde{P}_i$ and $\tilde{P}_j$. This is possible in ***seven distinct space cases***. To be able to elaborate them, we have to define the join, link, transformation and coherence operators. The ***join operator*** $\bowtie$ for two space attributes depends on the combination of the major and the minor attribute:

$$\begin{array}{l} \tilde{P}_i \bowtie \tilde{s}^j = \tilde{s}^j \ if\ \tilde{P}_i \in \tilde{s}^j; \tilde{P}_i \bowtie \tilde{s}^j = \emptyset \ if\ \tilde{P}_i \notin \tilde{s}^j; \\ \tilde{P}_i \bowtie \tilde{p}_j = \tilde{p}_j \ if\ \tilde{P}_i \in \tilde{p}_j; \tilde{P}_i \bowtie \tilde{p}_j = \emptyset \ if\ \tilde{P}_i \notin \tilde{p}_j. \\ \tilde{S}^i \bowtie \tilde{p}_j = \tilde{p}_j \ if\ \tilde{p}_j \subset \tilde{S}^i; \tilde{S}^i \bowtie \tilde{p}_j = \emptyset \ if\ \tilde{p}_j \not\subset \tilde{S}^i; \\ \tilde{S}^i \bowtie \tilde{s}^j = \tilde{s}^j \ if\ \tilde{s}^j \subset \tilde{S}^i; \tilde{S}^i \bowtie \tilde{s}^j = \emptyset \ if\ \tilde{s}^j \not\subset \tilde{S}^i. \end{array} \tag{10}$$

The ***link operator*** $\propto$ for two joined pairs is defined as: taking the ***intersection***.

The ***transformation operator***, indicated by square brackets, is basically defined as follows. For point of space $\tilde{P}_i$ is $[\tilde{P}_i] = P_i$, called a ***real point of space***. For major space $\tilde{S}^i$ is $[\tilde{S}^i] = \Theta^{\boldsymbol{B}}(S^i)$, $\boldsymbol{B}$ being the magnetic field inside. This object occurs for an intersection of major spaces; then the described object is called a ***microspace***. For minor space $\tilde{s}^i$ is $[\tilde{s}^i] = \theta(s^i)$, called a ***femtospace*** (previously: microspace), being equal to the space occupied by a proton. The transformation of a ***pellicle*** $\tilde{p}^i$ is an exception, as this mathematical object has no similar physical realization and so it is broken down in two parts. The potential energy of each part may be contracted into actual energy of a smaller object, in general called a ***pellet particle***. We suppose that this is at least a spherical particle having a radius of its width, and if it is larger, then the size of the width remains the same. A spherical pellet particle is defined as: $[\tilde{p}^i] = \circ\ (p_i)$, called a ***pellet space***. For the intersection of a ***pellicle and a minor space*** the definition is: $[\tilde{s}^i \cap \tilde{p}_j] = \odot(s^i \cap p_j)$, called a ***dotspace***, being a curved, disc shaped object.

The large- and small-scale objects of one and the same space zip are coherent if the one is inside the other and if they move uniformly (for simplicity we ignore partly overlapping objects). Then the ***coherence operator*** $<>$, combining X_n and x_n into a single expression called a ***space aspect*** $\Omega_n(\mathbf{r})$, is defined as follows.

If X_n indicates P_i, and P_i is overlapped by x_n, then $P_i <> x_n = P_i \cup x_n$ being the ***union*** of both elements into a ***single object***, so in that case, X_n and x_n are two distinct types of information about this object.

If P_i is not overlapped by x_n, then $P_i <> x_n = \emptyset$.

If $x_n = \emptyset$, then $X_n <> x_n = X_n$, being P_i or S^i, so only the ***large-scale*** element, and if $X_n = \emptyset$, then $X_n <> x_n = x_n$, so only the ***small-scale*** element.

If X_n indicates S^i, then $X_n <> x_n$ cannot be defined as their union, because x_n is in all cases transformed into a particle moving through a pellicle, so they cannot move uniformly and thus space and the tiny particle inside are considered as ***two distinct objects***. In this case, the only remaining option is that the zip appears as one of the two elements, so the operator will be defined as follows: if S^i overlaps x_n, then $S^i <> x_n = x_n$; if S^i does not overlap x_n, they are considered as not coherent and so $S^i <> x_n = \emptyset$.

We will use ***three distinct energy densities*** for the obtained objects: a high, a medium and a low one. An object having a ***high*** energy density is called a ***compact space*** or simply ***mass***. It may be a

Fig. 2. Two examples of space case 7, with more or less overlapping major spaces.

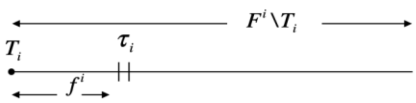

Fig. 3. Representation of the set of time attributes.

solid particle or a pellicle particle. An object having a ***medium or low*** energy density is called an ***extended space*** or simply ***space***. If having a medium energy density, it is magnetized and called a ***microspace***. If having a low density, it is not magnetized and called a ***macrospace***.

3.1. Two examples of space zippers

We will consider space cases 1 and 7 below, because they contain everything which we will need later to deduce electrons. The ***first example*** is interaction $H_i * H_j$ in ***space case 1***; then the points of space are coinciding, so $\tilde{P}_i \cap \tilde{P}_j = \tilde{P}_{ij}$. The space zipper is reduced to:

$$Z_{ij}(\mathbf{r}) = \{\{P_i, \theta(s^i)\}, \{\Theta_{ij}^{\boldsymbol{B}}(S^i),\ \circ(p_i)\}, \emptyset, \emptyset\}. \tag{11}$$

Dropping the empty space zips $z_3(\mathbf{r})$ and $z_4(\mathbf{r})$ and carrying out the coherence operators, the ***set of space aspects*** of interaction $H_i * H_j$ is equal to:

$$\Omega_{ij}(\mathbf{r}) = \{\{P_i \cup \theta_{ij}(s^i)\}, \{\circ(p_i)\}\}. \tag{12}$$

Space aspect $\Omega_1(\mathbf{r})$ is identified as a compact space, occupying femtospace $\theta(s^i)$, localized in real point of space P_i. This is a particle having mass, identified as a ***solid particle***. Space aspect $\Omega_2(\mathbf{r})$ is also identified as a compact space, occupying pellet space $\circ(p_i)$ and so identified as a ***pellet particle***, existing in the coinciding pellicles upon the surface of the solid particle. Thus, in space case 1, the potential energy of H_i and H_j is converted into two particles, both having mass. We cannot say more about their movement and possible charge or fields inside without involving the time and the mark zipper.

The ***second example*** is interaction $H_i * H_j$ in ***space case 7***; then the distance between the two H-units is such, that only their major spaces have an overlapping region, so none of the other attributes are overlapping or coinciding (see Fig. 2). Then the space zipper is reduced to:

$$Z_{ij}(\mathbf{r}) = \{\emptyset, \{\Theta_{ij}^{\boldsymbol{B}}(S^i \cap S^j), \emptyset\}, \emptyset, \emptyset\}, \tag{13}$$

in which the three empty space zips will be dropped. Note that zip $z_2(\mathbf{r})$ also has an empty small-scale element.

The ***set of space aspects*** of $H_i * H_j$, after carrying out the coherence operator, is reduced to the second element:

$$\Omega_{ij}(\mathbf{r}) = \{\Omega_2(\mathbf{r})\} = \{\ \Theta_{ij}^{\boldsymbol{B}}(S^i \cap S^j)\}. \tag{14}$$

Space aspect $\Omega_2(\mathbf{r})$ is identified as an extended space, called a ***microspace***. Its shape is more or less oval, as it is the intersection of two spheres. Because the small-scale element is empty, a microspace is a non-observable object. It is plausible that this reflects physical reality, as no experiment could ever measure the existence of space, the experiment of Michelson and Morley (1887) being a well-known example. On the other hand, we know very well that space really exists. In Fig. 2 we see that the volume of a microspace cannot be more than about 30% of the volume of a major space and it may be even less.

Space case 7 shows the advantage of using ***geometric instead of algebraic*** descriptions; moreover, it shows how ***uncertainty*** is involved in the space zipper. In Fig. 2 we will consider two variants of the overlapping region. We don't know to what extent the two major spaces exactly overlap, but, because the extension of the overlapping region $S^i \cap S^j$ is not involved in the space zipper (equation 9), the two interactions as depicted in Fig. 2 have exactly the same zipper, so it doesn't matter how large the coverage is. If we would describe these two variants algebraic, it would be much more complicated to distinguish them. These details are not important in twin physics, because they do not fundamentally influence the resulting phenomenon and so it is much simpler than algebraic methods. In twin physics we don't need all, but enough information to describe the physical reality; it is not the exact sizes of objects, but basic relative features that determine the result of a combination. This is the very reason why a coherence operator for a large- with a small-scale space object can be defined.

4. The zipper of time and its operators

We need a definition of the quality 'time' to describe the behavior of three-dimensional objects, in the isolated case as well as being near each other. We suppose that units of time are not necessary, like in the example above in which we don't need to know the exact size of involved major spaces. In choosing a definition of time, we followed the advice of Einstein,[9] saying that, if the concept of four-dimensional spacetime has to be abandoned, space and time should be treated ***mathematically similarly***. So we define time as the one-dimensional version of the three-dimensional set of space attributes. Because in one dimension we have no pellicle, an aberrant definition for transformation is not necessary. Thus mathematical and physical time attributes are the same and we write the ***set of time attributes*** $h_i(t)$ of the H-unit H_i without tildes as:

$$h_i(t) = \{T_i, F^i, \tau_i, f^i\}. \tag{15}$$

The major attributes are subsequently the ***point of time*** T_i and the ***future*** F^i (previously this was notated as $F^i \backslash T_i$). The future is a finite, open interval, so the points at the beginning and end are excluded. The first minor attribute is the ***flash*** τ_i (tau, determinate, analogous to the pellicle); if two flashes are partly overlapping, we describe this as the ***double flash*** $\tau_i \cap \tau_j$ (previously τ_i was defined as the time differential dt). The last element is the ***flying time***

f^i (analogous to the minor space); it includes T_i and has an open end at the other side of the interval. The flying time has an important role in describing ***uncertainty of time***. During this period no measurement is possible, because a time measurement is a cyclic process with only one measurement per cycle. In classical physics the indeterminate character of the flying time has been hidden by extrapolating the measured points of time to a continuous time axis.

Time attributes contain no potential or actual energy. The past is not represented, in agreement with the physical reality that no phenomenon can be observed in the past. So, time is not a physical item on its own, like a proton is; it is just a tool to describe the behavior of three-dimensional objects.

Inserting the time attributes in the general zipper (3), we obtain the general ***time zipper***, describing all possible information about the time interaction of $H_i * H_j$ as:

$$Z_{ij}(t) = \begin{pmatrix} \{[\tilde{T}_i \cap \tilde{T}_j], [\tilde{f}^i \cap \tilde{f}^j \cap (\tilde{T}_i \bowtie \tilde{f}^j) \cap (\tilde{T}_j \bowtie \tilde{f}^i)]\} \\ \{[\tilde{F}^i \cap \tilde{F}^j], [\tilde{\tau}_i \cap \tilde{\tau}_j \cap (\tilde{F}^i \bowtie \tilde{\tau}_j) \cap (\tilde{F}^j \bowtie \tilde{\tau}_i)]\} \\ \{[\tilde{T}_i \cap \tilde{F}^j], [\tilde{f}^i \cap \tilde{\tau}_j \cap (\tilde{T}_i \bowtie \tilde{\tau}_j) \cap (\tilde{F}^j \bowtie \tilde{f}^i)]\} \\ \{[\tilde{T}_j \cap \tilde{F}^i], [\tilde{f}^j \cap \tilde{\tau}_i \cap (\tilde{T}_j \bowtie \tilde{\tau}_i) \cap (\tilde{F}^i \bowtie \tilde{f}^j)]\} \end{pmatrix}. \quad (16)$$

Like the space zipper, the time zipper is entirely determined by the ***relative distance*** between the points of time $\tilde{T}_i$ and $\tilde{T}_j$. The join, link and coherence operators for time attributes are defined similarly to those of space attributes; they will not be repeated here. After applying the coherence operator to each zip, the obtained ***set of time aspects*** $\Omega_n(t)$ supplies information about how the belonging object behaves. We renamed the set of time attributes a ***time tool kit***, as this reflects the concept of time in twin physics better. One element of it is called a ***time label***. Because the set of time attributes is the same in mathematical as in physical sense, the time label is the connection between mathematical and physical descriptions of a phenomenon, guarding the relationship between potential and actual energy.

We have ***four distinct time cases*** for interaction $H_i * H_j$, which are given below.

Time case 1: if $T_i \cap T_j = T_i$, then the time tool kit is:

$$\Omega_{ij}(t) = \{\Omega_1, \Omega_2\} = \{T_i \cup f^i, \tau_i\}. \quad (17)$$

Time case 2: if $T_i \cap T_j = \emptyset$ and $\tau_i \cap \tau_j \neq \emptyset$, then the time tool kit is:

$$\Omega_{ij}(t) = \{\Omega_2, \Omega_3\} = \{\tau_i \cap \tau_j, T_i\}. \quad (18)$$

Time case 3: if $\tau_i \cap \tau_j = \emptyset$, $T_i \notin \tau_j$ and $T_j \notin \tau_i$, then the time tool kit is:

$$\Omega_{ij}(t) = \{\Omega_2, \Omega_3\} = \{F^i \cap F^j, T_i\}. \quad (19)$$

In ***subcase 3(a)*** is $T_i \notin f^j$; then the time label is the future excluded interval T_iT_j and the time tool kit can be written as:

$$\Omega_{ij}(t) = \{\Omega_2, \Omega_3\} = \{(F^j \backslash f^j) \cup (f^i \cap f^j), T_i\}. \quad (20)$$

In ***subcase 3(b)*** is $T_i \in F^j \backslash (f^j \cup \tau_j)$; then the time label is the future excluded the flying time and the flash of time, and the time tool kit can be written as:

$$\Omega_{ij}(t) = \{\Omega_2, \Omega_3\} = \{F^j \backslash T_iT_j,\ T_i\}. \quad (21)$$

in which T_iT_j is a time interval, including the borders.

Time case 4: if $T_i \in \tau_j$, then the time tool kit is:

$$\Omega_{ij}(t) = \{\Omega_2, \Omega_3\} = \{f^i \cap \tau_j, T_i \cup (f^i \cap \tau_j)\}. \quad (22)$$

Time case 1 is the same for the ***mirrored interaction*** $H_j * H_i$, so $\Omega_{ji}(t) = \{\Omega_1, \Omega_2\}$. However, time cases 2 through 4 have a different sequence in the mirrored case: the third and fourth elements are interchanged, so the time tool kit has an empty third element and thus in these cases $\Omega_{ji}(t) = \{\Omega_2, \Omega_4\}$.

Each time tool kit contains four elements, two of them being empty. Supposing that phenomena without a time aspect are not existing, the set of H-events may contain ***at most two elements*** and so the chosen time case depends on the considered objects. A specific space case may be combined with more than one time label, describing distinct movements.

The information about movement, as given by the time label, has to be complementary and so we suppose that it is based upon a combination of ***immutability*** and ***change***. If the time label contains T_i and/or f^i, this indicates immutability, because an observation cannot change in a point of time or in the extended present, so the object moves with a ***constant speed which may be zero***. In spherical coordinates r, ϑ, φ this movement is ***rotational*** if r and ϑ are constant; it is in a ***straight line*** if ϑ and φ are constant. If the time label contains τ_i or $\tau_i \cap \tau_j$, this indicates change and so the object cannot stand still and consequently the ***speed cannot be zero***; τ_i indicates a ***constant velocity*** and $\tau_i \cap \tau_j$ indicates ***acceleration***. If the time label contains F^i and/or $F^i \cap F^j$, it cannot be ascertained how the belonging object will behave, because these intervals are indeterminate. If a second H-event exists, this will give more information, as this is generated by the same two H-units and so their movements have to be compatible. In time cases 3 and 4, the composite time label indicates a combination of immutability and change; it depends on the specific case which aspect will be realized.

4.1. Adding the time zipper to the examples

We will consider time cases 1 and 3, respectively, in combination with space cases 1 and 7, as deduced in Section 3.2.

In the ***first example***, concerning interaction $H_i * H_j$ in space case 1 (equation 12), we will add the time tool kit of ***time case 1*** (equation 17), obtaining the ***set of time-space aspects*** $\Omega_{ij}(t, \mathbf{r})$:

$$\Omega_{ij}(t, \mathbf{r}) = \{\{T_i \cup f^i, P_i \cup \theta_{ij}(s^i)\}, \{\tau_i, \circ\, (p_i)\}\}. \quad (23)$$

Particle $P_i \cup \theta_{ij}(s^i)$ has time label $T_i \cup f^i$, so it has a ***constant speed*** which may be zero. The much smaller pellet particle $\circ\,(p_i)$ has time label τ_i and so it has a ***constant speed*** which cannot be zero;

because it is restricted to the surface of the large particle, it is rotating.

In the ***second example***, concerning interaction $H_i * H_j$ in space 7 (equation 14), we will add the time tool kit of ***time case 3*** (equation 21) to the set of space aspects, obtaining the ***set of time-space aspects*** $\Omega_{ij}(t,\mathbf{r})$:

$$\Omega_{ij}(t,\mathbf{r}) = \{\Omega_2\} = \{\Theta_{ij}^{\boldsymbol{B}}(F^i \cap F^j,\ S^i \cap S^j)\}. \qquad (24)$$

This contains only one element, being microspace $\Theta_{ij}^{\boldsymbol{B}}$. The time label is $F^i \cap F^j$, so we cannot be ascertained how it will move. However, in time subcase 3(a), with $T_i \in f^j$, the time label gives more information, as the belonging time label is $(F^j \backslash f^j) \cup (f^i \cap f^j)$, including the interaction of flying times. This allows $\Theta_{ij}^{\boldsymbol{B}}$ to move with a ***constant velocity***, and if this occurs with a constant radial distance, then $\Theta_{ij}^{\boldsymbol{B}}$ ***rotates*** and so it is a ***stable*** phenomenon. In time subcase 3(b) the time label does not give more information, as the flying time and the flash of time are excluded from the future.

Because a time label is mathematically as well as physically valid, it may indicate also the movement of the generating H-units. If the two H-units move together at a fixed distance in a ***straight line***, it is also a ***stable*** phenomenon. If time label 3(a) indicates a constant speed of the two ***H-units***, they are moving towards or away from each other and so $\Theta_{ij}^{\boldsymbol{B}}$ ***grows or shrinks***. If moving towards each other, this continues until the pellicles will touch each other; then $\Theta_{ij}^{\boldsymbol{B}}$ will be annihilated and a pellet particle will be generated. If moving away from each other, the interaction will be finished as soon as the major spaces do not overlap anymore; then $\Theta_{ij}^{\boldsymbol{B}}$ will be annihilated and the actual energy will be transformed back into potential energy. In the latter two cases, $\Theta_{ij}^{\boldsymbol{B}}$ is a ***temporary*** phenomenon.

5. Basics of electricity and magnetism

In this section we will consider the quality ***mark***, conceived as ***giving an identity*** to an H-unit by ***marking*** each of its two ***major space attributes***, being point of space $\tilde{P}_i$ and major space $\tilde{S}^i$. Minor space attributes will not be marked. A point and a space cannot be marked by one and the same mathematical expression, so we have to treat them separately. This double way of notating will make the mark zipper appear more complicated, but in specific cases this will be reduced considerably.

The most important difference with the qualities time and space is that the elements of the mark zipper cannot be transformed into physical items independently, as only ***real objects*** can be given an identity. In case a real object is non-observable, it still exists and so it is possible to identify it, analogous to people who vote without appearing at a polling station. This implies that the mark aspect is not exposed to the extended Heisenberg principle (see Section 2).

5.1. Definitions of electric and magnetic fields

Point of space $\tilde{P}_i$ will be marked with a major ***determinate*** attribute, being a constant, positive or negative ***real number*** $\tilde{Q}_i$, or with a major ***indeterminate*** attribute, being a constant positive or negative ***imaginary number*** $\tilde{Q}_i \times i$. ***Major space*** $\tilde{S}^i$ will be marked with a determinate vector field $\widetilde{\boldsymbol{E}}_i$, or with an indeterminate vector field $\widetilde{\boldsymbol{B}}^i$. Collecting them in two sets, $\{\tilde{Q}_i, \widetilde{\boldsymbol{E}}_i\}$ is the ***major determinate*** mark and $\{\tilde{Q}_i \times i, \widetilde{\boldsymbol{B}}^i\}$ is the ***major indeterminate*** mark of H_i.

Electric vector field $\widetilde{\boldsymbol{E}}_i$ is defined as an infinite, radial, three-dimensional vector field, having real source $\tilde{Q}_i$ in point of space $\tilde{P}_i$, so:

$$\tilde{\nabla} \cdot \widetilde{\boldsymbol{E}}_i = \tilde{Q}_i. \qquad (25)$$

It is a major ***determinate*** mark, because any arbitrary vector $\tilde{\boldsymbol{e}}_i$ of $\widetilde{\boldsymbol{E}}_i$ is determined. Two electric fields $\widetilde{\boldsymbol{E}}_i$ and $\widetilde{\boldsymbol{E}}_j$, belonging to H-units H_i and H_j, are equal if both $\tilde{Q}_i = \tilde{Q}_j$ and $\tilde{P}_i = \tilde{P}_j$.

Magnetic vector field $\widetilde{\boldsymbol{B}}^i$ is defined as an infinite, circular, three dimensional vector field, having imaginary source $\tilde{Q}_i \times i$ in point of space $\tilde{P}_i$. An arbitrary vector $\tilde{\boldsymbol{b}}^i$ of $\widetilde{\boldsymbol{B}}^i$ is directed in a plane perpendicular to the radius of $\widetilde{\boldsymbol{E}}_i$ and so perpendicular to the electric vector in that point of space. Thus $\widetilde{\boldsymbol{E}}_i \cdot \widetilde{\boldsymbol{B}}^i = \mathbf{0}$ and because $\widetilde{\boldsymbol{E}}_i$ is radial, is:

$$\tilde{\nabla} \cdot \widetilde{\boldsymbol{B}}^i = 0. \qquad (26)$$

Moreover, to define $\widetilde{\boldsymbol{B}}^i$ as an ***indeterminate*** field, each vector $\tilde{\boldsymbol{b}}^i$ has an ***indefinite magnitude and direction***, so adjacent vectors may differ in direction as well as absolute value. This definition makes it possible to introduce the ***principle of uniqueness***, saying that identical magnetic fields $\widetilde{\boldsymbol{B}}^i$ and $\widetilde{\boldsymbol{B}}^j$ do not exist. Consequently, for any two H-units H_i and H_j, is $\widetilde{\boldsymbol{B}}^i \neq \widetilde{\boldsymbol{B}}^j$, even if they are coinciding and equally marked, so ***each H-unit is unique***.

To obtain the set of mark attributes, we also need ***two complementary minor attributes***. We will choose them in such a way that by mixing the attributes, field derivatives in time or space may be obtained, so we take mathematical units of space and time. For the point of space, the minor attributes are the real number 1 and the imaginary unit *i*. For the fields, the minor attributes are the ***laplace operator*** $\tilde{\nabla} = (\partial/\partial\tilde{r}, \partial/\partial\tilde{\vartheta}, \partial/\partial\tilde{\varphi})$ in which $\tilde{r}$ is the radial distance, $\tilde{\vartheta}$ is the polar angle and $\tilde{\varphi}$ is the azimuthal angle, and the ***time derivative*** $\partial/\partial\tilde{t}$.
All together, the set of mark attributes $h_i(\tilde{q})$ can be written as:

$$h_i(\tilde{q}) = \left\{\{\tilde{Q}_i, \widetilde{\boldsymbol{E}}_i\}, \{\tilde{Q}_i \times i, \widetilde{\boldsymbol{B}}^i\}, \{1, \tilde{\nabla}\}, \{i,\ \partial/\partial\tilde{t}\}\right\}. \qquad (27)$$

A ***marked H-unit*** is in general indicated by H_i; if it is positively marked, it may be written as H_i^+ and if negatively, as H_i^-. If an H-unit is not marked, it is indicated by H_0, called a ***neutral H-unit;*** if more neutral H-units are involved, they will be indicated by H_{0i} .

Each H-unit, marked or neutral, has the same amount of potential energy. Consequently, a neutral H-unit H_0 has more potential energy available for ***space attributes*** and thus they are ***larger*** than those of a marked H-unit H_i. To create a ***mathematical bridge*** between atomic and astronomic phenomena, we suppose as a first estimation that the major space of H_0 may have an astronomic size; that of H_i is supposed to have a molecular size.

Because of the extreme differences between spatial sizes, the transformations of neutral and marked spaces will be named differently. The transformation of a ***neutral major space*** is called a ***macrospace*** Θ_0; that of a ***neutral minor space*** is called *a* ***nanospace*** θ_0. The description of a macrospace, if indeed having an astronomic size, rotating as a stable phenomenon, might be a step forward to find a solution for the so-called ***angular momentum problem*** in cosmology.

We recall that the transformation of a marked major space is called a microspace and that of a marked minor space is called a femtospace. So, all together we have (in increasing size) femtospace θ, nanospace θ_0, microspace $\Theta^{\boldsymbol{B}}$ and macrospace Θ_0 (in the following of this paper the nanospace will not occur).

Inserting the mark attributes (27) of H_i and H_j in the general zipper (3), the mark zipper $H_i * H_j$ for the interaction between two marked H-units is obtained as:

$$Z_{ij}(q) = \begin{Bmatrix} \{\{[\tilde{Q}_i \propto \tilde{Q}_j], [\tilde{\boldsymbol{E}}_i \propto \tilde{\boldsymbol{E}}_j]\}, [\partial\tilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \partial\tilde{\boldsymbol{E}}_j/\partial\tilde{t}]\} \\ \{\{[(\tilde{Q}_i \times i) \propto (\tilde{Q}_j \times i)], [\tilde{\boldsymbol{B}}^i \propto \tilde{\boldsymbol{B}}^j]\}, [\tilde{\nabla} \times \tilde{\boldsymbol{B}}^i \propto \tilde{\nabla} \times \tilde{\boldsymbol{B}}^j]\} \\ \{\{[\tilde{Q}_i \propto (\tilde{Q}_j \times i)], [\tilde{\boldsymbol{E}}_i \propto \tilde{\boldsymbol{B}}^j]\}, [\partial\tilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \tilde{\nabla} \times \tilde{\boldsymbol{B}}^j \propto \tilde{\nabla} \times \tilde{\boldsymbol{E}}_i \propto \partial\tilde{\boldsymbol{B}}^j/\partial\tilde{t}]\} \\ \{\{[\tilde{Q}_j \propto (\tilde{Q}_i \times i)], [\tilde{\boldsymbol{E}}_j \propto \tilde{\boldsymbol{B}}^i]\}, [\partial\tilde{\boldsymbol{E}}_j/\partial\tilde{t} \propto \tilde{\nabla} \times \tilde{\boldsymbol{B}}^i \propto \tilde{\nabla} \times \tilde{\boldsymbol{E}}_j \propto \partial\tilde{\boldsymbol{B}}^i/\partial\tilde{t}]\} \end{Bmatrix}, \quad (28)$$

For numbers, the mark operators in the general zipper (3) are defined as follows. ***Joining*** (⋈) is defined by multiplication of $\tilde{Q}_i$ and $\tilde{Q}_i \times i$ with one of the minor attributes 1 or *i*. ***Linking*** (∝) for ***distinct numbers*** is defined as numerical addition, so if $\tilde{Q}_i = -\tilde{Q}_j$ then $\tilde{Q}_i \propto \tilde{Q}_j = 0$; if $\tilde{Q}_j = 0$ then $\tilde{Q}_i \propto \tilde{Q}_j = \tilde{Q}_i$. Linking for ***equal numbers*** is defined by: if $\tilde{Q}_i = \tilde{Q}_j$ then $\tilde{Q}_i \propto \tilde{Q}_j = \tilde{Q}_i$. ***Transformation*** for real numbers is defined as: $[\tilde{Q}_i] = Q_i$ and $[-\tilde{Q}_i] = -Q_i$, identified with ***charge***. For imaginary numbers: $[\tilde{Q}_i \times i] = 0$. So imaginary charge $\tilde{Q}_i \times i$ exists only in mathematical sense, in agreement with the absence of magnetic charges in experimental results.

For vector fields, the operators are defined as follows. ***Joining*** (⋈) is defined as allowing minor attributes to act upon major attributes in such a way that field derivatives are generated. Joined pairs of vector field $\tilde{\boldsymbol{A}}$ are: $\tilde{\boldsymbol{A}} \bowtie \tilde{\nabla} = \tilde{\nabla} \times \tilde{\boldsymbol{A}}$ and $\tilde{\boldsymbol{A}} \bowtie \partial/\partial\tilde{t} = \partial\tilde{\boldsymbol{A}}/\partial\tilde{t}$. ***Linking*** (∝) is defined as vector addition. ***Transformation*** for vector fields is defined as: $[\tilde{\boldsymbol{E}}_i] = \hat{\boldsymbol{E}}_i$, $[\tilde{\boldsymbol{B}}_i] = \hat{\boldsymbol{B}}^i$, $[\partial\tilde{\boldsymbol{E}}_i/\partial\tilde{t}] = \partial\hat{\boldsymbol{E}}_i/\partial\tilde{t}$, $[\tilde{\nabla} \times \tilde{\boldsymbol{B}}^i] = \nabla \times \hat{\boldsymbol{B}}^i$, $[\tilde{\nabla} \times \tilde{\boldsymbol{E}}_i] = \nabla \times \hat{\boldsymbol{E}}_i$ and $[\partial\tilde{\boldsymbol{B}}^i/\partial\tilde{t}] = \partial\hat{\boldsymbol{B}}^i/\partial\tilde{t}$. They are called ***real fields*** (or field derivatives). The ***rooflet accents*** above the field terms indicate that these items have a physical meaning only ***inside*** the corresponding spatial object. Mark aspect $\Omega_n(q)$ does not need a coherence operator, as it is not exposed to the extended Heisenberg principle, related only to time and space.

H-event Ω_n contains mark items only as far as the time and space aspects allow them to appear; the remaining mark items will stay unused. If $\Omega_n(\mathbf{r})$ is a ***large-scale*** geometric object, like a point of space or a microspace, then the large-scale mark element of $\Omega_n(q)$ will be used. If $\Omega_n(\mathbf{r})$ is a ***small-scale*** object, like a pellicle or a femtospace, then the small-scale mark element will be used. If $\Omega_n(\mathbf{r})$ is a combination of small- and large-scale objects, the small-scale mark aspect of $\Omega_n(q)$ provides the details of the large-scale one.

5.2. Simplification of the mark zipper

Each zip of the mark zipper, written as $z_n(q)$, contains information about charge and fields of a geometric object, described by the corresponding space zip $z_n(\mathbf{r})$. The mark zipper (equation 28) can be ***simplified*** by adapting the first two zips to the corresponding space zips (equation 9).

First we will combine $z_1(q)$ with $z_1(\mathbf{r})$. If large-scale element $[\tilde{P}_i \cap \tilde{P}_j]$ is empty, then no field vector of $\tilde{\boldsymbol{E}}_i \propto \tilde{\boldsymbol{E}}_j$ can be attached; if $\tilde{P}_i = \tilde{P}_j$, then this element is equal to $[\tilde{P}_i]$ and none of the two E-fields is defined in this point. Thus in $z_1(q)$ the electric field never appears in the large-scale element and so we will reduce it to $[\tilde{Q}_i \propto \tilde{Q}_j]$.

In zips $z_2(q)$, $z_3(q)$ and $z_4(q)$, the imaginary numbers $\tilde{Q}_i \times i$ and $\tilde{Q}_j \times i$ will in any case disappear by transforming them, so they will be dropped from the large-scale elements. In space zip $z_3(\mathbf{r})$, large-scale element $[\tilde{P}_i \cap (\tilde{S}^j \backslash \tilde{P}_j)]$ is empty if the point of space is not inside the major space, so then no field vector $\tilde{\boldsymbol{e}}_i$ of $\tilde{\boldsymbol{E}}_i$ can appear in $z_3(q)$, but if $\tilde{P}_i \in (\tilde{S}^j \backslash \tilde{P}_j)$, then it is equal to $[\tilde{P}_i]$ where $\tilde{\boldsymbol{E}}_i$ is not defined. So the large-scale element of $z_3(q)$ is reduced to $[\tilde{\boldsymbol{B}}^j]$. Mark zip $z_4(q)$ is reduced similarly.

Then the ***general mark zipper*** for interaction $H_i * H_j$, adapted to the general space zipper (9), is:

$$Z_{ij}(q) = \begin{Bmatrix} \{[\tilde{Q}_i \propto \tilde{Q}_j], [\partial\tilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \partial\tilde{\boldsymbol{E}}_j/\partial\tilde{t}]\} \\ \{[\tilde{\boldsymbol{B}}^i \propto \tilde{\boldsymbol{B}}^j], [\tilde{\nabla} \times \tilde{\boldsymbol{B}}^i \propto \tilde{\nabla} \times \tilde{\boldsymbol{B}}^j]\} \\ \{\{[\tilde{Q}_i], [\tilde{\boldsymbol{B}}^j]\}, [\partial\tilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \tilde{\nabla} \times \tilde{\boldsymbol{B}}^j \propto \tilde{\nabla} \times \tilde{\boldsymbol{E}}_i \propto \partial\tilde{\boldsymbol{B}}^j/\partial\tilde{t}]\} \\ \{\{[\tilde{Q}_j], [\tilde{\boldsymbol{B}}^i]\}, [\partial\tilde{\boldsymbol{E}}_j/\partial\tilde{t} \propto \tilde{\nabla} \times \tilde{\boldsymbol{B}}^i \propto \tilde{\nabla} \times \tilde{\boldsymbol{E}}_j \propto \partial\tilde{\boldsymbol{B}}^i/\partial\tilde{t}]\} \end{Bmatrix}. \quad (29)$$

The mark zipper ***depends only on the charges*** of the interacting H-units and so we have ***three mark cases:*** two equal charges, two opposite charges, and one charge with one zero charge. ***Mark case 1*** describes interaction $H_i^+ * H_j^+$ or $H_i^- * H_j^-$; ***mark case 2*** describes opposite charges, so $H_i^+ * H_j^-$, and ***mark case 3*** describes the interaction with a neutral H-unit $H_i * H_0$. Note that the difference in these three cases only concerns the ***large-scale*** elements of the zips.

The mark zipper of interaction $H_i * H_0$, a marked H-unit with a neutral one, is obtained by dropping all items with index *j* in the general mark zipper (29):

$$Z_{i0}(q) = \begin{Bmatrix} \{[\tilde{Q}_i], [\partial\tilde{\boldsymbol{E}}_i/\partial\tilde{t}]\} \\ \{[\tilde{\boldsymbol{B}}^i], [\tilde{\nabla} \times \tilde{\boldsymbol{B}}^i]\} \\ \{\{[\tilde{Q}_i]\}, [\partial\tilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \tilde{\nabla} \times \tilde{\boldsymbol{E}}_i]\} \\ \{\{[\tilde{\boldsymbol{B}}^i]\}, [\tilde{\nabla} \times \tilde{\boldsymbol{B}}^i \propto \partial\tilde{\boldsymbol{B}}^i/\partial\tilde{t} \end{Bmatrix}. \quad (30)$$

So, two interacting H-units may generate a magnetic field if at least one of them is marked.

Each mark zip $z_n(q)$ of the general zipper (29) can be written as a set of a large-scale and a small-scale element:

$$z_n(q) = \{X_n(q), x_n(q)\}, \quad (31)$$

in which $X_n(q)$ is in general a set, containing a charge and/or a real field, and $x_n(q)$ is a combination of real field derivatives. Each of these two elements adds information about fields and charge, which have to be restricted to the belonging real object and the time label.

A ***charge*** can only be attached to an available point of space P_i; a particle containing this point is called a charged particle. If no point is available, the object is neutral. A large-scale ***field*** element will be restricted to an extended space, which after this addition is called a ***microspace***, being magnetized and indicated by $\Theta^{\boldsymbol{B}}$. The ***field derivatives*** will be restricted to a small-scale compact space, in general written as $x_n(\mathbf{r})$. If $x_n(\mathbf{r}) = \emptyset$, then $x_n(q)$ is independent of space and time, so it is also valid in the large-scale space element. If two H-events are generated by one interaction, then fields and field derivatives can be restricted further by realizing that fields and field derivatives have to be ***valid in both H-events*** to make them compatible.

5.3. Identity protection

Because the marks of an H-unit are conceived as an identity, we require that this by interaction will not be changed, which is called ***identity protection***. To realize this, the ***limiting condition*** is that ***two equally charged and coinciding*** H-units H_i and H_j cannot generate changing fields, so they may ***generate only static fields***. This implies that in this case all small-scale mark elements have to be reduced to zero vector field $\mathbf{0}$. We will check the consequences of this requirement.

In the coinciding case of $H_i * H_j$ is $\tilde{Q}_i = \tilde{Q}_j$ and $\widetilde{\boldsymbol{E}}_i = \widetilde{\boldsymbol{E}}_j$, so $\partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \partial\widetilde{\boldsymbol{E}}_j/\partial\tilde{t} = \partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t}$. Then the field in the small-scale element of the ***first mark zip*** $z_1(q)$ of equation (29) is reduced to $\partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t}$, and because in the isolated coinciding case the velocity of P_i is zero, $\partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t} = \mathbf{0}$. Thus in $z_1(q)$ the limiting condition is already met.

In the ***second mark zip*** $z_2(q)$, because $\widetilde{\boldsymbol{B}}^i \neq \widetilde{\boldsymbol{B}}^j$, the small-scale element $\widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^i \propto \widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^j$ cannot be reduced. An additional requirement at hand is, that in general for each H-unit is:

$$\widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^i = \partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t}, \tag{32}$$

because then, in the coinciding case, is $\widetilde{\nabla} \times \tilde{B}^i = \mathbf{0}$.

Considering the ***third and fourth mark zips***, by inserting the previous results $\partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t} = \partial\widetilde{\boldsymbol{E}}_j/\partial\tilde{t} = \mathbf{0}$ and $\widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^i = \widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^j = \mathbf{0}$ in (29), the small-scale element of $z_3(q)$ is reduced to $\widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_i \propto \partial\widetilde{\boldsymbol{B}}^j/\partial\tilde{t}$ and that of $z_4(q)$ to $\widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_j \propto \partial\widetilde{\boldsymbol{B}}^i/\partial\tilde{t}$. The indices of the ***electric fields*** can be interchanged because of $\widetilde{\boldsymbol{E}}_i = \widetilde{\boldsymbol{E}}_j$, so these elements can also be written as $\widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_j \propto \partial\widetilde{\boldsymbol{B}}^j/\partial\tilde{t}$ and $\widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_i \propto \partial\widetilde{\boldsymbol{B}}^i/\partial\tilde{t}$, respectively. Each of them has to be reduced to a zero field, so we require that in general for each H-unit:

$$\widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_i = -\partial\widetilde{\boldsymbol{B}}^i/\partial\tilde{t}. \tag{33}$$

Combining these two requirements with the field définitions (25) and (26), vector fields $\widetilde{\boldsymbol{E}}_i$ and $\widetilde{\boldsymbol{B}}^i$ of H_i have to meet the ***field conditions***:

$$\widetilde{\nabla} \cdot \widetilde{\boldsymbol{E}}_i = \tilde{Q}_i; \widetilde{\nabla} \cdot \widetilde{\boldsymbol{B}}^i = 0; \partial\tilde{E}_i/\partial\tilde{t} = \widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^i; \partial\widetilde{\boldsymbol{B}}^i/\partial\tilde{t} = -\widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_i, \tag{34}$$

and similar for H_j, with indices j. They can be recognized as the ***laws of Maxwell***. Nevertheless, there is an important difference which is expressed by the tildes. Originally these equations were supposed to have a physical meaning, which at the time was a logic consequence of conceiving space as infinite. However, in twin physics these equations describe mathematical vector fields, having ***no physical meaning***. Only after being transformed, they describe physical electric and magnetic fields, and only as far as they ***cover*** the belonging objects.

5.4. Adding the mark zipper to the examples

After having deduced the general mark zipper (29), adapted to the general space zipper and being valid under the conditions (34), we will apply this to the two examples of Sections 3.1 and 4.1, describing interactions in space cases 1 and 7, in case both H-units are positively marked. ***In the first example***, about interaction $H_i^+ * H_j^+$ in the coinciding time-space case (equation 23), only the first two zips are non-empty, so we have to consider only the first two mark zips. Because $\tilde{P}_i = \tilde{P}_j$ and $\tilde{Q}_i = \tilde{Q}_j$, is $\widetilde{\boldsymbol{E}}_i = \widetilde{\boldsymbol{E}}_j$ and so: $\partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \partial\widetilde{\boldsymbol{E}}_j/\partial\tilde{t} = \partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t}$. Note that in all cases $\widetilde{\boldsymbol{B}}^i \neq \widetilde{\boldsymbol{B}}^j$. Then the general mark zipper (29) is reduced to a set of two elements:

$$Z_{ij}(q) = \{z_1(q), z_2(q)\} = \begin{Bmatrix} \{Q_{ij}^+, \partial\widehat{\boldsymbol{E}}_i/\partial\tilde{t}\} \\ \{\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j, \nabla \times \widehat{\boldsymbol{B}}^i + \nabla \times \widehat{\boldsymbol{B}}^j\} \end{Bmatrix}. \tag{35}$$

Combining this set with equation (23), we obtain the ***set of H-events*** $\Omega_{ij}(t, \mathbf{r}, q)$ as:

$$\Omega_{ij}(t, \mathrm{r}, q) = \{\Omega_1, \Omega_2\} = \begin{Bmatrix} \sigma_{ij}^+(T_i \cup f^i, P_i \cup \theta_{ij}(s^i), \{Q_{ij}^+, \partial\widehat{\boldsymbol{E}}_i/\partial\tilde{t}\}) \\ s_{ij}(\tau_i, \circ\,(p_i), \widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j) \end{Bmatrix}. \tag{36}$$

H-event $\Omega_1(t, \mathbf{r}, q)$ is a solid particle, charged by Q_i^+ and having an electric field derivative inside femtospace $\theta_{ij}(s^i)$. The time label indicates a constant speed, so $\partial\widehat{\boldsymbol{E}}_i/\partial t = \mathbf{0}$. Because of the conditions (34) is $\nabla\times\widehat{\boldsymbol{B}}^i=\mathbf{0}$ and, because $\widehat{\boldsymbol{E}}_i = \widehat{\boldsymbol{E}}_j$, also $\nabla\times\widehat{\boldsymbol{B}}^j=\mathbf{0}$, so the large-scale element of $z_2(q)$ is transformed into $\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j$. This particle is identified with a ***proton of type 1*** and indicated by σ_{ij}^+.

H-event $\Omega_2(t, \mathbf{r}, q)$ is a pellet particle, moving across the surface of the proton with a constant velocity. Inside $\circ\,(p_i)$ is magnetic field $\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j$ and so it produces a magnetic spin. It is identified as the associated ***spin particle*** of the proton, indicated by s_{ij}. So, the set of H-events may be written in short as:

$$\Omega_{ij}(t, \mathbf{r}, q) = \{\sigma_{ij}^+, s_{ij}\}. \tag{37}$$

Note that, although in the isolated case the velocity of the proton is zero, it is not devoid of time, as its associated spin particle carries out a cyclic movement, being the basis of a time measurement; with some phantasy it looks like the proton is wearing a watch. This example has been used in a previous paper;[7] we compared the rest energy of the proton with the relativistic energy of the spin particle, to deduce the relation between Planck's constant and the speed of light.

In the second example, about interaction $H_i^+ * H_j^+$ in time case 3 and space case 7 (equation 24), only $\Omega_2(t,\mathbf{r})$ is generated, describing extended space $\Theta_{ij}^{\boldsymbol{B}}(S^i \cap S^j)$. The mark zipper is reduced to a set of one element:

$$Z_{ij}(q) = \{z_2(q)\} = \{\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j\}. \quad (38)$$

Combining this set with equation (24), we obtain the ***set of H-event*** $\Omega_{ij}(t,\mathbf{r},q)$ as:

$$\Omega_{ij}(t,\mathbf{r},q) = \{\Omega_2\} = \{\Theta_{ij}^{\boldsymbol{B}}(F^i \cap F^j, S^i \cap S^j, \widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j)\}. \quad (39)$$

Magnetic field $\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j$ is restricted to $\Theta_{ij}^{\boldsymbol{B}}$ and because an extended space is supposed to be much smaller if it is magnetized, it is called a microspace. Time label $F^i \cap F^j$ says that $\Theta_{ij}^{\boldsymbol{B}}$ may rotate or move in a straight line, as a stable phenomenon, or it may grow or shrink until it will be annihilated (see Section 4.1).

So now we have ***two indications*** for extended spaces. A neutral extended space is indicated by Θ_0, called a ***macrospace*** and having a size of almost zero to an astronomic order. A magnetized extended space is indicated by $\Theta^{\boldsymbol{B}}$, called a ***microspace*** and having a size of at most a molecular order.

5.5. More about the physical electric and magnetic fields

In the general mark zipper (29), vector field $\widetilde{\boldsymbol{E}}_i$ does not occur in the large-scale elements at the left side and so a ***static electric field does not exist***. Consequently, a lightning bolt cannot come into existence by a static electric field in the cloud; in Section 6 we will give an alternative explanation. Note that the everyday understanding of the expression 'static electricity' refers to the experience of a temporarily electric current, for instance as a result of putting on a plastic sweater.

The small-scale elements, on the right side, show that the electric field can appear only by its derivatives, that is, if the marked spatial object is ***moving***. This is similar to potential gravitational energy: only by falling down, the potential energy of an object can be transformed into actual energy.

By contrast, magnetic vector field $\widetilde{\boldsymbol{B}}^i$ does occur in the large-scale elements on the left side of the general mark zipper (29), except in the first zip. We will consider it in the sequence of appearing. The ***second zip*** describes in space case 7 (see Section 3.2) a magnetized microspace $\Theta_{ij}^{\boldsymbol{B}}$. Magnetic field $\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j$ is restricted to this space. In the ***third zip***, if $P_i = P_j$ then the large-scale mark zip is not defined in the coinciding points, so no magnetic vector appears. If $P_i \neq P_j$ then $z_3(\mathbf{r}) = P_i$ and so a ***vector*** $\widehat{\boldsymbol{b}}^j$ of magnetic field $\widehat{\boldsymbol{B}}^j$ is attached to P_i. In the ***fourth zip*** the situation is mirrored; then vector $\widehat{\boldsymbol{b}}^i$ will be attached to P_j.

The laws of Maxwell (34) suggest that $\widetilde{\boldsymbol{E}}_i$ and $\widetilde{\boldsymbol{B}}^i$ are adapting to ***each other***. However, the first law defines $\widetilde{\boldsymbol{E}}_i$ as a determinate vector field, depending on the constant $\tilde{Q}_i$, and so $\widetilde{\boldsymbol{E}}_i$ ***cannot adapt to*** $\widetilde{\boldsymbol{B}}^i$. The second law defines $\widetilde{\boldsymbol{B}}^i$ as an indeterminate vector field; its adjacent vectors may differ in direction as well as absolute value, making each H-unit unique. This creates the possibility that ***only*** $\widetilde{\boldsymbol{B}}^i$ ***adapts to*** $\widetilde{\boldsymbol{E}}_i$, according to the third (32) and fourth (33) laws.

Consequently, if H_i moves during an interaction with a constant velocity, then $\partial\widetilde{\boldsymbol{E}}_i/\partial t$ is a constant vector field and $\widetilde{\boldsymbol{B}}^i$ is adapted in such a way that $\widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^i$ is also constant. By this adaptation, $\widetilde{\boldsymbol{B}}^i$ will lose a part of its indeterministic character; however, by definition it has to preserve this to some measure, so it will be characterized by some ***uncertainty***. This is similar to the spatial uncertainty in space case 7 (Section 3.2), where we don't know exactly how far the major spaces overlap each other.

It is well-known that a charged particle traveling through a homogeneous magnetic field will start to circle around. This seems to be an adaptation of the electric field to the magnetic field, but as this is impossible, the charged particle changes its direction. By this ***spatial adaptation***, instead of an adaptation of the electric field, the third law is met. This alternative adaptation suggests a kind of ***intelligence*** of the H-units.

An interesting fact is that the fourth law, being $\partial\widetilde{\boldsymbol{B}}^i/\partial t = -\widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_i$, is almost similar to the third one, being $\partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t} = \widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^i$, but having a minus sign. This is related to the photon, which in suitable time, space and mark cases can be described by the third or fourth zip.[4] Then the mark aspect expresses the ***entanglement*** of $\widetilde{\boldsymbol{E}}_i$ and $\widetilde{\boldsymbol{B}}^i$ into an ***electromagnetic field***, propagating with the speed of light. There the minus sign pops up; in this paper we will not consider this further.

5.6. Summary of Section

A complementary description of the quality mark is realized by defining a mathematical, determinate field $\widetilde{\boldsymbol{E}}_i$ determined by number $\tilde{Q}_i$ and an indeterminate field $\widetilde{\boldsymbol{B}}^i$. The last one is unique for each marked H-unit H_i. They represent potential mark energy, which may in general be transformed by the interaction between two H-units (if at least one of them is marked) into charge Q_i, real electric field $\widetilde{\boldsymbol{E}}_i$, real magnetic field $\widetilde{\boldsymbol{B}}^i$, a vector of these fields, or real field derivatives.

An important difference between the deduction of the laws of Maxwell in classical physics on the one hand and twin physics on the other hand is, that in twin physics charges and fields ***only mathematically*** extend to infinity; after being transformed, they appear in reality only as far as the belonging space aspect allows. So, the ***fields are geometrically restricted*** to the belonging objects, described by the time and space aspects of the H-events.

A static electric field does not exist physically but only in a mathematical sense, as potential energy. A static magnetic field does exist physically, but each magnetic field is characterized by some measure of uncertainty.

6. Four types of electrons

In this section four distinct types of electrons will be described. The given names are related to their possible relation with a proton, although they also might occur independently. Only the sets of H-events will be presented; for the zippers, see [4] and for only time, space and mark cases, see [3]. Types 1 and 3 are generated by ***two marked H-units*** in interaction $H_i^- * H_j^+$; H-unit H_i^- has a negative mark $\tilde{Q}_i^-$ and H_j^+ has a positive mark $\tilde{Q}_j^+$. Types 2 and 4 are generated by *a **marked and a neutral** H-unit* in

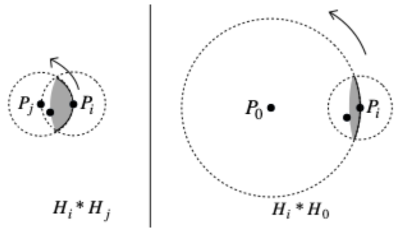

Fig. 4. Electron of type 1 (the magnetic vector is not shown) and that of type 2, with spin particles.

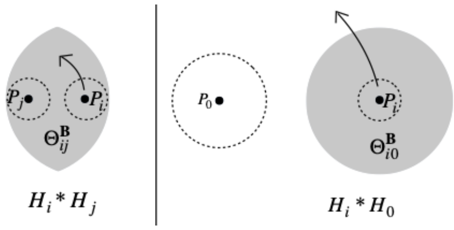

Fig. 5. Electrons of type 3 (the magnetic vector is not shown) and type 4, with their microspaces.

interaction $H_i^- * H_0$. We suppose that $s^i \ll s^0$ and $S^i \ll S^0$, with s^i having the size of a proton, s^0 at least one order of magnitude larger, S^i having a molecular size, and S^0 being many orders of magnitude lager.

For the electron of type 1 we consider interaction $H_i^- * H_j^+$ in ***time case 4*** and ***space case 3***, characterized by $T_i \in \tau_j$, $\tilde{P}_j \in \tilde{p}_i$ and $\tilde{P}_i \in \tilde{p}_j$. Then the set of H-events $\{\Omega_2, \Omega_3\}$, as far as possible reduced, is:

$$\Omega(H_i^- * H_j^+) = \begin{Bmatrix} s_{ij}\,(F^i \cap F^j),\circ\,(p_i \cap p_j), \nabla \times (\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j)) \\ e_{ij}^-(T_i \cup (f^i \cap \tau_j), P_i \cup \odot_{ij}\,(s^i \cap p_j), \{\{Q_{ij}^-, \boldsymbol{b}^j\}, [\tilde{x}_3(\tilde{q})]\}) \end{Bmatrix}, \quad (40)$$

in which $[\tilde{x}_3(\tilde{q})]$ is equal to the right element of $z_3(q)$ in equation (29).

H-event Ω_2 is a pellet particle, moving through the path of intersecting pellicles $\circ\,(p_i \cap p_j)$; time label $F^i \cap F^j$ allows a rotational movement. Inside is magnetic field rotation $\nabla\times(\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j)$, so we identify Ω_2 as a ***spin particle***, indicated by s_{ij}.

H-event Ω_3 is an electron of type 1, indicated by e_{ij}^-. It is localized by P_i and occupies dotspace $\odot_{ij}(s^i \cap p_j)$, having the form of a cap, so it has mass. The electron revolves through the pellicle p_j around P_j; the time label is a combination of the extended present and the flash of time, so the speed is constant. This implies that also $\nabla \times \widehat{\boldsymbol{B}}^i$ of the spin particle is constant. Its electro-magnetic behavior is described by $[\tilde{x}_3(\tilde{q})]$, which will not be considered here.

The electron of type 1 is called a ***free electron*** for reasons which we will explain in Section 7. The free electron is depicted on the left side of Fig. 4, together with the spin particle. Because the spin particle borders on the electron cap, we consider the two particles together as ***one coherent object***.

For the electron of type 2 we will consider interaction $H_i^- * H_0$ in ***time case 4*** and ***space case 8C***, characterized by $T_i \in \tau_0$ and $\tilde{P}_i \in \tilde{p}_0$. Then the set of H-events $\{\Omega_2 , \Omega_3\}$ is:

$$\Omega(\,H_i^- * H_0) = \begin{Bmatrix} s_{i0}(F^i \cap F^0,\ \circ\,(p_i \cap p_0), \nabla \times \widehat{\boldsymbol{B}}^i) \\ e_{i0}^-(T_i \cup (f^i \cap \tau_i), P_i \cup \odot_{i0}(s^i \cap p_0)\{Q_{i0}^-, [\partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_i]\}) \end{Bmatrix}. \quad (41)$$

H-event Ω_2 describes a ***spin particle***, indicated by s_{i0}, having a rotational magnetic field $\nabla \times \widehat{\boldsymbol{B}}^i$ inside. Because this is a small-scale mark aspect and the time label contains no small-scale time zip, this rotational field is time independent and thus ***constant***.

H-event Ω_3 is an electron of type 2, indicated by e_{i0}^-. Similar to the electron of type 1, it has mass in $\odot_{i0}(s^i \cap p_0)$; the difference is, that this electron revolves through the ***neutral*** pellicle around P_0, instead of through the marked pellicle, and so it has a larger radius than the electron of type 1. The time label indicates the possibility of a ***constant speed***, in agreement with the constant magnetic rotation in s_{i0}. Note that only charge Q_{i0}^- is attached to P_i; no magnetic field vector occurs, as the second H-unit is neutral. As we will see in the next section, it may revolve around a proton on the lowest atomic level and so we call it a ***ground electron***; it is depicted on the right side of Fig. 4.

For the electron of type 3 we will consider interaction $H_i^- * H_j^+$ in ***time case 3*** and ***space case 6***, characterized respectively by $\tau_i \cap \tau_j = \emptyset$, $T_i \notin \tau_j$, and $\tilde{p}_i \cap \tilde{p}_j = \emptyset$, $\tilde{P}_i \in \tilde{S}^j$, $\tilde{P}_j \in \tilde{S}^i$. Then the set of H-events $\{\Omega_2 , \Omega_3\}$ is:

$$\Omega(H_i^- * H_j^+) = \begin{Bmatrix} \Theta_{ij}^{\boldsymbol{B}}(F^i \cap F^j, S^i \cap S^j, \widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j \\ e_{ij}^-(T_i, P_i, \{\{Q_{ij}^-, \boldsymbol{b}^j\}, \nabla \times \boldsymbol{b}^j + \partial \boldsymbol{b}^j/\partial t\}) \end{Bmatrix}. \quad (42)$$

H-event Ω_2 is identified as a ***microspace*** $\Theta_{ij}^{\boldsymbol{B}}$, being a finite, more or less oval shaped magnetized space. On the left side of Fig. 5 is shown that the shape of this object is determined by the overlapping region of the marked major spaces. Note that the magnetic field $\widehat{\boldsymbol{B}}^i + \widehat{\boldsymbol{B}}^j$ is restricted to $S^i \cap S^j$.

H-event Ω_3 is identified as the electron of type 3, indicated by e_{ij}^-. It has no spatial extension, so it is ***massless;*** the charge Q_{ij}^- and the magnetic vector $\boldsymbol{b}^j$are attached to P_i. The time label indicates that the electron has a ***constant speed***. Because e_{ij}^- and $\Theta_{ij}^{\boldsymbol{B}}$ are moving together, $\Theta_{ij}^{\boldsymbol{B}}$ is called the ***associated microspace*** of the electron.

Time case 3 describes cyclic as well as straightforward movements (see Section 4.1). If r and ϑ are constant and $\vartheta = \pi/2$, then e_{ij}^- ***revolves*** around P_j. If both angels ϑ and φ are constant, then e_{ij}^- moves towards, or away from P_j in a ***straight line;*** in the first case it may be transformed into an electron of type 2, in the second case into an electron of type 4. So the electron may occupy a ***series of atomic levels*** and step over from one level to another one. This makes it the most common electron in all kind of chemical bonds and so we call it a ***chemical electron***. If the distance P_iP_j exceeds the radius of the marked major space of H_j, without having the opportunity to interact with another H-unit, then the electron will be annihilated.

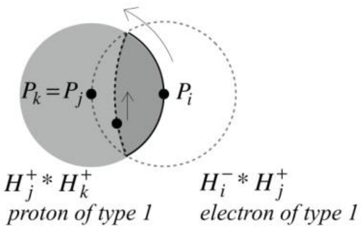

Fig. 6. Bond of a proton of type 1 and an electron of type 1. Both have an associated spin particle upon the surface; only the one of the electron is depicted.

Magnetic vector $\boldsymbol{b}^j$, attached to P_i, is supposed to play an important role in magnetic materials. This vector is deduced from small-scale mark zip $[\partial\widetilde{\boldsymbol{E}}_i/\partial\tilde{t} \propto \widetilde{\nabla} \times \widetilde{\boldsymbol{B}}^j \propto \widetilde{\nabla} \times \widetilde{\boldsymbol{E}}_i \propto \partial\widetilde{\boldsymbol{B}}^j/\partial\tilde{t}]$ in the general mark zipper (29); bear in mind that in P_i the electric field is not defined. This vector is independent of time and space, because of the lack of small-scale items, and so it is ***constant***. Thus, if the electron in P_i revolves around P_j, the magnetic vector has a direction ***perpendicular*** to the plane of the revolving electron, ***up or down***, and so $\boldsymbol{b}^j$ is identified as a ***spin vector***.

For the electron of type 4 we will consider interaction $H_i^- * H_0$ in ***time case 3*** and ***space case 7C***, characterized respectively by $\tau_i \cap \tau_0 = \emptyset$, $T_i \notin \tau_0$ and $\tilde{p}_i \cap \tilde{p}_j = \emptyset$, $\tilde{P}_i \in \tilde{S}^0$, $\tilde{P}_0 \in \tilde{S}^i$. Moreover, for the sake of convenience we suppose that $S^i \cap S^0 = S^i$, so the marked major space is ***fully overlapped*** by the neutral major space. Then the set of H-events $\{\Omega_2, \Omega_3\}$ is:

$$\Omega(H_i^- * H_0) = \{\Omega_2, \Omega_3\} = \left\{\begin{matrix} \Theta_{i0}^{\boldsymbol{B}}(F^i \cap F^0, S^i, \widehat{\boldsymbol{B}}^i) \\ e_{i0}^-(T_i, P_i, Q_{i0}^-) \end{matrix}\right\}. \quad (43)$$

H-event Ω_2 is identified as a ***microspace***, indicated by $\Theta_{i0}^{\boldsymbol{B}}$ and in this case being spherical (Fig. 5 on the right side); magnetic field $\widehat{\boldsymbol{B}}^i$ is restricted to S^i.

H-event Ω_3 is identified as an electron of type 4, indicated by e_{i0}^-. It is a massless point particle with the charge Q_{i0}^- attached to the point of space P_i. A magnetic vector in this point is lacking, as H_0 is not marked. According to the time label, the electron has a ***constant speed***. If r and ϑ are constant and $\vartheta = \pi/2$, then e_{i0}^- ***revolves*** around P_0. Its radius is in general ***much larger*** than that of the chemical electron, because H_0 has a much larger major space than H_j; for that reason, we call it a ***plasma electron***. If ϑ and φ are constant, then e_{i0}^- moves towards, or away from P_0 in a ***straight line***. In the first case it may be transformed into an electron of type 3; in the second case it will be annihilated unless another H-unit takes over the interaction with H_i. Because the spherical microspace is connected with the revolving plasma electron, revolving around P_0 at a relatively considerable distance, its ***magnetic influence*** reaches much more far than its diameter would suggest.

A remarkable feature of the plasma electron is that it shows ***a perfect complementary*** in the generated H-events: the electron is described exclusively by transformations of ***determinate*** attributes and the microspace exclusively by transformations of ***indeterminate*** attributes. This interaction is the only one so far, having this feature; all other sets of H-events with two elements show a mixture of them in at least one H-event. Because each of the two H-events has the same actual energy, and because the energy of electron e_{i0}^- is equal to the mark energy of Q_i^-, this opens the road to find more information about the ***energy density*** of the microspace related to its radius, and maybe more.

Summarizing, the four types of electrons have in common that all have a constant speed and an associated magnetized object, being a spin particle or a microspace.

- Type 1: the free electron has ***mass*** in the shape of a cap and a ***magnetic vector*** attached to the center. It has an associated ***spin particle*** with a magnetic field inside, rotating along the border of the cap. Together they revolve through a marked pellicle.
- Type 2: the ground electron has ***mass*** in the shape of a cap, but no magnetic vector. It has an associated ***spin particle*** with a magnetic field inside, rotating along the border of the cap. Together they revolve through a neutral pellicle.
- Type 3: the chemical electron is ***massless*** and a ***magnetic vector*** is attached. It exists inside an associated ***non-spherical microspace***, outside of its center. Together they revolve around a central point ***inside*** this space, or they move towards or away from the center.
- Type 4: the plasma electron is ***massless***. It exists in the center of an associated ***spherical microspace***. Together they revolve around a central point ***outside*** this space, with the largest radius of the four types, or they move towards or away from the central point.

7. Junction rules for interactions between multiple H-units

The zipper describes the interaction between two H-units only; it is not possible to design a zipper for more. To describe a real phenomenon, we need many H-units and so they have to be considered two by two. This might seem a hard task, but it turns out to be rather easy by introducing ***junction rules*** for their ***geometric combinations***. In this way, insight is gained into the logic and built-in intelligence of phenomena. The basic idea is that, to describe a phenomenon, you may use as many H-units as you need; they are just mathematical constructs.

If in an interaction some mathematical space attributes of an H-unit have been transformed into H-events, so $H_1 * H_2 \to \Omega_{12}$, and if H_1 still has potential energy left, then it may simultaneously transform this into actual energy in a second interaction $H_1 * H_3 \to \Omega_{13}$ if this meets the ***junction rules***. These are defined as follows:

1. Point of space $\tilde{P}_1$ can be transformed ***once***.
2. Minor space $\tilde{s}^1$ can be transformed ***once***.
3. Pellicle $\tilde{p}_1$ can be transformed ***twice***.
4. Major space $\tilde{S}^1$ is available for ***more*** transformations.

The first three rules concern ***compact spaces*** (mass). The ***first rule*** prevents the occurrence of double charged protons. The ***second rule*** prevents the occurrence of protons with double mass. The ***third rule*** is the consequence of the definition of transformation, breaking the pellicle into two parts in some way or another. The ***fourth rule*** concerns ***extended spaces*** (a magnetized microspace or a neutral macrospace); they are allowed to overlap each other to an energetic maximum of energy density. These rules are most practical if used

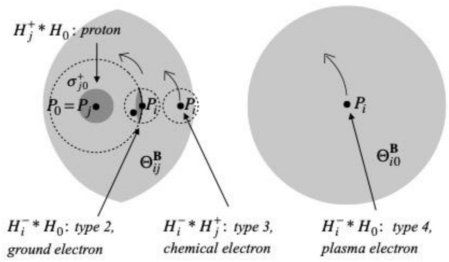

Fig. 7. Three electron bonds with a proton of type 2. Only one microspace of the ground electron is depicted and the one of the plasma electron.

together with a geometric representation of the interactions. If potential space attributes are indicated in ***grey*** and transformed ones in ***colors***, then only grey or black ones may be transformed in another interaction. The junction rules are a first step to describe multiple interactions; possibly they have to be adapted in the future.

We will consider possible bonds of ***an electron with a proton***. Then we need three H-units, being H_i^-, H_j^+ and H_k^+ or H_0. Because an electron of type 1 is a special case, we will consider it here and leave the remaining three electron-proton bonds to the next section.

The *electron of type 1*, the ***free electron***, is generated by $H_i^- * H_j^+$ (equation 40) and has an associated spin particle. We will add a ***second*** interaction $H_j^+ * H_k^+$, generating the ***proton of type 1*** (equation 36, with indices j and k); then the electron moves across the surface of the proton (see Fig. 6). Note that the junction rules allow the occurrence of ***two objects*** in the coinciding pellicles; in this case these are the electron with the spin particle along its border (considered as one object) and the spin particle of the proton. The ***third*** interaction $H_i^- * H_k^+$ is equal to $H_i^- * H_j^+$, but, because point of space P_i and pellet space $(p_i \cap p_k)$ are already occupied, this interaction is empty and so H_k^+ is only involved in the generation of the proton and its spin particle.

If the free electron-proton bond by coincidence travels through a macrospace (generated by $H_{01} * H_{02}$), the energy of the electron and the spin particle (generated by $H_i^- * H_j^+$) could be transformed into a plasma electron with a microspace (generated by $H_i^- * H_{01}$). This is only possible if this bond is in the circumstance of having not too much mass around, to facilitate the generation of a plasma electron. For that reason, we suppose that this bond describes ***protium***, a stable isotope of hydrogen, occurring seldom in atmospheric circumstances but abundantly outside of it. If protium atoms reach the atmosphere, the electrons of type 1 will be transformed into electrons of type 4, being plasma electrons, having a spherical associated microspace. As soon as a plasma electron occasionally moves into the microspace of another one, it will be kicked away, possibly into the magnetic field of a third electron; in this way a ***thunderbolt*** may be created. The accidental character of this phenomenon is reflected in its whimsical shape.

The ***electron of type 1*** cannot bind at all to a ***proton of type 2***, generated by a marked and a neutral H-unit, because then it would exist inside the neutral minor space; there the proton already exists and the junction rules do not allow a second H-event. This is the reason that it is called a 'free' electron.

8. Electron-proton bonds with a proton of type 2

Electrons of type 2, 3 and 4 can bind only to a proton of type 2, which is generated by a marked and a neutral H-unit $(H_j^+ * H_0)$ in time case 1, space case 9D and mark case 3. These cases are characterized by $T_j \cap T_0 = T_j$ and $\tilde{p}_j \cap \tilde{p}_0 = \tilde{P}_{j0}$; $\tilde{Q}_j^+$ is positive and $\tilde{Q}_0 = 0$. The set of H-events of a ***proton of type 2*** is (see Backerra 2018b, Section 5.1.3):

$$\Omega(H_j^+ * H_0) = \{\Omega_1, \Omega_2\} = \begin{Bmatrix} \sigma_{j0}^+(T_j \cup f^j, P_j \cup \theta(s^j), \{Q_{j0}^+, \partial\hat{\mathbf{E}}_i/\partial t\}) \\ \Theta_{j0}^{\mathbf{B}}(\tau_i, S^j, \hat{\mathbf{B}}^j) \end{Bmatrix}, \tag{44}$$

describing ***proton σ_{j0}^+ of type 2*** with associated ***spherical microspace*** $\Theta_{j0}^{\mathbf{B}}$. The difference with the proton of type 1 is, that here the pellicles cannot coincide because of their different radii, so instead of a pellet particle, we obtain microspace $\Theta_{j0}^{\mathbf{B}}$ in the overlapping region of the marked and the neutral major spaces. Fig. 7 shows this proton on the left (the microspace is not shown), together with the electrons of subsequently type 2, 3 and 4. The relatively large neutral pellicle of H_0 offers the possibility to generate an electron by interacting with a third H-unit and so ***forming a molecule***.

In each description we will consider ***three H-units*** of which one is neutral, being H_i^-, $H_j^+$and H_0. Then three interactions are possible: $H_j^+ * H_0$ (generating the proton), $H_i^- * H_j^+$ and $H_i^- * H_0$ (one of them generating an electron), so in each bond, a third interaction might also play a role which will be taken into account.

The ***electron of type 2***, the ***ground electron***, is generated by $H_i^- * H_0$ (equation 41). The electron e_{i0}^- revolves around the proton through neutral pellicle p_0, with spin particle s_{i0} rotating along the border of its cap-formed mass. In s_{i0}, the magnetic field rotation is constant. We consider this electron as occupying the ***lowest atomic level***.

The ***remaining (third) interaction*** is $H_i^- * H_j^+$(space case 6, time case 2, 3 or 4 and mark case 1), having the set of H-events:

$$\Omega(H_i^- * H_j^+) = \{\Omega_2\} = \{\Theta_{ij}^{\mathbf{B}}(F^i \cap F^j, S^i \cap S^j, \hat{\mathbf{B}}^i + \hat{\mathbf{B}}^j)\}, \tag{45}$$

so, a ***non-spherical microspace*** $\Theta_{ij}^{\mathbf{B}}$ is generated (Fig. 7, the electron closest to the proton), accompanying the electron in its revolving movement around P_j. This means that this electron-proton bond has ***two associated microspaces***. The non-spherical microspace $\Theta_{ij}^{\mathbf{B}}$ doubles the spherical microspace $\Theta_{j0}^{\mathbf{B}}$ of the proton partly and so in the overlapping region the magnetic energy density is higher. All together the ground electron is accompanied by three magnetized items, being a spin particle, a non-spherical microspace and a spherical one.

The ***electron of type 3***, the ***chemical electron***, is generated by $H_i^- * H_j^+$ (equation 42). Its associated non-spherical microspace $\Theta_{ij}^{\mathbf{B}}$ is similar to the one accompanying the electron of type 2, but at a larger distance and so it is smaller (see Fig. 7, the middle electron; its microspaces are not depicted). The radius of the electron is not restricted to a pellicle, so it may revolve around P_j with a ***variety of radii*** with the radius of S^j as the maximum and so occupies ***higher atomic levels*** than the ground electron.

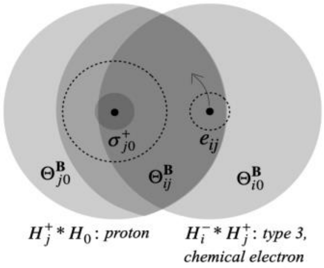

Fig. 8. Chemical electron binded to a proton, together having three associated microspaces.

The ***remaining (third) interaction*** is $H_i^- * H_0$; according to the junction rules, the electron cannot be generated once more, but a second microspace is possible:

$$\Omega(H_i^- * H_0) = \{\Theta^{\boldsymbol{B}}_{i0}(F^i \cap F^j,\ S^i,\ \widehat{\boldsymbol{B}}^i)\}, \tag{46}$$

being a ***spherical microspace*** $\Theta^{\boldsymbol{B}}_{i0}$, having P_i as the center. So, together with the spherical microspace of the proton, this electron-proton bond involves ***three microspaces***: $\Theta^{\boldsymbol{B}}_{j0}$ (spherical), $\Theta^{\boldsymbol{B}}_{ij}$ (non-spherical) and $\Theta^{\boldsymbol{B}}_{i0}$ (spherical). Microspace $\Theta^{\boldsymbol{B}}_{i0}$ reaches ***outside*** the influence of microspace $\Theta^{\boldsymbol{B}}_{j0}$, associated with the proton, so this bond will be more sensitive to influences of other spherical microspaces around than the ground electron. We suppose that $\Theta^{\boldsymbol{B}}_{i0}$ couples in some way or other with other microspaces to the so-called 'magnetic organ' of humans, as mentioned in the previous paper.[8] Because of the importance of the chemical electron, this bond is depicted once more in Fig. 8, together with all three microspaces.

The ***electron of type 4***, the ***plasma electron***, is generated by $H_i^- * H_0$ (equation 43). It has an associated spherical microspace $\Theta^{\boldsymbol{B}}_{i0}$, having a much larger distance to the proton than that of the chemical electron and thus its magnetic influence reaches ***furthest*** (Fig. 7). The electron in the center of this microspace occupies ***more remote*** atomic levels than the chemical electron, with maximum the radius of S^0, being much larger than that of S^j. For that reason, we suppose that the plasma electron occurs in circumstances where it gets enough space, without being disturbed by other H-units, so in vacuum, gaseous surrounding, nano-materials and on the surface of solid materials.[5,6]

The ***remaining (third) interaction*** is $H_i^- * H_j^+$, but because the macrospaces of H_i^- and H_j^+ do not overlap each other, this interaction is empty. Thus H_i^- of the plasma electron interacts ***exclusively*** with neutral H-unit H_0. Consequently, if P_0 and P_j would slightly shift, generating a neutron instead of a proton, there would be no energetic difference for the plasma electron and thus it may ***connect to neutrons*** just as to protons. We will meet this again in the next section.

The possibly extremely large radius of e_{i0}^-, revolving together with the spherical microspace $\Theta^{\boldsymbol{B}}_{i0}$ around a solid particle (a proton or a neutron), suggests that the ***magnetic influence*** of plasma electrons might be much larger than we ever surmised. This is the reason that we suggested in the previous publication that the shape of the corona virus might play a large role in its contagiousness.[8] Especially in air, its surface seems to be suitable for plasma electrons, which are

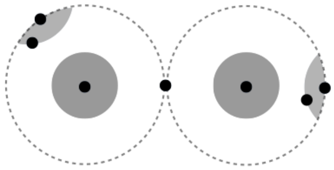

Fig. 9. Hydrogen molecule with two ground electrons. The associated microspaces are not depicted.

optimally equipped to influence the surrounding. Because the spherical microspace is connected with the revolving plasma electron, revolving around P_0 at a relatively considerable distance, its ***magnetic influence*** reaches relatively far.

Summarizing, electrons binded to a proton have an increasing distance to the proton from type 2 to type 4. In each bond one or two microspaces occur, associated with the electron, which will be determining for the possible influence of surrounding atoms.

9. From hydrogen via helium and beryllium to carbon

In this section we will apply the junction rules to build carbon out of smaller atoms. Of course there are more possible carbon structures; in the next section we will meet a second one. Here we will start by connecting two hydrogen atoms to a hydrogen molecule, then connect two hydrogen molecules to a helium atom and finally connect three helium atoms to a carbon atom. For the sake of comprehension, if additional interaction products add nothing useful, they will not be considered. First we will survey the involved particles.

The involved ***solid particles*** are protons and neutrons, both of type 2. The ***proton***, generated by $H_j^+ * H_{01}$ (equation 44), has an associated spherical microspace $\Theta^{\boldsymbol{B}}_{j01}$; its neutral pellicle p_{01} is available for at most two pellet particles. The ***neutron*** $(H_j^+ * H_{01})$ is generated in space case 2, with P_j and P_{01} slightly pushed apart; then no charge appears (see [4], equation 5.26). The associated microspace $\Theta^{\boldsymbol{B}}_{j01}$ of the neutron is almost the same as for the proton, only a tiny little bit smaller.

The involved ***pellet particles*** are ground electrons and so-called buttons. The ***ground electron*** (type 2, $H_i^- * H_{01}$), with its associated spin particle, travels through the neutral pellicle of a proton with a constant speed. The ***button*** is a type of pellet particle $(H_{01} * H_{02})$, generated if two neutral pellicles are 'touching' (then the overlapping space does not open in the middle), indicated by b_{0102}. The button has no charge and no magnetic field inside; it connects solid particles of type 2.

The involved ***point particles*** are chemical electrons and plasma electrons. The chemical ***electron*** (type 3, $H_i^- * H_j^+$) exists outside the neutral pellicle, in the spherical microspace of a proton. Its own associated (non-spherical) microspace doubles a part of the proton microspace, so in that region the energy density is higher. The ***plasma electron*** (type 4, $H_i^- * H_0$) has an associated spherical microspace; the distance from P_0 is too large for interaction $H_i^- * H_j^+$ to be possible, so H_i^- interacts only with H_0.

With this collection of particles we will make a ***theoretical construction of carbon***.

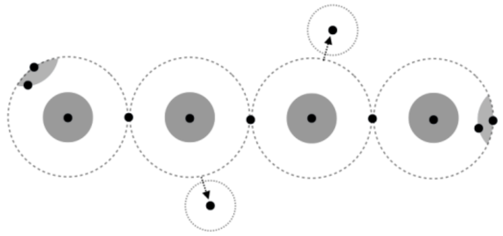

Fig. 10. Two electrons of type 2 are transformed in type 3 and snatched away, because the middle two protons are transformed into neutrons.

One hydrogen atom consists of 1 proton and 1 ***ground electron*** (type 2, $H_i^- * H_{01}$), revolving through the neutral pellicle, with a spin particle rotating along the border of the ground electron in the same neutral pellicle. The electron and the spin particle are considered as one object, so according to the junction rules, one object more may exist in the neutral pellicle.

Two hydrogen atoms can be connected if their neutral pellicles are touching, generating a button ($H_{01} * H_{02}$) and so keeping the two protons at a fixed distance. The obtained chain of solid particles is indicated by: **p** - **p** (with **p** is a proton). This is identified as a ***hydrogen molecule***, containing 2 protons, 2 ground electrons with spin particles and 1 button.

If two neutral pellicles of ***two hydrogen molecules*** touch each other, we obtain in similar way a ***chain of four protons***, **p** - **p** - **p** - **p**, connected by three buttons. This is an exceptional type of hydrogen molecule, which can be observed in the laboratory, but it is very unstable. We suppose that the two protons in the middle have too many and too close positive charged neighbors, so each of the ***two middle protons*** will be transformed into a ***neutron***, by a slight shifting apart of the coinciding points of space of $H_j^+$and H_{01} in interaction $H_j^+ * H_{01}$. Then no charge can appear, so the charge of the proton will be ***transformed back*** to potential mark energy. The newly generated neutrons have slightly shrunk associated microspaces.

According to the junction rules, the two ground electrons which previously were connected to the middle protons will be kicked out of the pellicle as soon as a button particle will be generated. They will be transformed into a ***chemical electron*** (type 3), having no spin particle anymore, but instead an additional (non-spherical) microspace, generated by $H_i^- * H_j^+$. As soon as the proton charge has been annihilated, the chain of four solid particles is not in balance considering the total charge. We suppose that for that reason, these two chemical electrons will be snatched away somehow and so that the two negative marked H-units will leave the stage. Then the obtained chain of solid particles is: **p** - n - n - **p** (with n is a neutron). This is identified as a ***helium atom*** (see Fig. 10), containing 2 neutrons, 2 protons, 3 buttons and 2 ground electrons.

Next, we connect ***two helium atoms*** to a longer chain, in a similar way as above. Again, the touching protons in the middle will be transformed into neutrons, the electrons will be transformed into chemical electrons and finally these will leave the stage. The obtained chain of solid particles is: **p** - n - n - **p** - **p** - n - n - **p**. This is identified as a ***beryllium atom***, containing 4 protons, 4 neutrons, 7 buttons, 2 ground electrons and 2 chemical electrons.

By adding a ***third helium atom*** in a similar way to the beryllium atom, the obtained chain of solid particles is:

(**p**-n-n-**p**)-(**p**-n-n-**p**)-(**p**-n-n-**p**). (47)

This is identified as a ***carbon atom***, containing 6 protons, 6 neutrons, 11 buttons, 2 ground electrons and 4 chemical electrons.

If this is a realistic reflection of a possible way in which a carbon atom in nature may come into existence, then it might also be possible to construct a chain with the same content, but ***another sequence*** of protons and neutrons. Bear in mind that two protons (of six) need to be at the ends of the chain, connected to two ground electrons; consequently at least two neutrons in the chain have to be adjacent. If two ***hydrogen*** molecules would connect to both proton ends of a ***helium*** atom, with the neutron sides connected to the protons, and if two more hydrogen atoms would be coupled in a similar way, then the obtained alternative carbon chain would be:

(**p** - n) - (**p** - n) - (**p** - n - n - **p**) - (n - **p**) - (n - **p**). (48)

Summarizing, it is theoretically possible to construct a carbon atom by connecting smaller atoms to a ***chain*** of protons and neutrons. Two hydrogen atoms may form a helium atom; two helium atoms may form a beryllium atom and adding one helium atom creates a carbon atom. An alternative sequence of solid particles is obtained by connecting one helium atom with four hydrogen atoms. In both cases, the protons at the ends of the chain have a ground electron with a spin particle. Each proton in between has an associated microspace with a chemical electron inside. Each neutron has an associated microspace without electron.

10. The influence of magnetism upon electric conductivity

In each of the four types of electrons, magnetism is represented as a spin particle (types 1 and 2) or a microspace (types 3 and 4), being finite, magnetized extended spaces. We will check their possible influence upon conducting.

Electrons of type 1 cannot be connected to a proton in a stable way; it is not clear yet if they could add to conduction as free electrons. ***Electrons of type 2***, if connected to a proton, are restricted to the neutral pellicle, so these ground electrons cannot participate in conducting; we expect that the magnetic fields inside their spin particles influence magnetic features of the material. ***Electrons of type 3 and 4***, accompanied subsequently by one and three ***microspaces***, may occupy various atomic levels. Under appropriate circumstances they may change from one level to another, so they ***may participate*** in conducting. Because only electrons of type 3 maintain interaction with the marked H-unit of the proton, they are considered as valence electrons. With this information, we will consider how electric conduction occurs.

A ***chemical electron*** (type 3, $H_i^- * H_j^+$), revolving around a proton (type 2, $H_j^+ * H_{01}$, coinciding), can leave this proton if another positive marked H-unit, for instance H_k^+, interacts with H_i^- in a similar way. This is possible if the ***marked major spaces*** of $H_i^-$and H_k^+ overlap each other without overlapping minor attributes. In the new interaction (type 3, $H_i^- * H_k^+$), again an electron of type 3 with an associated microspace is generated. If H_k^+ is simultaneously involved in the generation of another proton (type 2, $H_k^+ * H_{02}$), then the electron of type 3 apparently is passed on to another proton (although in principle it is a new electron), and this may go on with next protons. This can be identified as ***conducting***. For this type of conducting it seems important that the proton microspaces are ***close enough*** to each other. Bear in mind that this electron connects only to protons (not to neutrons).

A ***plasma electron*** (type 4, $H_i^- * H_{01}$) revolves around the proton at a much larger distance from the proton than the chemical electron. At that distance, H_i^- of the plasma electron interacts exclusively with neutral H-unit H_{01}. Consequently, the plasma electron may jump to another neutral H-unit, for instance H_{02} of an adjacent ***neutron*** ($H_j^+ * H_{02}$, off-coinciding). This can be identified as conducting. Because the plasma electron may connect to a proton as well as to a neutron, we suppose that it adds to a ***higher conductivity*** than that of the electron of type 3. For this type of conducting it seems important that the plasma electron gets ***enough space*** to move to another neutral H-unit, belonging to another proton.

We will try to explore the ***conductivity of carbon*** in the two atomic structures deduced above. At the two ends of the chain the two ground electrons of type 2 cannot be involved in conduction. The rest of the chain contains four electrons of type 3. The goal is to find out in which position of the chain these electrons could be replaced by plasma electrons.

In ***sequence*** (48) of the carbon chain, the protons have an almost perfect regular distribution of protons. We will wind up the chain around an imaginary cylinder, having a diameter of about a solid particle, such that the ***four protons*** connected to the chemical electrons form an almost perfect ***regular tetrahedron*** (this is a triangular pyramid). In this position, the protons have a maximum distance to each other, so their associated microspaces might be not overlapping. Then the electrons cannot move from one microspace to another and consequently the conductivity will be ***extremely low***. We identify this carbon structure as ***diamond***, having a conductivity which seems to be based mostly upon impurities. A typical atomic diameter of diamond is 0.3 nm, so we suppose that the size of the radius of a microspace is of the order of 0.1 - 0.2 nm.

In ***sequence*** (47), we will curl the carbon chain to an almost closed ring in one plane, as this seems optimal to make the existence of ***three plasma electrons*** possible. Note that it makes no difference for plasma electrons to be connected to a proton or to a neutron. In this form of the chain, three electrons can be connected to three solid particles such, that each time ***three other solid particles are between*** them. If this distance indeed offers enough space to exist as three plasma electrons, they will revolve with a relatively large distance around their solid particles. Only one chemical electron remains, revolving with a much smaller radius around a proton somewhere in the chain. If we further suppose that each plasma electron revolves ***in the plane*** of the ring, then the chemical electron disturbs the plasma electrons least if its plane is more or less perpendicular to the plane of the ring.

Now we arrange three more ring shaped carbon atoms in the plane around this carbon atom, in such a way that the atomic distances are greatest, but still overlapping enough of the neutral major spaces to reach the plasma electrons; this is a honeycomb structure. Then the plasma electrons in principle may jump easily to a solid particle in the surrounding atoms, thus adding to a ***very high conductivity***. If this honeycomb structure is lengthened, the ***chemical electron*** in each atom, being more or less perpendicular to the plane of the rings without further restrictions, causes the surface to be not completely flat. Then the plasma electrons may be identified with ***sigma-bonds*** in the plane and the chemical electron with a ***pi-bond***, outside of the plane. We identify this structure of carbon with a ***graphene molecule***.

The possible occurrence of plasma electrons (type 4) in carbon, as we considered above, shows their huge possible influence upon electric conductivity. Taking the specific features of their associated microspaces, as described in Section 8, also into account, it is of uttermost importance to find out experimentally if the corona virus indeed carries electrons of type 4, as we suggested in the previous publication,[8] because its shape seems to be suitable for it. In that case, they might be transformed into electrons of type 3, having a much smaller influential region, to decrease the activity of the virus. The occurrence of magnetized microspaces, associated with electrons of type 3 and 4, might open a new window to the role of magnetism in soft materials, like in human tissue, to reveal information about the related ***magnetic body***,[8] and so upon aspects of health.

11. Conclusions

Fundamental differences between electricity and magnetism are considered closer, by deriving the Maxwell equations in a more comprehensible way. In the complementary view of twin physics, the electric field is determinate and the magnetic field indeterminate. Only during ***movements*** of charge, electric field derivatives exist, so a static electric field is non-existing. By contrast, static magnetic fields do exist, but only in ***finite spaces***; they may overlap each other. A magnetic field adapts to the belonging electric field by changing its field strength and field direction, made possible by its indeterminate character. However, the other way around is not possible, as the electric field is completely determined by the charge; the only possible adaptation is by a geometric intervention, being a change of the direction of the charge.

Four types of electrons are described, each accompanied by an ***associated object***, being a magnetized particle (a spin particle) or a magnetized finite space (a microspace) and each having a constant speed. Also the specific connections with a proton are described. Apparently all electrons are accompanied by finite magnetized objects, so an entirely new way of thinking about electricity is obtained. These fields are restricted by the laws of Maxwell, but remain uncertain to some extent. A further elaboration of the laws of Maxwell in spherical coordinates seems a promising way to obtain more insight in magnetic features at an atomic or molecular level.

Type 1 is a ***free electron***, having mass in the form of a cap, and an ***associated spin particle*** at the border. Because of its small radius of revolving, it can only connect to a proton by moving over its surface. This is supposed to be ***protium***, a stable isotope of hydrogen, occurring rarely in atmospheric circumstances but abundantly outside of it.

Type 2 is a ***ground electron***, which is at first sight rather similar to type 1, also having mass and an associated spin particle, but moreover, it has the ability to connect to a proton at the lowest atomic level.

Type 3 is a ***chemical electron***, having no mass and no spin particle, but supplied with an ***associated microspace***, being a finite, oval shaped, magnetized space, and having a magnetic vector. It may connect to a ***proton*** at higher atomic levels; the variety of possible levels makes this the ***most common*** electron in chemical bonds. The magnetic vector is supposed to play a role in magnetic materials.

Type 4 is a ***plasma electron***, at first sight rather similar to type 3, but having a ***spherical*** microspace with a radius of about 0.1 - 0.2 nm, existing at a much larger distance of the proton and so occupying the highest atomic levels. Moreover, it has the ability to connect to a ***proton as well as a neutron***. Plasma electrons, together with their associated microspaces, seem to be responsible for specific features of nano materials; possibly they play an important role in the contagiousness of the corona virus, because their ***magnetic influence*** might reach much more far than their diameter would suggest.

Previously, descriptions were restricted to only a few units of potential energy (the Heisenberg-units). By formulating four ***junction rules***, it is possible to describe larger atoms and molecules, generated by a large number of H-units, in a straightforward way. This is shown for a ***carbon molecule***, in which solid particles are connected to each other by ***buttons***, forming a chain; a button is a neutral variant of a spin particle. Two constructions of the carbon chain are considered, having a different sequence of protons and neutrons. By choosing an appropriate bending of the chain, different types of electrons may be involved and their associated microspaces play a decisive role in the resulting ***conductivity***. One variant is related to diamond, having an extremely low conductivity, the other with graphene, having an extremely high conductivity.

Experimental research is required to find out if these theoretical results are reflected in the physical reality. The possible share of the electron of type 1 in conductivity needs to be investigated. The spin particles associated with electrons of type 2 might be determining for ***magnetic features*** in solid state material. The influence of microspaces, associated with electrons of type 3 and 4, seems to play a crucial role in ***electric conductivity***. The possible occurrence of plasma electrons in carbon shows an exceptional influence upon electric conductivity, so it is of uttermost importance to investigate experimentally the associated microspaces, to find out if their estimated size is realistic. If the proportion between the amount of electrons of type 3 and 4 in a material could be controlled, a way of ***fine-tuning*** conductivity and magnetic properties could be developed. If the ***corona virus*** indeed contains plasma electrons, as we suggested in the previous publication,[8] it might be possible to transform them into chemical electrons, decreasing the activity of the virus. If this could be reached by spraying normal clothing, it would decrease the nuisance of wearing airtight protective clothing for healthcare people.

The occurrence of magnetized microspaces might add to the ***consistency*** of bulk materials. Also it might open a new window to the role of magnetism in soft materials, like in human tissue, to reveal information about the related ***magnetic body*** and so upon aspects of health. This requires a next step from microspaces in molecules to magnetism on a human scale.

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Conflicts of Interest

The authors declare no conflict of interest.

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