Vibration of Yukawa Potential dependent Time

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ABSTRACT

Atom's nucleus force understand by Yukawa potential independent time. We study Yukawa potential dependent about time. We make Klein-Gordon equation is satisfied by Yukawa potential dependent about time.

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Key words: Nucleus vibration;

Yukawa potential;

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1. Introduction

Atom's nucleus force understand by Yukawa potential. We study Yukawa potential dependent about time. We make Klein-Gordon equation is satisfied by Yukawa potential dependent about time.

At first, Yukawa potential V describes nucleus's combine force in semi-classical method.

$$V = -\frac{g^2}{r}\exp(-\frac{m_\pi r c}{\hbar}$$

g is real number, m_π is the meson's mass (1)

Klein-Gordon equation independent time is satisfied by Yukawa potential V.

$$-\partial_i\partial^i V + \frac{m^2c^2}{\hbar^2}V = -\nabla^2 V + \frac{m_\pi^{\,2}c^2}{\hbar^2}V = 0$$

$$V = -\frac{g^2}{r}\exp(-\frac{m_\pi rc}{\hbar}), i = 1,2,3 \quad (2)$$

2. Yukawa potential dependent about time from Klein-Gordon equation

If we focus Klein-Gordon equation make 4-dimential partial differential equation about Yukawa potential ϕ dependent time,

$$\frac{m_\pi^{\,2}c^2}{\hbar^2}\phi + \partial_\mu\partial^\mu\phi = \frac{m_\pi^{\,2}c^2}{\hbar^2}\phi + \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\phi - \nabla^2\phi = 0 \quad (3)$$

In this time, Yukawa potential ϕ dependent time is.

$$\phi = -\frac{g^2}{r}\exp(-\frac{m_\pi rc}{\hbar}) + A_0\sin\omega t, \quad \text{Frequency } \omega = \frac{m_\pi c^2}{\hbar} \quad (4)$$

Absolutely, if we calculate, Eq(3) is satisfied by Eq(4). Because Yukawa potential ϕ is vibrated about the amplitude A_0, we know the nuclear strong force vibrate about time.

3. Conclusion

We found Yukawa potential dependent time. Hence, the nuclear strong force vibrate about time..

References

[1]J.M. Normand, A Lie group: Rotations in Quantum Mechanics(North-Holland Pub. Co., 1980)

[2]J.D. Bjorken & S. D. Drell, Relativistic Quantum Field(McGraw- Hill Co., 1965)

[3]P.Bergman,Introduction to the Theory of Relativity(Dover Pub. Co.,Inc., New York,1976),Chapter V

[4]R.L.Liboff, Quantum Mechanics(Addison-Wesley Publishing Co., Inc.,1990)

[5]A.Beiser, Concept of Modern Physics(McGraw-Hill,Inc.,1991)