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## A New Order Relation on the Set of Neutrosophic Truth Values

### Abstract

In this article, we discuss all possible cases to construct an atom of matter, antimatter, or unmatter, and also the cases of contradiction (i.e. impossible case).

### 1. Introduction

Anti-particle in physics means a particle which has one or more opposite properties to its "original particle kind". If one property of a particle has the opposite sign to its original state, this particle is anti-particle, and it annihilates with its original particle.

The anti-particles can be electrically charged, color or fragrance (for quarks). Meeting each other, a particle and its anti-particle annihilate into gamma-quanta.

This formulation may be mistaken with the neutrosophic  $\langle \text{anti}A \rangle$ , which is strong opposite to the original particle kind. The  $\langle \text{anti}A \rangle$  state is the ultimate case of anti-particles [6].

In [7], F. Smarandache discusses the refinement of neutrosophic logic. Hence,  $\langle A \rangle$ ,  $\langle \text{neut}A \rangle$  and  $\langle \text{anti}A \rangle$  can be split into:  $\langle A_1 \rangle$ ,  $\langle A_2 \rangle$ , ...;  $\langle \text{neut}A_1 \rangle$ ,  $\langle \text{neut}A_2 \rangle$ , ...;  $\langle \text{anti}A_1 \rangle$ ,  $\langle \text{anti}A_2 \rangle$ , ...; therefore, more types of matter, more types of unmatter, and more types of antimatter.

One may refer to  $\langle A \rangle$ ,  $\langle \text{neut}A \rangle$ ,  $\langle \text{anti}A \rangle$  as "matter", "unmatter" and "anti-matter".

Following this way, in analogy to anti-matter as the ultimate case of anti-particles in physics, the unmatter can be extended to "strong unmatter", where all properties of a substance or a field are unmatter, and to "regular unmatter", where just one of the properties of it satisfies the unmatter.

### 2. Objective

The aim is to check whether the indeterminacy component  $I$  can be split to sub-indeterminacies  $I_1, I_2, I_3$ , and then justify that the below are all different:

$$I_1 \cap I_2 \cap I_3, I_1 \cap I_3 \cap I_2, I_2 \cap I_3 \cap I_1, I_2 \cap I_1 \cap I_3, I_3 \cap I_1 \cap I_2, I_3 \cap I_2 \cap I_1. \quad (1)$$

### 3. Cases

Let  $e, e^+, P, \text{anti}P, N, \text{anti}N$  be electrons, anti-electrons, protons, anti-protons, neutrons, anti-neutrons respectively, also  $\cup$  means union/OR, while  $\cap$  means intersection/AND, and suppose:

$$I = (e \cup e^+) \cap (P \cup \text{anti}P) \cap (N \cup \text{anti}N) \quad (2)$$

The statement (2) shows indeterminacy, since one cannot decide the result of the interaction if it will produce any of the following cases:

1.  $(e \cup e^+) \cap (P \cup \text{anti}P) \cap (N \cup \text{anti}N) \rightarrow e \cap P \cap \text{anti}N$ ,  
which is *unmatter* type (a), see reference [2];
2.  $(e \cup e^+) \cap (N \cup \text{anti}N) \cap (P \cup \text{anti}P) \rightarrow e^+ \cap N \cap \text{anti}P$ ,  
which is *unmatter* type (b), see reference [2];
3.  $(P \cup \text{anti}P) \cap (N \cup \text{anti}N) \cap (e \cup e^+) \rightarrow P \cap N \cap e^+ = \text{contradiction}$ ;
4.  $(P \cup \text{anti}P) \cap (e \cup e^+) \cap (N \cup \text{anti}N) \rightarrow \text{anti}P \cap e \cap \text{anti}N = \text{contradiction}$ ;
5.  $(N \cup \text{anti}N) \cap (e \cup e^+) \cap (P \cup \text{anti}P) \rightarrow N \cap e \cap P$ ,  
which is a *matter*;
6.  $(N \cup \text{anti}N) \cap (P \cup \text{anti}P) \cap (e \cup e^+) \rightarrow \text{anti}N \cap \text{anti}P \cap e^+$ ,  
which is *antimatter*.

#### 4. Comment

It is obvious that all above six cases are not equal in pairs; suppose:

$$e \cup e^+ = I_1 = \text{uncertainty},$$

$$P \cup \text{anti}P = I_2 = \text{uncertainty},$$

$$N \cup \text{anti}N = I_3 = \text{uncertainty}.$$

Consequently, the statement (2) can be rewritten as:

$$I = I_1 \cap I_2 \cap I_3$$

but we cannot get the equality for any pairs in eq. (1).

#### 5. Remark

This example is a response to the article [4], where Florentin Smarandache stated that "for each application we might have some different order relations on the set of neutrosophic truth values; (...) one can get one such order relation workable for all problems", and also to a commentary in [5], that "It would be very useful to define suitable order relations on the set of neutrosophic truth values".

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