The Diagrams of Particles Decay Process and the Prediction of New Particles

Zhi CHENG

（9 Bairong st. Baiyun District, Guangzhou, China. 510400. gzchengzhi@hotmail.com）

Abstract: I have proposed an intuitive diagrammatic method to explore the elementary particles' structures and decay processes based on virtual space-time. Then I discuss the possibilities of the existing of new particles.

Key words: Elementary particles; diagram; neutron; decay

0 Introduction

Currently, we have no tools to observe the structures of elementary particles. So the most useful tools are the diagrams, such as Feynman's diagram. [1] Here I postulate a new diagram scheme based on virtual space-time. [2~4] This diagram can provide us an intuitive view of the elementary particles' structure and help us explore the particles' decay process.

1 Some conventions

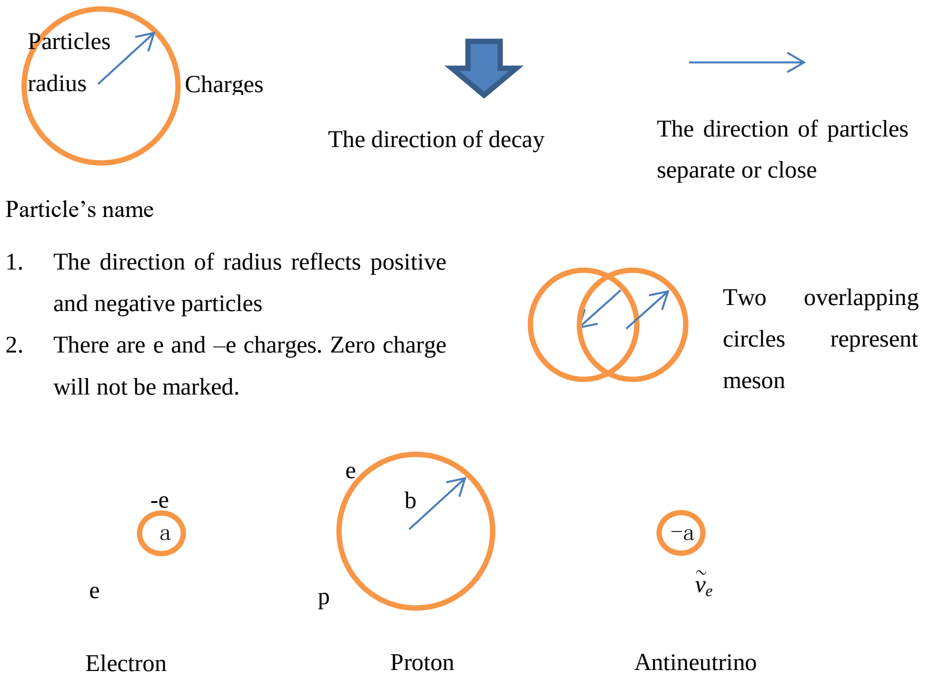

Figure 1. Diagram conventions

There may be another postulate. It means that there is a sequence that the leptons will only decay in step by step. For example, the Tau cannot decay to electrons directly. However, the higher energy photons can produce three lepton pair of positive and negative particles directly.

2 Is this W boson?

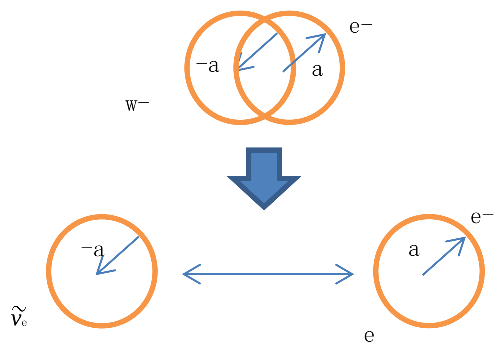

Figure 2. The structures of W boson and its decay

We can use uncertainty principle to estimate the mass of this particle. Since all of two particles (electron and anti-neutrino) are limited in the area of radius a, we can calculate the virtual photon's energy

$$h\nu = \frac{\hbar c}{4a} = \frac{m_p c^2}{2\alpha} = 64.3\text{GeV}$$

Since

$$h\nu >> m_e c^2$$

So the mass of this particle is close to 64.3GeV

This energy is located in the energy range of W and Z bosons. If this model is correct, then we can draw the conclusion that W and Z bosons are some kind of mesons.

Figure 3 shows the diagrams of W+ and Z bosons.

Figure 3. The diagrams of W+ and Z bosons

3 Several common particles decay diagram

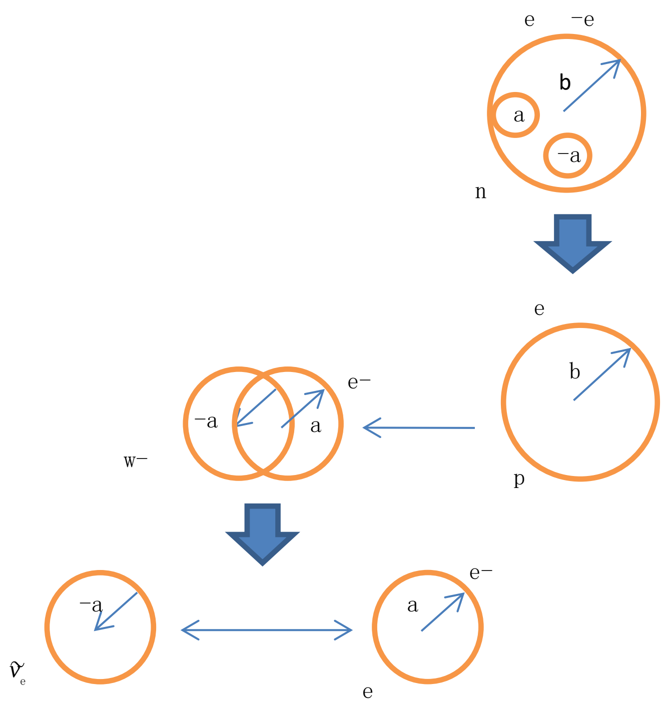

Figure 4. Neutron decay

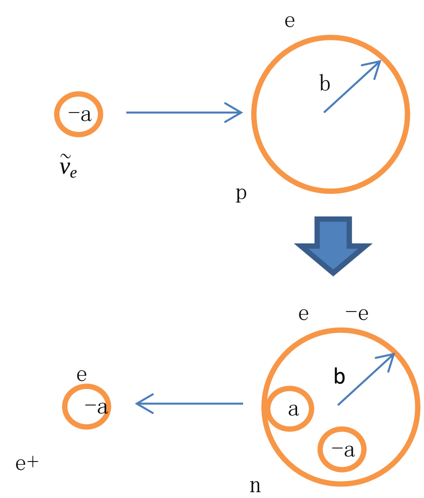

Figure 5. The reaction of antineutrino and proton

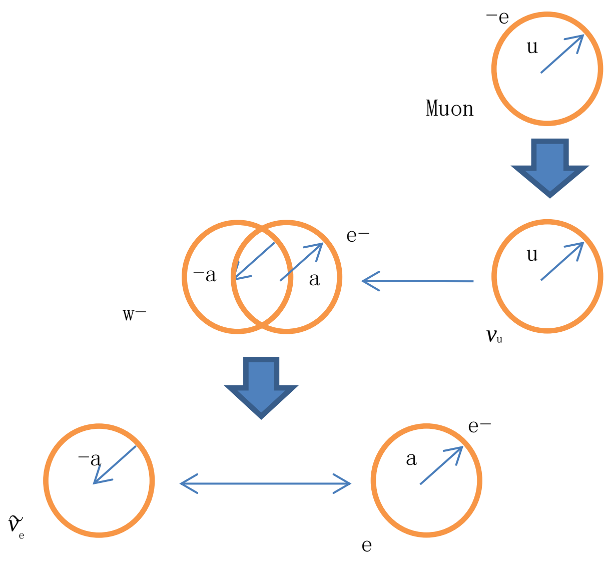

Figure 6. Muon and its decay process

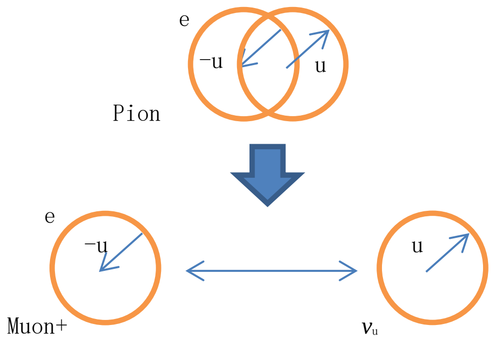

Figure 7. The structure of Pion and its decay

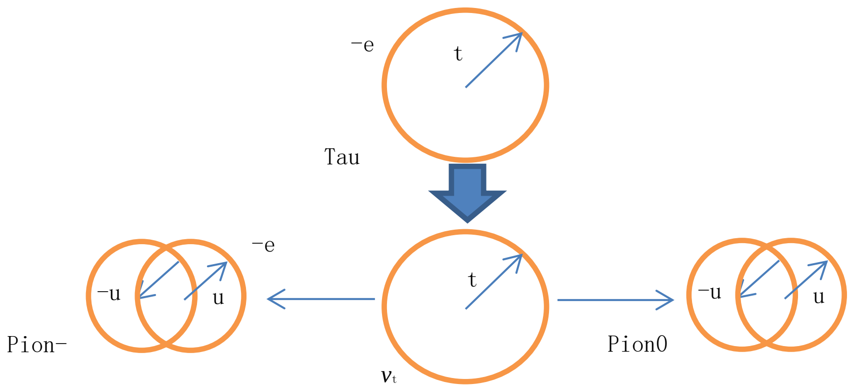

Figure 8. Tau's decay 1

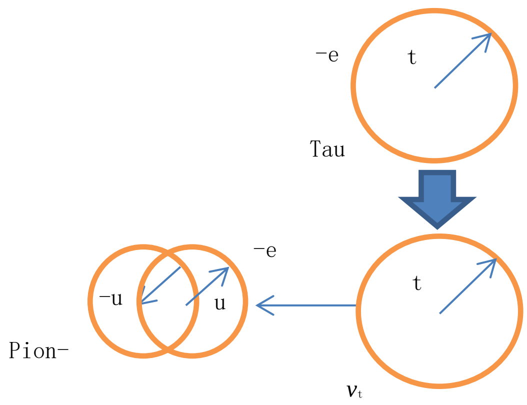

Figure 9. Tau's decay 2

4 Other particles decay diagram

Since the final stable particles are only electrons, protons, neutrinos and photons in all of the particles decay process, so the diagram method provided in this paper can be applied in all of the elementary particles' decay process. It can be also supported by the fact that six quarks and six leptons have the correspondence relationships in standard model.

5 The calculation of other particle

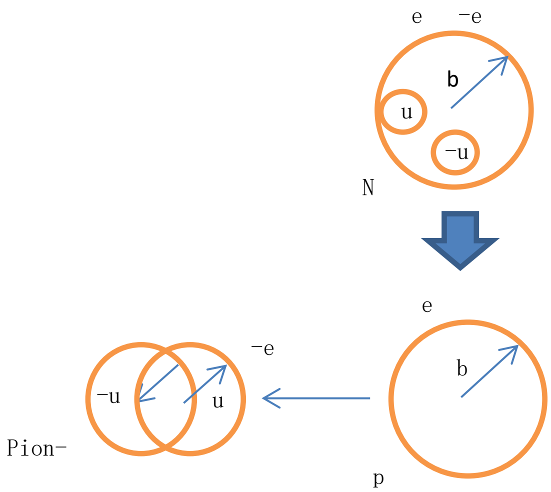

Figure 10. New particle

If the process in figure 8 exists, then we can calculate the new particle's mass according to paper [2].

We can calculate the virtual photon's energy carried by chargeless Muon according to paper [2].

$$h\nu = \frac{\hbar c}{4b} = \frac{m_e c^2}{2\alpha}$$

So the total energy of chargeless Muon is

$$E = \sqrt{m_u{}^2 c^4 + \left(\frac{e^2}{8\pi\varepsilon u}\right)^2 + h^2\nu^2 + h^2\nu^2}$$

Since $m_u{}^2 c^4 + \left(\frac{e^2}{8\pi\varepsilon u}\right)^2 >> h^2\nu^2 + h^2\nu^2$

We have $E_3 \approx \frac{2h^2\nu^2}{2\sqrt{m_u{}^2 c^4 + \left(\frac{e^2}{8\pi\varepsilon u}\right)^2}} = 11.59\mathrm{MeV}$

We can obtain the new particle's mass as

$$m_N c^2 \approx m_p c^2 + m_\mu c^2 + E_1 + E_2 + E_3 \approx 1055.01(MeV)$$

It is close to the particle Λ^0. Since lifetime of muon is shoter, the lifetime of this particle may be also shorter.

6 Proton decay

Since protons are the structure less particles just like electrons in this model, protons will not decay. It is the key difference between this model and standard model.

7 Conclusion

We can understand the particles behaviors intuitionally through the new diagram scheme. In the same time we can also calculate some important parameters of elementary particles by using these diagrams, such as the mass and charge. It also provides a new method to predict new particles. The key difference between this model and standard model is that protons will not decay in any way.

Reference

[1] Faddeev, L. D., & Popov, V. N. (1967). Feynman diagrams for the Yang-Mills field. Physics Letters B, 25(1), 29-30.
[2] Cheng, Z. (2016). A Calculation of Neutron's Mass Based on Virtual Space-Time. http://vixra.org/pdf/1608.0385v2.pdf
[3] Cheng, Z. (2016). On the Relationship Between Proton-Mass and Electron-Mass. http://vixra.org/abs/1606.0010
[4] Cheng, Z. (2016). On the new quark and neutrino model based on virtual space-time. http://vixra.org/pdf/1606.0326v1.pdf

Appendix: Chinese Version

图解粒子的衰变过程及新粒子的预测

程智
（广州市白云区机场路百荣街 9 号. gzchengzhi@hotmail.com）

内容摘要：本文依据基于虚时空的基本粒子模型，提出了一种直观的图解方法来探讨基本粒子的结构及其衰变过程。在此基础上探讨了新粒子存在的可能性。
关键词：基本粒子；图解；中子；衰变

The diagrams of particles decay process and the predictions of new particles

CHENG Zhi
（9 Bairong st. Baiyun District, Guangzhou, China. 510400. gzchengzhi@hotmail.com）

Abstract: I have proposed an intuitive diagrammatic method to explore the elementary particles' structures and decay processes based on virtual space-time. Then I discuss the possibilities of the existing of new particles.
Key words: Elementary particles; diagram; neutron; decay

0 导言

由于基本粒子处于物质结构的最底层，目前还没有可使用的观察工具来观察基本粒子的结构，故一些图解的方法成为了探索基本粒子规律的常用工具。最常见的图解方法就是费曼图[1]。按照我以前建立的基于虚时空的基本粒子模型[2~4]，这里也提出一种新的图解方法，以便我们能够以一种更直观的方式来了解基本粒子的结构。

1 一些约定

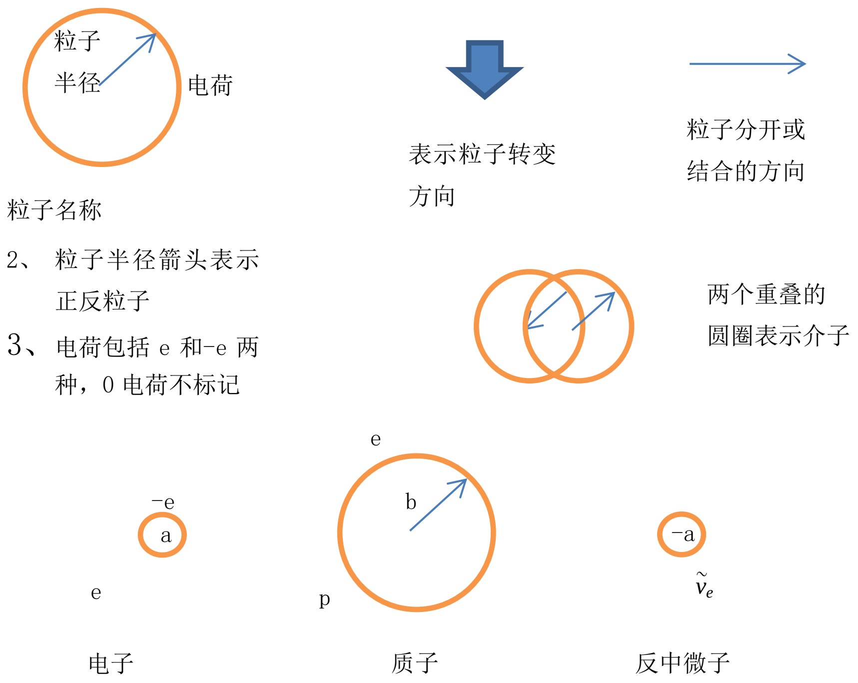

图 1 图解约定

三个轻子的衰变可能有一个顺序，即半径逐步减少，而非跳跃式减少或增加。但高能光子可以直接产生三个轻子的正反粒子对。

2 这是 W 玻色子吗

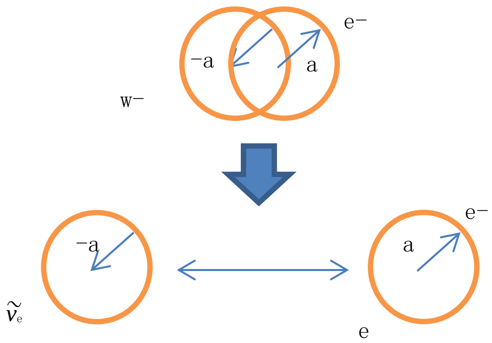

图 2 W 玻色子结构及其衰变

按照上述结构，一个电子和一个反电子中微子构成类似介子的结构，从衰变的产物来看，有点类似 W-玻色子。

可以利用测不准原理估算一下该粒子的质量：

由于两个粒子被局限在半径大约为 a 的范围之内，则可以按照测不准原理计算出虚光子的质量：

$$h\nu = \frac{\hbar c}{4a} = \frac{m_p c^2}{2\alpha} = 64.3\text{GeV}$$

而由于

$$h\nu >> m_e c^2$$

故该粒子的质量大约为 64.3GeV

这一能量范围的粒子主要是 W 和 Z 玻色子。如果该模型正确，那么 W 和 Z 玻色子本质上是一种介子。

图 3 显示的是 W+和 Z 的图解。

图 3 W+和 Z 的图解

3 常见的几种粒子衰变图解

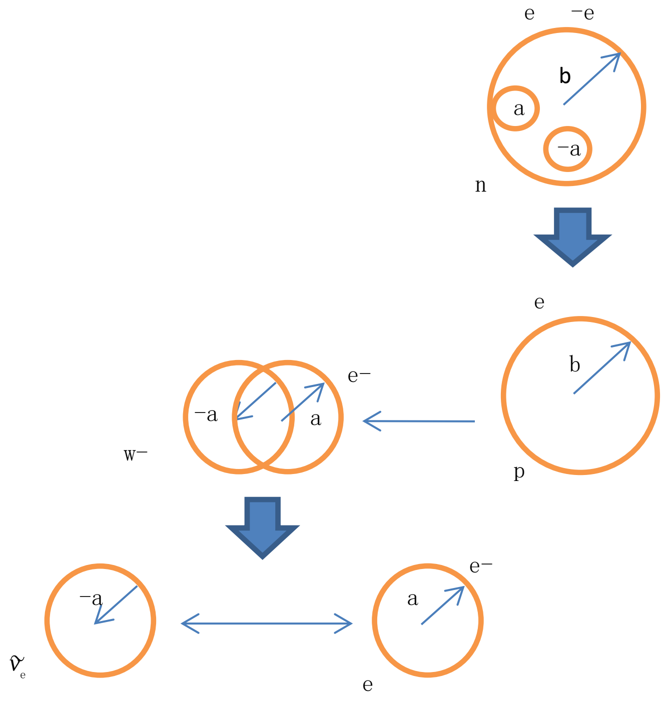

图 4 中子的衰变

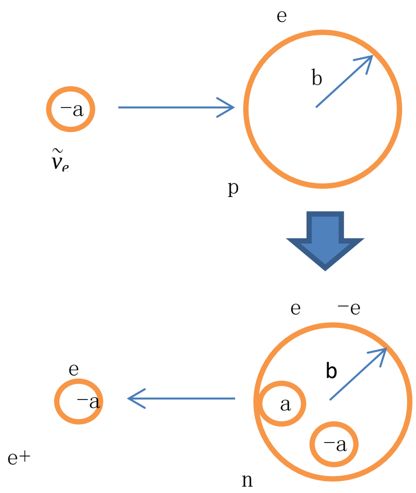

图 5 反中微子与质子的反应

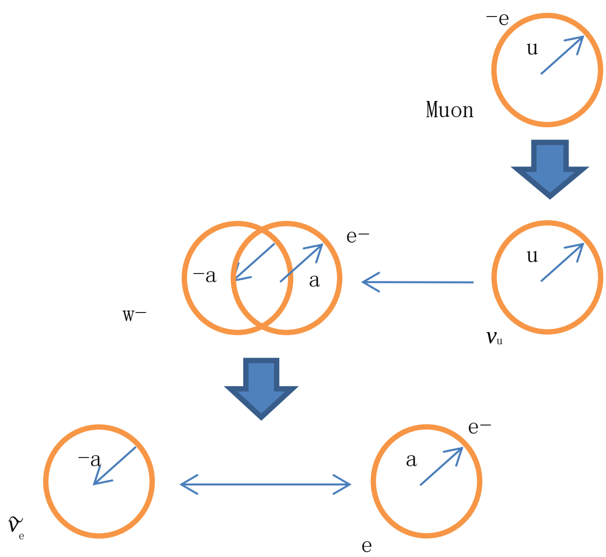

图 6 Muon 模型及其衰变

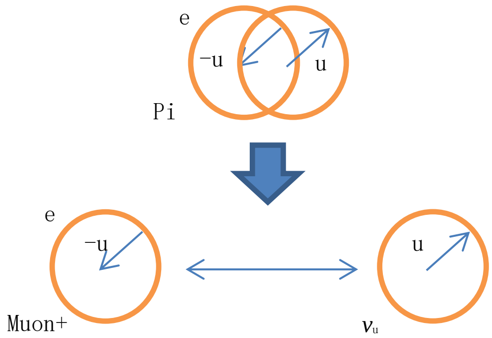

图 7 Pion 结构及其衰变

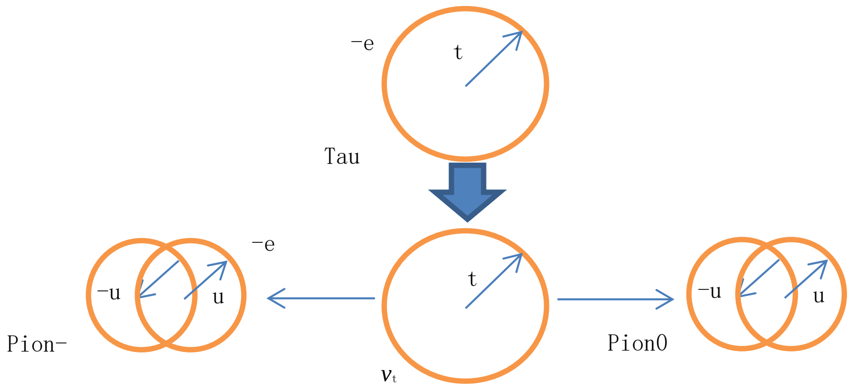

图 8 Tau 衰变 1

从半径 t 无法直接衰变到半径 a，存在一个中间过程。中性 Pion 的形成是与 Tau 粒子中的极高能量有关系的。

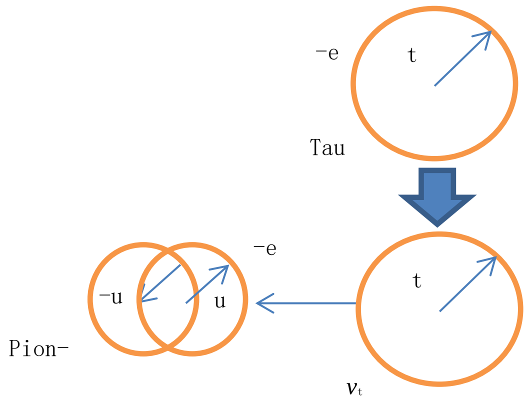

图 9 Tau 衰变 2

4 其他粒子的衰变图解

从已有的实验可知，目前所有的粒子衰变以后的最终稳定粒子只有：电子、质子、中微子和光子等。同时标准模型中的六个夸克与六种轻子存在互相对应的关系，故本文所提供的图解方法将适用于所有粒子的结构和转变过程。

5 其他粒子图解分析实例

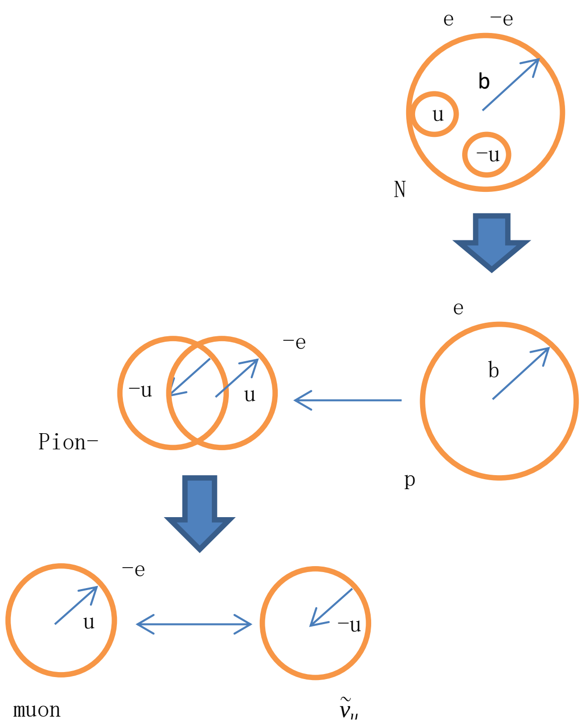

图 10 某粒子

如果存在图 8 所示的过程，则可以计算出该粒子的质量。

按照文献[2]，可以计算出不带电荷 Muon 所携带虚光子能量为：

$$h\nu = \frac{\hbar c}{4b} = \frac{m_u c^2}{2\alpha}$$

其中不带电荷的 muon 的总能量为：

$$E = \sqrt{m_u{}^2 c^4 + \left(\frac{e^2}{8\pi\varepsilon u}\right)^2 + h^2\nu^2 + h^2\nu^2}$$

由于：$m_u{}^2 c^4 + \left(\frac{e^2}{8\pi\varepsilon u}\right)^2 >> h^2\nu^2 + h^2\nu^2$

故：$E_3 \approx \frac{2h^2\nu^2}{2\sqrt{m_u{}^2 c^4 + \left(\frac{e^2}{8\pi\varepsilon u}\right)^2}} = 11.59\text{MeV}$

这样可以计算出该粒子的质量约为：

$$m_N c^2 \approx m_p c^2 + m_\mu c^2 + E_1 + E_2 + E_3 \approx 1055.01(MeV)$$

该粒子质量接近已知粒子 Λ^0，由于 muon 的寿命比较短，故该粒子的寿命也会比较短，且必须小于 muon 的寿命。

6 质子的衰变

如果将质子看作是如同电子一样的最基本的粒子，按照本文提出的模型，则质子是不会发生衰变的。因为不清楚如同质子这样很单纯的结构还能够衰变成哪一种粒子。

7 结论

通过图解的方式，我们能够更直观地理解粒子的结构和转变的过程。同时图解的方式也便于我们计算粒子的各种参数，并为新粒子的预测提供更简单的工具。本模型与标准模型的一个重要差异在于，本模型中的质子是不会产生衰变的。

目前来看本模型还存在一个比较严重的问题，就是计算出来的粒子质量误差比较大。其中原因有待进一步分析。

参考文献

[1] Faddeev, L. D., & Popov, V. N. (1967). Feynman diagrams for the Yang-Mills field. Physics Letters B, 25(1), 29-30.

[2] Cheng, Z. (2016). A Calculation of Neutron's Mass Based on Virtual Space-Time. http://vixra.org/pdf/1608.0385v2.pdf

[3] Cheng, Z. (2016). On the Relationship Between Proton-Mass and Electron-Mass. http://vixra.org/abs/1606.0010
[4] Cheng, Z. (2016). On the new quark and neutrino model based on virtual space-time. http://vixra.org/pdf/1606.0326v1.pdf