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# From Quark to Infinite Dimensionality

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**ABSTRACT**

This article gives a overall picture of how the universe works from the likelihood that our universe is infinite dimensional at the nanometer scale of an indestructible quark. The article explains that we only can perceive for sure up to 4 dimensions of physical reality. However, the speculation in this article seems very clear that likely we are seeing activity in the 5th dimension in particle physics experimentation explaining the EPR paradox and other mysteries seen in particle physics. Finally, the article shows why the Mendeleev Chart has historically listed possible stable atoms without giving the exact number possible. The way protons and other hadrons are composed of six quarks and six antiquarks held together by gluons leads to the inevitable conclusion that only 108 stable atoms can exist. Being stable means the protons in an atom are composed of 3 quarks/antiquarks having charge 1. Recent discoveries in particle physics research demonstrates that there exists a particle named the pentaquark composed of five quarks. The article explains that pentaquarks have been identified in recent particle research. It is not known yet whether the pentaquark leads to a different proton that leads in turn to a pentaquark atom. New particle research will likely answer this question.

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## Introduction

We assume that our universe is N dimensional where N can be any positive integer. We know that our three-dimensional way of looking at the universe can be considered four dimensional with time being the 4th dimension. We can view a universe as any dimension from N equal one to infinity using the well-known accepted Cartesian system of co-ordinates. So, N can be any integer from 1 to an infinite number N of integral digits.

At present we have visible dimension that extends easily to four dimensions assuming time is a dimension. Unlike the three-dimensional universe the four-dimensional universe has a time dimension that seems not to be reversible. Yet time travel to the past is not beyond visualization. It is a view of historical time that is not unlike viewing any of the other three dimensions. The 2N color theorem is highly relevant to the content of this research article that addresses the construction of the universe from Quark/Antiquark to infinite dimensionality. So, the theorem is stated in its general form for convenience to the reader. The article that gives the proof of the theorem by the author of this article stated next [1].

## 2N Color Theorem

A hyper-spatial graph represented in N dimensions requires at most 2N colors to ensure that no two adjacent vertices require the same color.

## Dimensionality of the Universe

The generalization to the Four-Color Theorem opens the door to new particle physics research as well as other areas of science and engineering. Here we are concerned with both the 2N Color Theorem's impact on particle physics and the structure of the universe. This article makes the grandiose argument that the generalized 2N Color Theorem offers clarity to the nature of both the microscopic substance of our universe and the macroscopic. The 2N Color theorem gives an encompassing picture of how the universe is constructed from the quark to infinite dimensionality. The 2N Color theorem is in a class of what mathematicians call a representation theorem covering a wide area of abstraction.

At infinite dimension we are left with a dilemma because only the 3rd and 4th dimension possibilities for our universe can be experienced physically as what is verifiable. In addition, there is a suspicion based on particle physics experimentation that a Five-dimension universe could explain some of the peculiar mysteries of sister particles that each react when one is tweaked despite there being a distance between them. This situation suggests that the sister particles are possibly tied through an unseen Fifth Dimension or can defy causality and the speed of light. The EPR Paradox explained in 1935 gives an accounting of the anomaly in quantum theory offered by Einstein, Podolsky, and Rosen in reference [2]. The EPR paradox basically says that quantum theory is inconsistent. How can two quantum particles that initially interacted still react to physical action with each other simultaneously after being separated by miles of distance? Attempts have been made to explain the EPR paradox but are not provable. In this article is offered a more likely explanation that particles are connected in the five-dimensional way of viewing the universe.

It is theorized that the universe is not just a 4-dimensional reality but is an ascending infinite sequence of dimensions for n=1 to infinity. Clearly our reality has its best situation for our limited sensory perception when n is 3 or 4. The EPR paradox can be explained along with other mysteries of particles disappearing and reappearing best by there being a fifth dimension that is included in all larger N dimensionalities. Mathematically it would be consistent that our universe could be infinitely dimensioned by an ascending chain of dimensionality to infinity. If it were true that our universe is infinitely dimensional then higher dimensionality may be impossible to experience with our normal physical methods but offer possibilities in the spiritual realm. If this theory is true that the universe is really an ascending sequence of higher dimensionality then this might be where spiritual reality resides. Presently there is much activity using sophisticated sensory devises to experience ghost activity. Parapsychologists have done much research investigating spiritual activity. And Reincarnation has long been theorized as the only thing that makes sense from a religious perspective. Science has no choice but to proceed with the possibly totally false assumption of a four-dimensional universe that only progresses in new discovery through measurements that use our limited sensory perception in up to 4 dimensions for sure and possibly a 5$^{th}$ dimension.

The 2N Color Theorem supports the notion that behavior at higher dimensions affects our reality only in ways that are not directly observable [1]. The 2N-Color Theorem applies to unobservable dimensions. Yet, it has great power to make observations in three through four dimensions. The EPR paradox can be explained by admittance of particle physics experimentation allowing a 5th dimension perception in the ascending sequence of dimensionality to infinity. Einstein along with many other physicists believed that in the future the greatest gains in Physics will be obtained through parapsychology experimentation likely in higher dimensions. It should be noted that since repulsion gravity operates at the 3 and 4 dimensions very likely this is not just a local property of the universe in only the 4$^{th}$ dimension but carries over to the 5th dimension and beyond.

**Quarks and Leptons Reign at the Nanometer Level**

Particle physics experimentation breaking up protons with extreme heat and super collisions at CERN has led to the discovery that quarks are held together by gluons in protons and other hadrons. The quark is an indivisible particle in its natural state within a proton that comes in six variations along with six more variations of antiquarks. The 2N Color Theorem applies to any network in the universe. Quarks do not occur in a free independent state of their own. But they can be freed from a proton through intense collider induced heat that virtually explodes a proton into its parts.

Particle physics investigation has led to the realization that the proton is composed of quarks/antiquarks held together by gluon particles. The 2N color theorem can be visualized as applying to the exploded proton that allows for the quark/antiquark being separated from the others in a proton allowing it to be subject to the 2N Color Theorem. And the 2N Color Theorem restricts how the quarks and gluons return to their former stable state as protons and leptons. Because of proton quarks having existence even for a small time period we know that the explosion of quarks allows them to be subject to the 2N Color Theorem. In addition, the 2N Color Theorem constrains how the quark interfaces with other quarks to return to a stable proton state. Support to the existence of pentaquarks now has recently been established [3]. The Six Color Theorem is relevant to the Pentaquark now identified by particle physics researchers.

Abstractly we can conceive of a universe that goes beyond our normal thinking. Based on the existence of the fourth-dimension reality of our universe it seems logical that there are many ascending layers of dimension from N=1 to infinity. So, if the bubble chamber experiences point to a likely fifth dimension why would we not have an ascending sequence from 6 to infinity of dimensionality in the universe?.

**Quarks in Atoms Listed in the Mendeleev Chart of Stable Atoms**

Much Particle Physics research has occurred in the 20th Century. The Quark is one of the major discoveries in the mid-20th Century. And this article depends squarely on the quark research described in reference [4 & 5]. With high energy colliders at CERN the proton was exploded into indestructible particles known as quarks/antiquarks. Extensive investigation followed that uncovered the properties of the quark/antiquark as the main building blocks of the proton and neutron. In addition, investigators found massless particles named Gluons that carried the nuclear force that held quarks in the nucleus of the proton and neutron.

Particle physicists found that there exist six distinguishable quarks and six antiquarks. Also, it was found that generally protons are composed of three quarks/antiquarks held together by the massless particles called Gluons. Recent particle research has shown that there exist a pentaquark composed of five quarks [3]. In this article we view an atom as stable if its proton consists of three quark/antiquarks whose charge adds to 1. This seems like the best way to define stability in an atom. There are other definitions of Atom stability but this is the one that seems the best given the current state of Particle Physics research.

We have two other possible protons/antiprotons with charge 1 and -1. A proton with 3 quarks with each having 1/3 charge gives rise to proton of charge 1. (Analogously, a proton with 3 quarks/antiquarks each having -1/3 charge give rise to an anti-proton of charge -1.) Early Mendeleev charts listed only known stable atoms. Over time the Mendeleev chart grew into the 100s by discovery of new atoms of higher atomic weight. The background to the history of the Mendeleev chart's evolution can be found in [6].

We approach the situation from a precise way of looking at quarks and antiquarks in a matrix of pairs according to their charges. Here is a list of quarks and antiquarks with their charge. Antiquarks all have the opposite charge of the corresponding quark.

| Quark | Antiquark |
|---|---|
| Up 2/3 | UP- -2/3 |
| Down -1/3 | Down- 1/3 |
| Charm 2/3 | Charm- -2/3 |
| Strange -1/3 | Strange- 1/3 |
| Top 2/3 | Top- -2/3 |
| Bottom -1/3 | Bottom- 1/3 |

For simplicity we form a matrix of quark/antiquark using U for up and U- for up-, D and D-, C and C-, and so forth. We form a matrix that allows us to view pairs of quarks that could be mates in a Proton. We know that all Protons have a combination of 3 quarks/antiquarks. The matrix will be 12x12 with entries to the matrix giving combined charge of any pair of quarks. After forming a matrix of quarks and antiquark pairs we then determine the possible quark combinations that can occur in a proton with the addition of a third quark that permits the proton to have a charge of 1.

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| | U | D | C | S | T | B | U- | D- | C- | S- | T- | B- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U | 4/3 | 1/3 | 4/3 | 1/3 | 4/3 | 1/3 | 0 | 1 | 0 | 1 | 0 | 1 |
| D | 1/3 | -2/3 | 1/3 | -2/3 | 1/3 | -2/3 | -1 | 0 | -1 | 0 | -1 | 0 |
| C | 4/3 | 1/3 | 4/3 | 1/3 | 4/3 | 1/3 | 0 | 1 | 0 | 1 | 0 | 1 |
| S | 1/3 | -2/3 | 1/3 | -2/3 | 1/3 | -2/3 | -1 | 0 | -1 | 0 | -1 | 0 |
| T | 4/3 | 1/3 | 4/3 | 1/3 | 4/3 | 1/3 | 0 | 1 | 0 | 1 | 0 | 1 |
| B | 1/3 | -2/3 | 1/3 | -2/3 | 1/3 | -2/3 | -1 | 0 | -1 | 0 | -1 | 0 |
| U- | 0 | -1 | 0 | -1 | 0 | -1 | -4/3 | -1/3 | -4/3 | -1/3 | -4/3 | -1/3 |
| D- | 1 | 0 | 1 | 0 | 1 | 0 | -1/3 | 2/3 | -1/3 | 2/3 | -1/3 | 2/3 |
| C- | 0 | -1 | 0 | -1 | 0 | -1 | -4/3 | -1/3 | -4/3 | -1/3 | -4/3 | -1/3 |
| S- | 1 | 0 | 1 | 0 | 1 | 0 | -1/3 | 2/3 | -1/3 | 2/3 | -1/3 | 2/3 |
| T- | 0 | -1 | 0 | -1 | 0 | -1 | -4/3 | -1/3 | -4/3 | -1/3 | -4/3 | -1/3 |
| B- | 1 | 0 | 1 | 0 | 1 | 0 | -1/3 | 2/3 | -1/3 | 2/3 | -1/3 | 2/3 |

We have a 12x12 matrix that displays all possible charges for pairs of quarks and antiquarks. Since stable protons all have the identical charge of 1, we only need to find the number of quarks that when combined with those pairs of quarks can add to a charge of 1. Only the pairs that have a charge of 4/3, 2/3, or 1/3 have a possibility of combining as a third quark/antiquark to form a proton with a charge of 1. For example, the pair of Up and Up can have a charge of one by combining it with any quark/antiquark with a -1/3 charge. There are 3 such possibilities Down, Strange and Bottom. Charm and up paired also add to 4/3 charge. So, there are 3 such possibilities for forming a proton with charge one with the pair of charm and up. Generally, every pair that has 4/3 charge can be combined with 3 quark/antiquarks to add to a charge of 1. There are 9 pairs adding to a charge of 4/3. It is possible to form 27 triplets of quarks/antiquarks with a charge of 1. The same reasoning applies to the pairs of quarks/antiquarks adding to 2/3. So, the matrix yields up to this point leads to 54 triplets that could form a proton of charge 1. The last of the pairs that yield 1/3 charge gives 18x3=54 possible protons of charge 1. Matrix pairs that add to 4/3, 2/3, and 1/3 all require adding a quark/antiquark to attain a proton of positive charge 1. We conclude there are 108 possible stable atoms of charge 1.

There is more to the story of potential atoms when one considers the elements both stable and unstable created by scientists in the particle Physics Laboratories with higher atomic numbers than 108. In addition, Reference [3] attributes certainty to the existence of a pentaquark. And reference [7] gives background to the evolution of the Mendeleev Chart [3,7]. If a Pentaquark proton, exists, it would have an integral charge determined by5 quarks including one antiquark or one that has 5 antiquarks including one quark. There can be no stable proton having 3 quarks and 2 antiquarks because the charge would not add up to a whole integer. The same reasoning applies to the possibility of 3 antiquarks and 2 quarks in a proton. So, beside the 108 possible stable atoms likely there could be two additional types of pentaquark protons that have not been entered into the historical Mendeleev Chart of atoms taught in chemistry classes. Further particle physics experiments will surely be directed to the identification of pentaquark protons, if indeed, they exist.

At present it is not known whether it can be proven that pentaquark atoms can exist. It is known that there is an ongoing scientific investigation into the pentaquark properties at this time. Besides stable atoms found in the current Mendeleev chart of atoms scientists know that unstable atoms also exist that have expanded the chart over the years. Radioactive elements have been created in laboratories. Radioactive elements have applications as tracers in current scientific research.

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