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# Unified Field Theory and Topology of Nuclei

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**Abstract** Even though all isotopes for each element are well studied, the structures of their nuclei are still unknown. This paper examines the topology and stability of ground state isotopes of major elements. According to Unified Field Theory (UFT), a proton has the shape of an octahedron. The nuclei result from protons and neutrons piling up. Since the strong forces are along the axes of the octahedron of protons and neutron, the structure of ground state isotopes of any given element can be logically induced. Only two of three axes of the octahedron nucleus have strong interactive forces internally. The structure starts with one or two base squares and accumulates smaller squares along the axis of the base squares in both directions. The possible proton base structures are square shaped. For example, the Technetium nucleus has one proton too many to be symmetrical. Therefore, no stable isotopes of Technetium can be found.

***Keywords:*** *Nuclear Physics, Particle Physics, Unified Field Theory*

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## 1. Introduction

Before publication of UFT (e.g. [1,2,3,4,5]), the Lattice model (e.g. [7-31]) is considered one of the best nuclear models so far. Even though it is more complex than the old water drop model (e.g. [32,33,34,35,36]), it can not predict the stabilities of Technetium (e.g. [37-53]).

Without knowing the structures of proton and neutron, the topology of the nucleus is "unclear". Fortunately, an important prediction of UFT regarding nuclear structure is the shapes of the particles (e.g. [5]). A nucleus is made up of protons and neutrons. Both proton and neutron share the same octahedron shape.

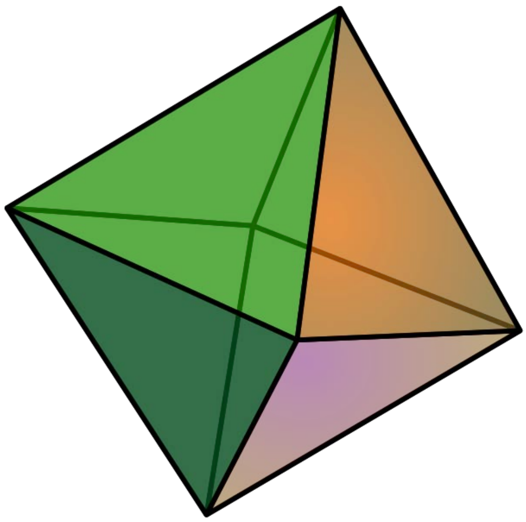

**Figure 1.** Octahedron Proton

Octahedron protons and neutrons pile themselves up to make a nucleus. The configuration of proton/neutron octahedron pile decides the characteristics of a nucleus.

This paper analyzes the piling structures for some stable nuclei and unstable nuclei. The stability of a nucleus is largely based on whether the piling is symmetrical or not. A symmetrical nucleus is stable; otherwise, it is not stable.

## 2. Topology of Nuclei

The following UFT concepts will be used extensively in the paper:

The main structure of the Proton and Neutron are their axes (e.g. [5]): $A^2$, $A^2$ and A (some time B).

The component "A" has the following mass formula:

A = (2*3*5)

In addition,

$A^2$ = (2*3*5)* (2*3*5)

Component "B" has the following mass formula:

B = 2*2*4

### 2.1. Nuclear Base Square

When the proton count is more than four, the protons and neutrons are piled on a 2D plane formed by two main octahedron axes $A^2$ and $A^2$. The particles are aligned along the octahedron axes so that the strong waves are in resonance along the straight lines.

When the proton count is seventeen, a 2D base square of 3*3 is formed.

In the 2D base square, neutrons are more stable if they are paired along the lines that are vertical to octahedron axes. For a 3*3 neutron formation, additional neutron is added to the base square when the pile is more than one layer.

### 2.2. Particle Piling

A proton has a single charge. The charged forces are evenly distributed across the eight faces of the proton (e.g. [5]).

The proton structure needs to be symmetrical to make the structure stable. The protons and neutrons are piled on 2D plane form by two octahedron axes first. The additional particles are piled on both side of 2D plane symmetrically.

When a nucleus has enough protons, the center of nucleus preferred to be one neutron. In some cases, it can be proton as well. The octahedron shaped neutron/proton at the center of the nucleus has a proton at each of six ends of its three axes. From the center of the nucleus, the preferred piling sequence is neutron/proton → proton → neutron,… The three axes' directions will grow symmetrically into the main structure of the nucleus and make a large nucleus octahedron shape.

## 3. Bonding Forces

### 3.1. Deuterium

A deuterium (e.g. [54-61]) nucleus has a proton and a neutron. It is a stable symmetrical nucleus.

Mass:

Deuterium:

3671.48294(22) e or 2.01410178u

Proton + Neutron:

3674.836332953(59)e or 2.015941382812u

Lost Energy:

3.35339e or 0.00183960u

Original:

$(2A^2 + A + 2*3 + 0.15267) +$

$(2A^2 + A + 2*3 + 2.5 + 0.15267 + 0.030987)$

Combining two particles share 2*3 component as 3*3:

Proton: $(2A^2 + A + 0.15267) +$

Neutron: $(2A^2 + A + 2 + 0.15267 + 1/(900*2*2))$

Sharing: 3*3

Binding: 0.1782

Lost: 3.35339

Binding Energy

137/900+ 137/(900*2*3) +(2*2*3)/(137*137) = 0.1782

### 3.2. Tritium

A deuterium (e.g. [62-69]) nucleus has a proton and two neutron.

Mass:

5497.9213(56)e or 3.0160492u

Proton + 2Neutron:

5513.519993448(72)e or 3.024606298812u

Lost Energy:

15.598636(88)e or 0.0085570(98)u

Original:

$(2A^2 + A + 2*3 + 0.15267) +$

$2*(2A^2 + A + 2*3 + 2.5 + 0.15267 + 0.030987)$

A proton is at the center and the three particles are not identical. Combining three particles eliminates 2*3 wave and weak interactions related to 2*3:

Proton: $(2A^2 + A+137/900)$

Neutrons:

$2*(2A^2 + A + 2 +137/900)$

Sharing: 2*2

Binding: 0.464(6)

Lost: 15.598636(88)e

Binding Energy

3*137/900+137/(900*2*2*5) = 0.464

### 3.3. Helium-3

A helium-3 (e.g. [70-78]) nucleus has two protons and a neutron. It is a stable symmetrical nucleus.

Mass:

5497.8851158(96)e or 3.0160293191u

2Proton + Neutron:

5510.9890054(12)e or 3.023217849624u

Lost Energy:

13.1038896e or 0.00718853u

Original:

$2(2A^2 + A + 2*3 + 0.15267) +$

$(2A^2 + A + 2*3 + 2.5 + 0.15267 + 0.030987)$

Neutron is at the center and three particles are not identical. Sharing 2*3:

Protons: $2*(2A^2 + A + 137/900)$

Neutrons: $(2A^2 + A + 1.5)$

Sharing: 2*3

Binding: 0.08

Lost: 13.1038896e

Binding Energy

137/(900*2) =0.08

### 3.4. Helium-4

A helium-4 (e.g. [70-78]) nucleus has two protons and two neutrons. It is a stable symmetrical nucleus.

Mass:

7296.2993815(97)e or 4.00260325415u

2Proton + 2Neutron:

7349.6726659(07)e or 4.031882765624u

Lost Energy:

53.3732844e or 0.0292795u

Original:

$2*(2A^2 + A + 2*3 + 0.15267) +$

$2*(2A^2 + A + 2*3 + 2 + 0.15267 + 0.030987)$

Two neutrons are at the center, without a structure, no strong binding within protons and neutrons, add proximately 1/9 charging energy:

Protons: $2*(2A^2 +2*2*4 + 2*2)$

Neutrons: $2*(2A^2 + 2*2*4 + 2*2+ 2)$

Sharing: 2*3+2*4

Binding: 0.3

Lost: 53.3732844e

Binding Energy

2*137/900 = 0.3

## 4. Single Layer Proton Pile Nuclei

### 4.1. Hydrogen

A hydrogen (e.g. [79-96]) nucleus with a single proton is the simplest stable symmetrical nucleus.

A deuterium nucleus has a proton and a neutron. It is a stable symmetrical nucleus.

A tritium nucleus has a proton and two neutrons. It is a symmetrical but unstable nucleus and can be decayed into a Helium atom through beta decay.

### 4.2. Beryllium

A Beryllium-9 (e.g. [97-107]) nucleus has four protons and five neutrons. It is a stable symmetrical nucleus.

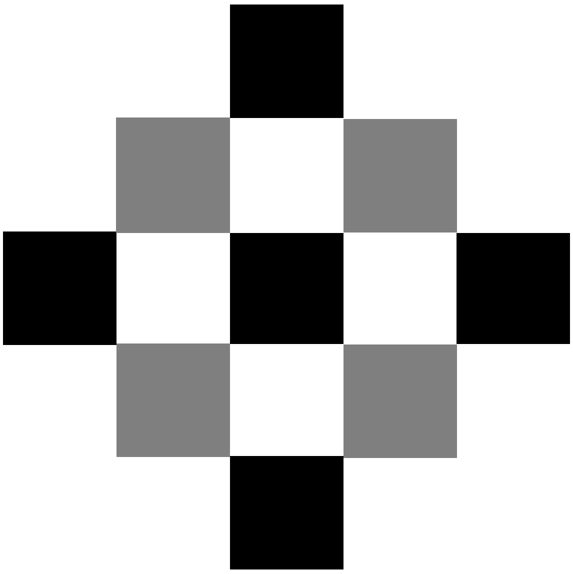

**Figure 2.** $^{9}$Beryllium

Mass: 16428.2031561(66)e
Possible structural formula:
Protons: 4*(2A$^2$ +2*2*4 + 2*2)
Neutrons: 5*(2A$^2$ + 2*2*4 + 2*2 +0.5)
Sharing: 9*1
Binding: 0.70315616(59)

### 4.3. Phosphorus

A Phosphorus-31 nucleus has fifteen protons and sixteen neutrons. It is a stable symmetrical nucleus

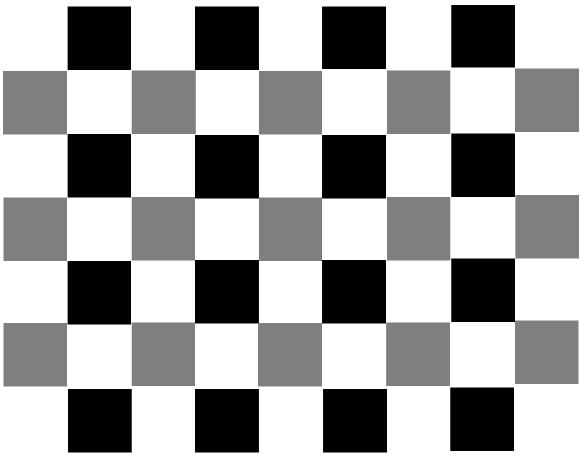

**Figure 3.** $^{31}$Phosphorus

## 5. Multi Layer Nuclei

### 5.1. Potassium

A Potassium-41 (e.g. [108-113]) nucleus has nineteen protons and twenty two neutrons. It is a stable symmetrical nucleus.

Atomic number: 19

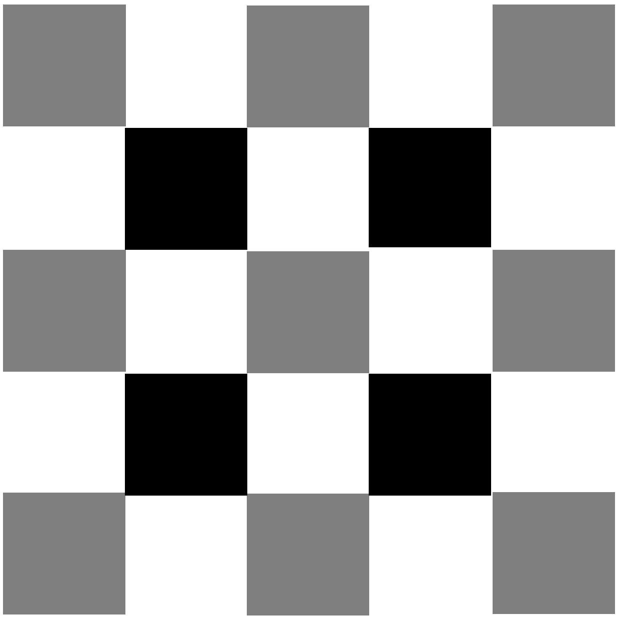

**Figure 4.** Potassium Base 3*3 + 2*2

The Structure for $^{41}$Potassium:
Base: Proton 3*3 + Neutron 2*2
Second Layer: Proton 2*2*2 + Neutron 2*5
Third Layer: Proton: 2*1 + Neutron 2*2
Mass: 74668.8404982(26)e
Possible structural formula:
Protons: 19*(2A$^2$ +2*2*4 + 2*2)
Neutrons: 22*(2A$^2$ + 2*2*4 + 2*2 +0.1)
Sharing: 41*1.1375731(27)

### 5.2. Ruthenium

A Ruthenium-104 (e.g. [114,115,116]) nucleus has 44 protons and 60 neutrons. It is a stable symmetrical (except the base square) nucleus.

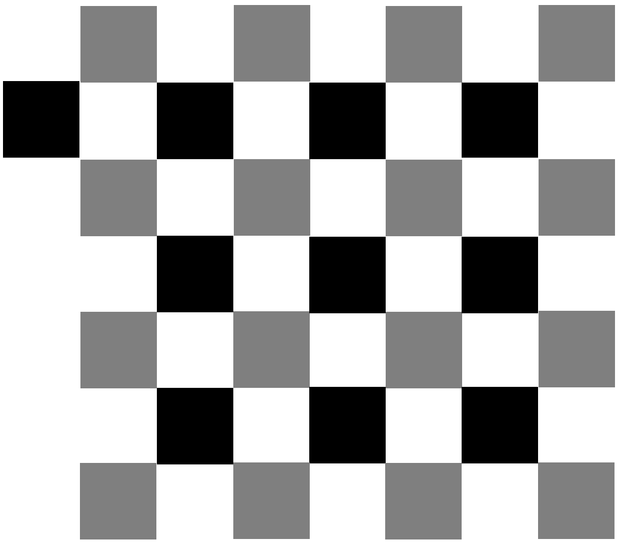

**Figure 5.** Ruthenium Base 4*4+(3*3 +1)

The Structure for $^{104}$Ruthenium:
Base: Proton 4*4 + Neutron 3*3 +1
Second Layer: Proton 2*3*3 + Neutron 2*12
Third Layer: Proton 2*2*2 + Neutron 2*3*3
Fourth Layer: Proton 2*1 + Neutron 2*2*2

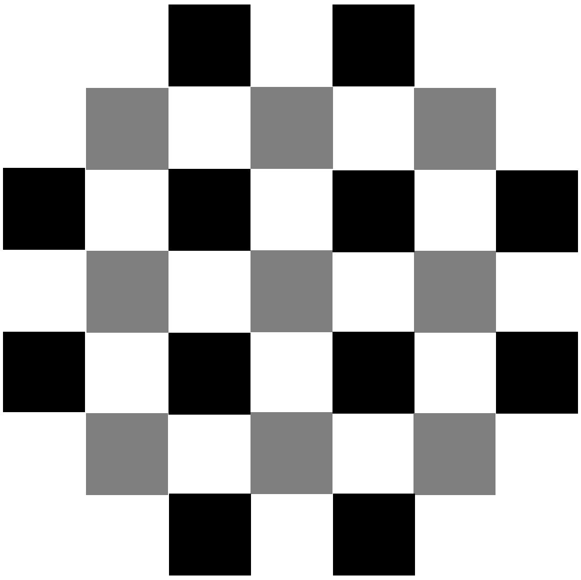

**Figure 6.** Ruthenium Second Layer: 3*3+12

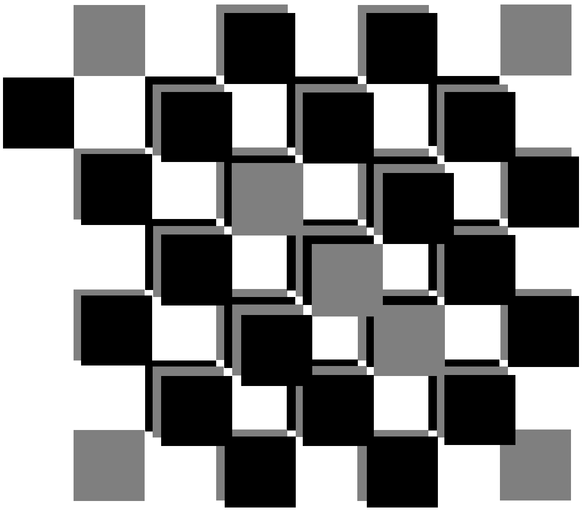

**Figure 7.** $^{102}$Ruthenium top down view

**Ruthenium Isotopes Forth Layer**

$^{102}$Ruthenium: Proton 2*1 + Neutron (2+4)

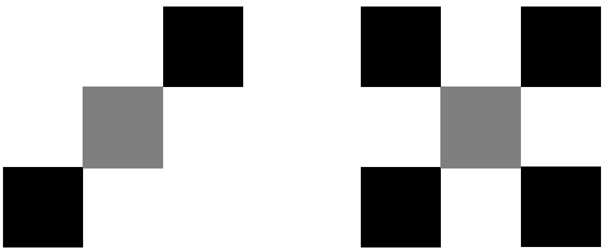

**Figure 8.** Proton 1 + Neutron 2, Proton 1 + Neutron 4

$^{101}$Ruthenium: Proton 2*1 + Neutron (2+3)

**Figure 9.** Proton 1 + Neutron 2, Proton 1 + Neutron 3

$^{100}$Ruthenium: Proton 2*1 + Neutron (2+2)
$^{99}$Ruthenium: Proton 2*1 + Neutron (2+1)
$^{98}$Ruthenium: Proton 2*1 + Neutron (1+1)
$^{96}$Ruthenium: Proton 2*1

## 5.3. Samarium

Atomic number: 62
The Structure for $^{144}$Samarium:
Base: Proton 4*4 + Neutron (3*3 + 8 + 1)
Second Layer: Proton 2*3*3+ Neutron 2*16
Third Layer: Proton 2*2*2+ Neutron 2*3*3
Fourth Layer: Proton 2*3*3+ Neutron 2*2*2
Fifth Layer: Proton 2*1+ Neutron 2+2

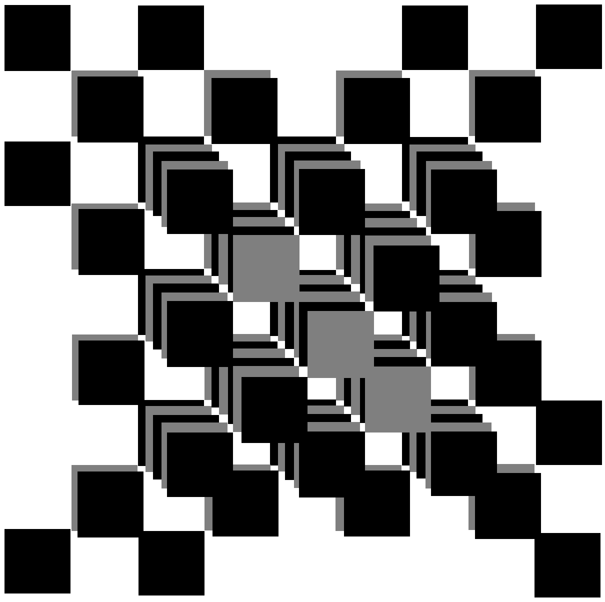

**Figure 10.** $^{150}$Samarium

The Structure for 150Samarium:
Base: Proton 4*4 + Neutron (3*3 + 12 + 1)
Second Layer: Proton 2*3*3+ Neutron 2*16
Third Layer: Proton 2*2*2+ Neutron 2*3*3
Fourth Layer: Proton 2*3*3+ Neutron 2*2*2
Fifth Layer: Proton 2*1+ Neutron 2+2

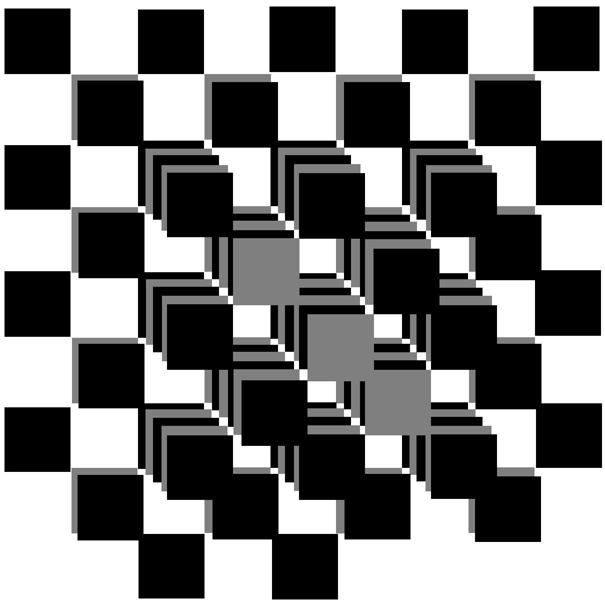

**Figure 11.** $^{152}$Samarium

The Structure for $^{152}$Samarium:
Base: Proton 4*4 + Neutron (3*3 + 12 + 1)
Second Layer: Proton 2*3*3+ Neutron 2*16
Third Layer: Proton 2*2*2+ Neutron 2*3*3
Fourth Layer: Proton 2*3*3+ Neutron 2*2*2
Fifth Layer: Proton 2*1+ Neutron 3+3
The Structure for $^{154}$Samarium:
Base: Proton 4*4 + Neutron (3*3 + 12 + 1)
Second Layer: Proton 2*3*3+ Neutron 2*16
Third Layer: Proton 2*2*2+ Neutron 2*3*3
Fourth Layer: Proton 2*3*3+ Neutron 2*2*2
Fifth Layer: Proton 2*1+ Neutron 4+4

### 5.4. Ytterbium

Atomic number: 70
The Structure for $^{172}$Ytterbium:
Base: Proton 4*4 + Neutron (3*3 + 12 + 1)
Second Layer: Proton 2*3*3+ Neutron 2*16
Third Layer: Proton 2*2*2+ Neutron 2*3*3
Fourth Layer: Proton 2*3*3+ Neutron 2*2*2
Fifth Layer: Proton 2*2*2+ Neutron 2*3*3
Sixth Layer: Proton 2*1+ Neutron 2*2

### 5.5. Thulium

Atomic number: 69
The Structure for $^{169}$Thulium:
5*5+2*4*4+2*5 + 2
Base: Proton 5*5 + Neutron (4*4)
Second Layer: Proton 2*4*4+ Neutron 2*5*5
Third Layer: Proton 2*5+ Neutron 2*4*4
Fourth Layer: Proton 2*1+ Neutron 2*1

At fourth layer, the neutron is at the center to sit on top of the proton at the center of the third layer. There should be one proton surround the central neutron.

### 5.6. Lead

Atomic number: 82
The Structure for $^{208}$Lead:
Base: Proton 5*5-1 + Neutron (4*4+2)
Second Layer: Proton 2*4*4+ Neutron 2*5*5
Third Layer: Proton 2*(3*3 -1)+ Neutron 2*(4*4)
Fourth Layer: Proton 2*(2*2)+ Neutron 2*(3*3)
Fifth Layer: Proton 2*1+ Neutron 2*(2*2)
The Structure for $^{207}$Lead:
Base: Proton 5*5-1 + Neutron (4*4+2)
Second Layer: Proton 2*4*4+ Neutron 2*5*5
Third Layer: Proton 2*(3*3-1)+ Neutron 2*(4*4)
Fourth Layer: Proton 2*(2*2)+ Neutron 2*(3*3)
Fifth Layer: Proton 2*1+ Neutron 3 + 4
The Structure for $^{206}$Lead:
Base: Proton 5*5-1 + Neutron (4*4+2)
Second Layer: Proton 2*4*4+ Neutron 2*5*5
Third Layer: Proton 2*(3*3-1)+ Neutron 2*(4*4)
Fourth Layer: Proton 2*(2*2)+ Neutron 2*(3*3)
Fifth Layer: Proton 2*1+ Neutron 3 + 3

### 5.7. Uranium

Atomic number 92
The Structure for $^{238}$Uranium (e.g. [117,118]):
Base: Proton 6*6 + Neutron (7*7+1)
Second Layer: Proton 2*5*5 + Neutron 2*(6*6 )
Third Layer: Proton 2*2+ Neutron 2 *(3*3 +2)
Fourth Layer: Neutron 2*2

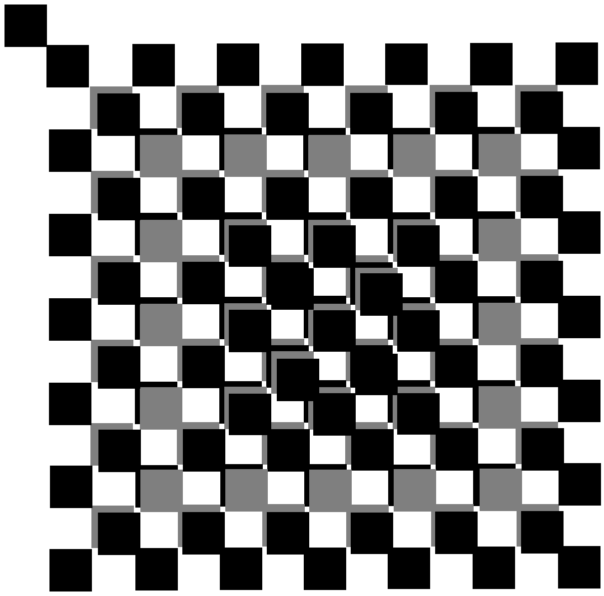

**Figure 12.** $^{238}$Urarium

The Structure for $^{236}$Uranium:
Base: Proton 6*6 + Neutron (7*7+1)
Second Layer: Proton 2*5*5 + Neutron 2*(6*6)
Third Layer: Proton 2*2+ Neutron 2 *(3*3 +2)
Fourth Layer: Neutron 2*1
The Structure for $^{235}$Uranium:
Base: Proton 6*6 + Neutron (7*7+1)
Second Layer: Proton 2*5*5+ Neutron 2*(6*6 )
Third Layer: Proton 2*2+ Neutron 2 *(3*3 +2)
Fourth Layer: Neutron 1
The Structure for $^{234}$Uranium:
Base: Proton 6*6 + Neutron (7*7+1)
Second Layer: Proton 2*5*5 + Neutron 2*(6*6 )
Third Layer: Proton 2*2+ Neutron 2 *(3*3 +2)
The Structure for $^{233}$Uranium:
Base: Proton 6*6 + Neutron (7*7)
Second Layer: Proton 2*5*5 + Neutron 2*(6*6)
Third Layer: Proton 2*2+ Neutron 2*(3*3 +2)

## 6. Unstable Nuclei

### 6.1. Technetium

Atomic number 43

Technetium (e.g. [37-53]) has no stable isotopes. The reason is that its proton pile structure is not symmetrical. The proton pile structure is:

4*4 + 2*3*3+2*2*2+1

There are two fourth layers, one on each side. Only one proton available for two layers. The unbalanced proton distribution is source of instabilities.

Many elements' proton piles are not symmetrical. Niobium has the following proton pile:

4*4 + 2*3*3+(4+3)

The imbalance of the third layer is: 4 vs. 3 as compared to Technetium's 1 vs. 0 at fourth layer.

The Structure for $^{99}$Technetium:
Base: Proton 4*4 + Neutron 3*3 +1
Second Layer: Proton 2*3*3 + Neutron 2*12
Third Layer: Proton 2*2*2 + Neutron 2*3*3

Fourth Layer: Proton 1 + Neutron 2*2
During decaying process, only fourth layer changes to:
Proton 1 + Neutron 2 and Proton 1 + Neutron 1
The Structure for $^{99}$Technetium:
Base: Proton 4*4 + Neutron 3*3 +1
Second Layer: Proton 2*3*3 + Neutron 2*12
Third Layer: Proton 2*2*2 + Neutron 2*3*3
Fourth Layer: Proton 1 + Neutron 2*2
During decaying process, its fourth layer changes to:
Proton 1 + Neutron 2 and Proton 1 + Neutron 1
The Structure for $^{98}$Technetium:
Base: Proton 4*4 + Neutron 3*3 +1
Second Layer: Proton 2*3*3 + Neutron 2*12
Third Layer: Proton 2*2*2 + Neutron 2*3*3
Fourth Layer: Proton 1 + Neutron 2+1
During decaying process, its fourth layer changes to:
Proton 1 + Neutron 1 and Proton 1 + Neutron 1
The Structure for $^{97}$Technetium:
Base: Proton 4*4 + Neutron 3*3 +1
Second Layer: Proton 2*3*3 + Neutron 2*12
Third Layer: Proton 2*2*2 + Neutron 2*3*3
Fourth Layer: Proton 1 + Neutron 1+1
During decaying process, its fourth layer changes to:
Neutron 1 and Neutron 2

## 6.2. Promethium

Atomic number 61

Promethium (e.g. [129,130,131,132,133]) has no stable isotopes. The reason is same as Technetium. The proton pile structure is:

4*4 + 2*3*3+2*2*2+2*3*3+1
There are a few relatively stable isotopes:
The Structure for $^{145}$Promethium:
Base: Proton 4*4 + Neutron (3*3 + 1)
Second Layer: Proton 2*3*3+ Neutron 2*12
Third Layer: Proton 2*2*2+ Neutron 2*3*3
Fourth Layer: Proton 2*3*3+ Neutron 2*12
Fifth Layer: Proton 1+ Neutron 4+4

# 7. Conclusions

1. The structures of nuclei are mainly the result of octahedron shaped protons and neutrons piling. The protons are symmetrical, while the neutrons are paired and symmetrical after meeting the pairing requirements.

2. The piling process starts from the base layer. Protons determine the ultimate configuration of the piling.

3. Piled neutrons and protons keep the $2A^2$ structure. When atomic number is greater than two, 2*3*5 + 2*3 will be changed to 2*2*4 + 2*2 structure, due to charged waves that have to resonate with the charge octahedron face count eight.

4. As atomic number increases, the mass difference between neutron and proton decreases. But their roles are significantly different.

5. Symmetrical piling is more stable as compared to non-symmetrical ones.

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