Neutrinos via Charm Decays in Astrophysical Sources

by

Fritz Ali Agildere

fritz.agildere@udo.edu

Abstract

Abbreviations

Contents

1 Introduction

first zeroth test.[1–3]

second zeroth test.[1,2]

third zeroth test[1,3]

test.[4]

first test [1–3]

second test [1, 2]

third test [1, 3]

[5]

[4]

[6]

$(2.998 \pm 0.001) \times 10^{10}\,\mathrm{cm\,s^{-1}}$

$\pm \times + - \cdot 6.626 \times 10^{-27}\,\mathrm{erg\,s}$

$4.803 \times 10^{-10}\,\mathrm{esu}$

$10^{14}\,\mathrm{G}$

1.4×10^{0} 1.4×10^{0}

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6} \tag{1}$$

$\sqrt{1-\beta^2}$

$\alpha\beta\gamma\delta\eta\zeta\xi\chi\varphi\phi\vartheta\theta\mu\nu\rho$

2 Background

2.1 Particle Physics

After centuries of progress, modern physics can be broadly subdivided into two irreconcilable notions of reality. One conceptualizes the universe as continuous and smooth, the other postulates nature to be fundamentally quantized. The first view has largely been supplanted by the latter, culminating in the *Standard Model* (SM) of particle physics.

General Relativity (GR) describes gravitational effects as the mass induced curvature of a continuous manifold called spacetime. This combines

The field of modern physics as

Over the past century, there has been tremendous success in the realm of physical theories, gradually constructing the

The interaction and classification of elementary particles is generally described by the *Standard Model* (SM) of particle physics. Included in this view are three of the four known fundamental forces, namely electromagnetism as well as the weak and strong interactions. Each of these sectors is characterized mathematically in the context of *Quantum Field Theory* (QFT), which combines aspects from classical field theory, special relativity and quantum mechanics to deliver some of the most precise predictions available today. Further gauge theoretical considerations as well as the symmetries encoded in the unitary $\mathrm{U}(1) \times \mathrm{SU}(2) \times \mathrm{SU}(3)$ group give rise to a self consistent model of physics on microscopic scales.

Despite its impressive predictive power, there are some important observations which this approach has so far been incapable of explaining. Perhaps most importantly, gravitational interactions as the fourth fundamental force are not incorporated at all. Due to the historical successes in quantizing classical theories, it is widely believed that some form of quantum gravity is the most likely candidate for explaining the emergence of macroscopic phenomena as described by *General Relativity* (GR), another extremely accurate model of the universe at large. However, in the energy regimes where such a hypothetical graviton is expected to become relevant, the formulation of the SM breaks down.

Hadrons

Leptons

2.2 Multimessenger Astronomy

2.3 Astrophysical Sources

Magnetars

Active Galactic Nuclei

3 Results

4 Conclusion & Outlook

Acknowledgements

Appendix

Bibliography

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