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# A New Form of Matter — Unmatter, Composed of Particles and Anti-Particles

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Besides *matter* and *antimatter* there must exist *unmatter* (as a new form of matter) in accordance with the neutrosophy theory that between an entity  $\langle A \rangle$  and its opposite  $\langle \text{Anti}A \rangle$  there exist intermediate entities  $\langle \text{Neut}A \rangle$ . Unmatter is neither matter nor antimatter, but something in between. An atom of unmatter is formed either by (1): electrons, protons, and antineutrons, or by (2): antielectrons, antiprotons, and neutrons. At CERN it will be possible to test the production of unmatter. The existence of unmatter in the universe has a similar chance to that of the antimatter, and its production also difficult for present technologies.

## 1 Introduction

This article is an improved version of an old manuscript [1]. This is a theoretical assumption about the possible existence of a new form of matter. Up to day the unmatter was not checked in the lab.

According to the neutrosophy theory in philosophy [2], between an entity  $\langle A \rangle$  and its opposite  $\langle \text{Anti}A \rangle$  there exist intermediate entities  $\langle \text{Neut}A \rangle$  which are neither  $\langle A \rangle$  nor  $\langle \text{Anti}A \rangle$ .

Thus, between “matter” and “antimatter” there must exist something which is neither matter nor antimatter, let’s call it UNMATTER.

In neutrosophy,  $\langle \text{Non}A \rangle$  is what is not  $\langle A \rangle$ , i.e.  $\langle \text{Non}A \rangle = \langle \text{Anti}A \rangle \cup \langle \text{Neut}A \rangle$ . Then, in physics, NON-MATTER is what is not matter, i.e. nonmatter means antimatter together with unmatter.

## 2 Classification

### A. Matter is made out of electrons, protons, and neutrons.

Each matter atom has electrons, protons, and neutrons, except the atom of ordinary hydrogen which has no neutron.

The number of electrons is equal to the number of protons, and thus the matter atom is neutral.

### B. Oppositely, the **antimatter** is made out of antielectrons, antiprotons, and antineutrons.

Each antimatter atom has antielectrons (positrons), antiprotons, and antineutrons, except the antiatom of ordinary hydrogen which has no antineutron.

The number of antielectrons is equal to the number of antiprotons, and thus the antimatter atom is neutral.

### C. **Unmatter** means neither matter nor antimatter, but in between, an entity which has common parts from both of them.

Etymologically “un-matter” comes from [ME  $\langle$  OE, akin to Gr. *an-*, *a-*, Latin *in-*, and to the negative elements in *no*, *not*, *nor*] and [ME *matière*  $\langle$  OFr  $\langle$  Latin *material*] matter (see [3]), signifying no/without/off the matter.

There are two types of unmatter atoms, that we call unatoms:

- u1. The first type is derived from matter; and a such unmatter atom is formed by electrons, protons, and antineutrons;
- u2. The second type is derived from antimatter, and a such unmatter atom is formed by antielectrons, antiprotons, and neutrons.

One unmatter type is oppositely charged with respect to the other, so when they meet they annihilate.

The unmatter nucleus, called **unnucleus**, is formed either by protons and antineutrons in the first type, or by antiprotons and neutrons in the second type.

The charge of unmatter should be neutral, as that of matter or antimatter.

The charge of un-isotopes will also be neutral, as that of isotopes and anti-isotopes. But, if we are interested in a negative or positive charge of un-matter, we can consider an un-ion. For example an anion is negative, then its corresponding unmatter of type 1 will also be negative. While taking a cation, which is positive, its corresponding unmatter of type 1 will also be positive.

Sure, it might be the question of how much *stable* the unmatter is, as J. Murphy pointed out in a private e-mail. But Dirac also theoretically supposed the existence of antimatter in 1928 which resulted from Dirac’s mathematical equation, and finally the antimatter was discovered/produced in large accelerators in 1996 when it was created the first atom of antihydrogen which lasted for 37 nanoseconds only.

There does not exist an unmatter atom of ordinary hydrogen, neither an unnucleus of ordinary hydrogen since the ordinary hydrogen has no neutron. Yet, two isotopes of the hydrogen, *deuterium* ( $^2\text{H}$ ) which has one neutron, and

artificially made *tritium* ( ${}^3\text{H}$ ) which has two neutrons have corresponding unmatter atoms of both types, *un-deuterium* and *un-tritium* respectively. The isotopes of an element X differ in the number of neutrons, thus their nuclear mass is different, but their nuclear charges are the same.

For all other matter atom X, there is corresponding an antimatter atom and two unmatter atoms

The unmatter atoms are also neutral for the same reason that either the number of electrons is equal to the number of protons in the first type, or the number of antielectrons is equal to the number of antiprotons in the second type.

If antimatter exists then a higher probability would be for the unmatter to exist, and reciprocally.

Unmatter atoms of the same type stick together form an **unmatter molecule** (we call it **unmolecule**), and so on. Similarly one has two types of unmatter molecules.

The *isotopes* of an atom or element X have the same atomic number (same number of protons in the nucleus) but different atomic masses because the different number of neutrons.

Therefore, similarly the **un-isotopes of type 1** of X will be formed by electrons, protons, and antineutrons, while the **un-isotopes of type 2** of X will be formed by antielectrons, antiprotons, and neutrons.

An *ion* is an atom (or group of atoms) X which has lost one or more electrons (and as a consequence carries a negative charge, called *anion*, or has gained one or more electrons (and as a consequence carries a positive charge, called *cation*).

Similarly to isotopes, the **un-ion of type 1** (also called **un-anion 1** or **un-cation 1** if resulted from a negatively or respectively positive charge ion) of X will be formed by electrons, protons, and antineutrons, while the **un-ion of type 2** of X (also called **un-anion 2** or **un-cation 2** if resulted from a negatively or respectively positive charge ion) will be formed by antielectrons, antiprotons, and neutrons.

The ion and the un-ion of type 1 have the same charges, while the ion and un-ion of type 2 have opposite charges.

**D. Nonmatter** means what is not matter, therefore non-matter actually comprises antimatter and unmatter. Similarly one defines a nonnucleus.

### 3 Unmatter propulsion

We think (as a prediction or supposition) it could be possible at using unmatter as fuel for space rockets or for weapons platforms because, in a similar way as antimatter is presupposed to do [4, 5], its mass converted into energy will be fuel for propulsion.

It seems to be a little easier to build unmatter than antimatter because we need say antielectrons and antiprotons only (no need for antineutrons), but the resulting energy might be less than in matter-antimatter collision.

We can collide unmatter 1 with unmatter 2, or unmatter 1 with antimatter, or unmatter 2 with matter.

When two, three, or four of them (unmatter 1, unmatter 2, matter, antimatter) collide together, they annihilate and turn into energy which can materialize at high energy into new particles and antiparticles.

### 4 Existence of unmatter

The existence of unmatter in the universe has a similar chance to that of the antimatter, and its production also difficult for present technologies. At CERN it will be possible to test the production of unmatter.

If antimatter exists then a higher probability would be for the unmatter to exist, and reciprocally.

The 1998 Alpha Magnetic Spectrometer (AMS) flown on the International Space Station orbiting the Earth would be able to detect, besides cosmic antimatter, unmatter if any.

### 5 Experiments

Besides colliding electrons, or protons, would be interesting in colliding neutrons. Also, colliding a neutron with an antineutron in accelerators.

We think it might be easier to produce in an experiment an unmatter atom of deuterium (we can call it un-deuterium of type 1). The deuterium, which is an isotope of the ordinary hydrogen, has an electron, a proton, and a neutron. The idea would be to convert/transform in a deuterium atom the neutron into an antineutron, then study the properties of the resulting un-deuterium 1.

Or, similarly for un-deuterium 2, to convert/transform in a deuterium atom the electron into an antielectron, and the proton into an antiproton (we can call it un-deuterium of type 2).

Or maybe choose another chemical element for which any of the previous conversions/transformations might be possible.

### 6 Neutrons and antineutrons

Hadrons consist of baryons and mesons and interact via strong force.

Protons, neutrons, and many other hadrons are composed from quarks, which are a class of fermions that possess a fractional electric charge. For each type of quark there exists a corresponding antiquark. Quarks are characterized by properties such as *flavor* (up, down, charm, strange, top, or bottom) and *color* (red, blue, or green).

A neutron is made up of quarks, while an antineutron is made up of antiquarks.

A neutron (see [9]) has one Up quark (with the charge of  $+\frac{2}{3}\times 1.606\times 10^{19}$  C) and two Down quarks (each with the

charge of  $-\frac{1}{3} \times 1.606 \times 10^{19}$  C), while an antineutron has one anti Up quark (with the charge of  $-\frac{2}{3} \times 1.606 \times 10^{19}$  C) and two anti Down quarks (each with the charge of  $+\frac{1}{3} \times 1.606 \times 10^{19}$  C).

An antineutron has also a neutral charge, through it is opposite to a neutron, and they annihilate each other when meeting.

Both, the neutron and the antineutron, are neither attracted to nor repelling from charges particles.

## 7 Characteristics of unmatter

Unmatter should look identical to antimatter and matter, also the gravitation should similarly act on all three of them. Unmatter may have, analogously to antimatter, utility in medicine and may be stored in vacuum in traps which have the required configuration of electric and magnetic fields for several months.

## 8 Open Questions

- 8.a Can a matter atom and an unmatter atom of first type stick together to form a molecule?
- 8.b Can an antimatter atom and an unmatter atom of second type stick together to form a molecule?
- 8.c There might be not only a You and an anti-You, but some versions of an un-You in between You and anti-You. There might exist un-planets, un-stars, un-galaxies? There might be, besides our universe, an anti-universe, and more un-universes?
- 8.d Could this unmatter explain why we see such an imbalance between matter and antimatter in our corner of the universe? (Jeff Farinacci)
- 8.e If matter is thought to create gravity, is there any way that antimatter or unmatter can create antigravity or ungravity? (Mike Shafer from Cornell University)

I assume that since the magnetic field or the gravitons generate gravitation for the matter, then for antimatter and unmatter the corresponding magnetic fields or gravitons would look different since the charges of subatomic particles are different. . .

I wonder how would the universal law of attraction be for antimatter and unmatter?

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