Title of the presentation:

Quark confinement in Schwarzchild-like space-time with a metric generated by a non-gravitational Yukawa-like strong field

Authors:

André Aimé Atangana Likéné [1;2] **and Germain Hubert Ben-Bolie**[1y]

Affiliations:

[1]*Laboratory of Atomic, Molecular and Nuclear Physics, Department of Physics, Faculty of Science, University of Yaounde I, P.O. Box 812, Yaounde, Cameroon.*
[2]*The Nuclear Technology Section (NTS), Institute of Geological and Mining Research, P.O. Box 4110, Yaounde, Cameroon.*

Abstract

In this work, we use the approach recently introduced by C. C. Barros to study hadron spectra and some quark confinement properties in a Schwarzchild-like space-time generated by a non-gravitational field. As a starting point, for the non-gravitational field we make the choice of a strong Yukawa-like field whose associated potential is a generalized Yukawa-like potential, typical of strong interactions. Then, from the latter field, the energy momentum tensor is constructed, the Einstein field equations are solved and the curvature function of the Schwarzchild metric is obtained. The correspondence principle applied to the Schwarzchild metric has enable us to construct the Dirac equation in the latter space. The resolution of the coupled differential equations of Dirac made it possible to obtain the energy spectrum of the strong interaction. The latter is obtained in a more general form than in the previous investigations. Then, the energy spectrum, masses and confinement radius of few hadrons are estimated and compared with experimental data and other theoretical studies. In most considered cases, our predictions are found to be in good agreement with experimental data. The good agreement observed between our outcomes and the experiment can be attributed to the choice of our potential, which has more free parameters than in past studies with the same approach.

Keywords: Dirac equation; Schwarzchild metric; space-time; quark; confinement; hadrons; curvature; Yukawa potential.

[1]Corresponding author: aandreaime@yahoo.fr . Phone (Direct):+237-6-9742-7891

[1y]gbenbolie@yahoo.fr

References

1. C. C. Barros Jr., *Eur. Phys. J. C* **42**, 119 (2005).

2. C. C. Barros Jr., *Eur. Phys. J. C* **45**, 421 (2006).

3. C. C. Barros Jr., physics/0609115 (2006).

4. C. C. Barros, *Braz. J. Phys.* **37**, 17 (2007).

5. G. Zweig, CERN Rept. 8182/Th401 (1964).

6. K. A. Olive *et al.* [Particle Data Group Collaboration], Review of Particle Physics, Chin. Phys. C 38, 090001 (2014).

7. **A. Atangana Likéné**, Ali Zarma, D. Nga Ongodo, J.M. Ema'a Ema'a, P. Ele Abiama, G.H. Ben-Bolie: Effect of gravitational field of a topological defect on statistical properties of heavy quark-antiquark systems. **East European Journal of Physics**, Vol.**3**, No.129-141(2022), **EEJP** 2022.

8. **A. Atangana Likéné**, J.M. Ema'a Ema'a, P. Ele Abiama, G.H. Ben-Bolie: Non-relativistic quark model for mass spectra and decay constants of heavy-light mesons using conformable fractional derivative and asymptotic iteration method. **International Journal of Modern Physics A**, Vol.**41**, No.24(2022), **World Scientific** 2022.

9. S. Weinberg, Gravitation and cosmology: principles and applications of the general theory of relativity, (John Wiley andsons, New York, 1972).

10. T. Abdellah, Confinement des quarks et structure de l'espace-temps (2020).

11. A. Le Yaouanc, L. Oliver, O. Pene, and J. C. Raynal, "Spontaneous breaking of chiral symmetry for confning potentials,"*Physical Review D: Particles, Fields, Gravitation and Cosmology*, vol. **29**, no. 6, pp. 1233–1257, 1984.