Why the Nuclear Drip Line Skews

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Abstract

Helium-4 nucleus is shown with the six attachment points for added neutrons and four attachment points for added protons, which matches the known isotopes of helium.

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Claims of Novelty

- Helium-4 nucleus has six specific attachment points for added neutrons and four specific attachment points for added protons.


Chapter 2 Introduction

Dedication
This work is dedicated to Ginger

Previous Work
The text and diagrams are substantially the same as my paper posted on the physics archive https://vixra.org/abs/2209.0057. In particular, the paper about tetrons Tetrons, viXra.org e-Print archive, viXra:2307.0050 is essential to understand the tetron references throughout this paper.

Chapter 3 Planar Configuration of Bound Nucleons
The planar configuration of bound nucleons is due to sharing gluons with neighboring particles. In particular, the 2 vertices available for attachment of the neutron compared to the 1 vertex available for attachment of the proton is responsible for the mass difference of the neutron and proton. This can be calculated.

Proton mass = 938.27208816 MeV/c²
Neutron mass = 939.56542052 MeV/c²
Difference = 1.29333 MeV/c²

Neutron mass = 3*quark mass + 3* internal gluon mass + 2* inter-particle gluon mass
Proton mass = 3*quark mass + 3* internal gluon mass + 1* inter-particle gluon mass
Assume internal gluon mass = inter-particle gluon mass
Neutron mass = 3*quark mass + 5* gluon mass
Proton mass = 3*quark mass + 4* gluon mass
Difference = 1 gluon mass

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1 Proton - Wikipedia
2 Neutron - Wikipedia
Free neutron mass = free proton mass = bound proton mass - gluon mass = 938.27208816 - 1.29333 = 936.97876 MeV/c^2

The Strong Force
In a high energy state, a gluon is simply extra mass added to a quark’s spine tetrons via E=mc^2. The secondary gluon or gluons formed between particles is the strong force. That means the strong force between two particles will be 1, 2 or 3 units of strength, depending on how many tetrons form a gluon bond.

Figure 2 - Comparing Forces Within a Quark, Particle and Between Particles

Chapter 4 Nucleons
Particle Pairs
Matter particles and their antimatter mirrors are permanently in a congruent particle pair, and do not collide in an annihilation event. Head-on annihilation does not occur if particles in a pair are congruent.
## Why the Nuclear Drip Line Skews

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### Figure 4 - Particle Pairs

<table>
<thead>
<tr>
<th>Proton</th>
<th>Neutron</th>
</tr>
</thead>
<tbody>
<tr>
<td>$= 2^*u + d$</td>
<td>$= 2^*d + u$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anti-Proton</th>
<th>Anti-Neutron</th>
</tr>
</thead>
<tbody>
<tr>
<td>$= 2^*u^{-1} + d^{-1}$</td>
<td>$= 2^*d^{-1} + u^{-1}$</td>
</tr>
</tbody>
</table>

Proton congruent with anti-proton

Neutron congruent with anti-neutron
**Nucleons Pictorial**

<table>
<thead>
<tr>
<th>Matter</th>
<th>Spin $+\frac{3}{2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proton</td>
<td>$2u + d$</td>
</tr>
<tr>
<td>Neutron</td>
<td>$2d + u$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antimatter</th>
<th>Spin $-\frac{3}{2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Proton</td>
<td>$2u^{-1} + d^{-1}$</td>
</tr>
<tr>
<td>Anti-Neutron</td>
<td>$2d^{-1} + u^{-1}$</td>
</tr>
</tbody>
</table>

Note: different up gluon & exterior tetron arrangements

**Figure 5 - Nucleons Pictorial**
Chapter 5 Nucleus

Nuclear Isotopes
Postulate the deviation of the proton - neutron ratio from 1 to 1 is due to neutrons having more potential gluon points than protons, explained in the following few diagrams.
Figure 7 - Nuclear Isotopes
### Figure 8 - Nuclear Isotopes Detail

<table>
<thead>
<tr>
<th>Neutrons</th>
<th>Protons</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
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</tr>
<tr>
<td>9</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Stable**
- **Beta plus**
- **Beta minus**
- **Alpha**
- **Proton emission**
- **Neutron emission**
- **Fission**

No naturally-occurring nuclei have proton or neutron emission.
**Figure 9 - Nuclides Drip Line "Decay" Paths**
Common Properties in Particle State Diagrams
In a proton or electron, vertex 8 is ww//zz and is available to form an apex bond with vertex 2, which is xx//yy. This will leave the proton or electron with only ww//zz vertices and able to bond only with a particle with a free xx//yy vertex, such as a neutron or electron neutrino. In the nucleus, protons and neutrons have an abundance of ww//zz valence tetrons. Protons have only ww//zz valence tetrons left if an apex (fourth) gluon is formed. Neutrons have one remaining xx//yy valence tetron left after forming an apex (fourth) gluon. This leaves neutrons in the nucleus with more inter-particle gluon possibilities than protons.

Figure 10 - Common Properties in Particle State Diagrams
**Apex (Fourth) Gluon Formation Between Quarks A & B**

![Diagram of Apex (Fourth) Gluon Formation Between Quarks A & B]

*Figure 11 - Apex (Fourth) Gluon Formation Between Quarks A & B*

**Protium (Hydrogen-1) Nucleus**

![Diagram of Protium (Hydrogen-1) Nucleus]

*Figure 12 - Protium (Hydrogen-1) Nucleus*
**Internal Tetrahedron in Apex Gluon Particle**

![Internal Tetrahedron in Apex Gluon Particle](image)

*Figure 13 - Internal Tetrahedron in Apex Gluon Particle*
Orthogonal Views of 3 Gluon Particle
Example is single proton nucleus of hydrogen-1 (protium)

Figure 14 - Orthogonal Views of 3 Gluon Particle
**Deuterium**

9 gluons and 6 \( \text{ww} // \text{zz} \) tetrons (exposed vertices) that are non-reactive with \( \text{ww} // \text{zz} \) vertices of other particles. This is the most likely isomer.

*Figure 15 - Deuterium Nucleons*
Tritium
- 1 reactive xx/yy vertex
- This is the most likely isomer

Figure 16 - Three Joint Deuterium (Hydrogen-2) Nucleus
Figure 17 - Four Joint Gluons Tritium (Hydrogen-3) Nucleus

**Helium-2 Nucleus**
- 2 protons
- 0 neutrons
- no reactive xx//yy vertex
- no apex gluons
- geometric symmetry about center
- hinge lines
Helium-4 Model

- 2 protons
- 2 neutrons
- 6 joint gluons
- no reactive xx/yy vertex
- no apex gluons
- geometric symmetry about center
- hinge lines

Selected for helium-4 nucleus because:

- even though there are 2 hinge lines and 2 pivot points between the 4 particles, the amount of rotation is limited by the ring nature of the structure
- one of the degrees of freedom between the neutron side and the proton side is at right angles with the remaining 2 degrees of freedom about the same particle types (2 neutrons hinge about their 2 connecting vertices and 2 protons do likewise)
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Figure 19 - Perspective View of the Helium-4 Nucleus

Figure 20 - Orthogonal Views of the Helium-4 Nucleus
Figure 21 - Orthogonal Views of Six Joint Gluons Helium-4 Nucleus

**Helium-4 Attachment Positions for Free Neutron // Anti-neutron Pairs**

For background on the beta reaction referenced in the following sections, see *The Weak Reaction*, viXra.org e-Print archive, viXra:2307.0076
Figure 22 – Six Helium-4 Attachment Positions for Free Neutron // Anti-neutron Pairs
Summary:

- A neutron emission is an anti-neutron capture
- A neutron capture is an anti-neutron emission

Findings from beta minus reaction extended to neutron emission & capture:

To matter observer:

- Matter velocity direction is the same as matter cause-effect direction
- Antimatter velocity direction is opposite of cause-effect direction
Four Helium-4 Attachment Positions for Free Proton // Anti-proton Pairs

12 wW//zz vertices are available for attachment but 4 maximum are used by He due to single pivot protons getting close to one another.

One of 4 preferred positions for free proton // anti-proton pair to attach to

Figure 25 - Helium-4 Attachment Positions for Free Proton // Anti-proton Pairs
Chapter 6 Summary

Chapter 3 introduced planar configuration of bound nucleons, which is bound by 3 gluons per particle. Chapter 4 introduced matter particles and their antimatter mirrors, which are permanently in a congruent particle pair. Chapter 5 claims the deviation of the proton to neutron ratio from 1 to 1 is due to neutrons having more potential gluon points than protons. Specifically, the Helium 4 nucleus is an example where six sites for a free neutron exceeds the four sites for a free proton.

The neutron has two \( xx//yy \) tetrons whereas the proton only has one \( xx//yy \) tetron. This may be visualized as a highly reactive free \( xx//yy \) tetron in an environment of available \( ww//zz \) tetrons. The neutron has two of these highly reactive tetrons, and the proton only has one. In addition to having more binding sites, a free neutron will likely bond both \( xx//yy \) tetrons, creating a more stable resultant nucleus. The proton has only one \( xx//yy \) tetron to bond, leaving this newly bonded nucleon with many more degrees of freedom to rotate around.