\*\*Gravitational Entanglement Eigenvalues and Vectors\*\*

\*\*Document Version:\*\* 1.4

\*\*Last Updated:\*\* October 30, 2023

\*\*1. Introduction\*\*

This specification document details the mathematical foundations of gravitational entanglement eigenvalues and vectors, building upon the theoretical framework introduced in "Specification Document: The Elenes Effect - Quantum Quark-Fluctuation Gravity." The primary focus is to establish the mathematical formalism for understanding how different types of particle entanglement influence the eigenvalue of the gravitational field and how Principal Component Analysis (PCA) can derive these eigenvalues. This document also includes a sample matrix calculation.

\*\*2. Mathematical Formalism\*\*

\*\*2.1. Gravitational Eigenvalues (λ)\*\*

The gravitational eigenvalues represent the strength of the gravitational field generated by the entanglement of different types of particles. The eigenvalue of the gravitational field is defined as follows:

\[ \lambda = - \frac{G}{c^2} \cdot \frac{m\_1 m\_2}{r^2} \]

Where:

- \( \lambda \) is the gravitational eigenvalue.

- \( G \) is the gravitational constant.

- \( c \) is the speed of light.

- \( m\_1 \) and \( m\_2 \) are the masses of the entangled particles.

- \( r \) is the distance between the entangled particles.

\*\*2.2. Gravitational Eigenvectors (v)\*\*

The gravitational eigenvectors represent the direction and magnitude of the gravitational force exerted on an object due to the entanglement of particles. The eigenvector is determined by the configuration and properties of the entangled particles.

The eigenvector is a unit vector that points in the direction of the gravitational force. It can be expressed as:

\[ \mathbf{v} = \frac{\mathbf{r}}{|\mathbf{r}|} \]

Where:

- \( \mathbf{v} \) is the gravitational eigenvector.

- \( \mathbf{r} \) is the vector representing the distance and direction between the object and the entangled particles.

The magnitude of the gravitational force (\( F \)) acting on the object can be calculated as:

\[ F = \frac{\lambda}{|\mathbf{r}|^2} \cdot m\_{\text{object}} \cdot m\_{1} \]

Where:

- \( F \) is the gravitational force.

- \( \lambda \) is the gravitational eigenvalue.

- \( |\mathbf{r}| \) is the distance between the object and the entangled particles.

- \( m\_{\text{object}} \) is the mass of the object.

- \( m\_1 \) is the mass of one of the entangled particles.

\*\*3. Principal Component Analysis (PCA) for Deriving Eigenvalues\*\*

Principal Component Analysis (PCA) is a mathematical technique used to derive the eigenvalues of a given system, in this case, the system of gravitational entanglement. PCA can be applied to calculate the eigenvalues from a matrix of data.

\*\*3.1. Sample Calculation: Matrix of Eigenvectors and Eigenvalues\*\*

Let's consider a scenario where we have different types of entangled particles, each with a unique entanglement configuration:

- Quarks (q), entangled pairs: 1000

- Electrons (e), entangled pairs: 500

- Photons (γ), entangled pairs: 200

We want to calculate the gravitational eigenvectors and eigenvalues for each type of entangled particle.

\*\*3.2. Gravitational Eigenvalues\*\*

Using the provided formula for gravitational eigenvalues, we can calculate them for each type of particle:

- For quarks (q):

\[ \lambda\_q = - \frac{G}{c^2} \cdot \frac{m\_q^2}{r^2} \]

- For electrons (e):

\[ \lambda\_e = - \frac{G}{c^2} \cdot \frac{m\_e^2}{r^2} \]

- For photons (γ):

\[ \lambda\_γ = - \frac{G}{c^2} \cdot \frac{m\_γ^2}{r^2} \]

Where \( m\_q \), \( m\_e \), and \( m\_γ \) are the masses of quarks, electrons, and photons, respectively, and \( r \) is the distance between the entangled particles.

\*\*3.3. PCA Calculation\*\*

Principal Component Analysis (PCA) can be applied to a matrix of data representing the entanglement configuration and properties of different particle types. The PCA calculations yield the eigenvalues corresponding to each particle type's entanglement configuration.

\*\*3.4. Sample Matrix Calculation\*\*

Let's create a sample matrix representing the entanglement configuration and properties:

\[

\begin{matrix}

& \text{Quarks (q)} & \text{Electrons (e)} & \text{Photons (γ)} \\

\text{Number of Entangled Pairs} & 1000 & 500 & 200 \\

\text{Mass (kg)} & 0.001 & 0.0002 & 0 \\

\text{Distance (m)} & 1 & 2 & 3 \\

\end{matrix}

\]

Using PCA, we can derive the eigenvalues corresponding to each particle type's entanglement configuration. PCA involves diagonalizing the covariance matrix of the data, and the resulting eigenvalues represent the strengths of gravitational entanglement for each particle type.

\*\*4. Explanation of Hawking Radiation\*\*

The presence of Hawking radiation in black holes can be explained by the variation in gravitational entanglement between different types of particles. In scenarios where the entanglement of particles is not the same for all particle types, such as electrons and positrons having weaker entanglement than quarks, we observe distinct gravitational effects.

Hawking radiation, as predicted by Stephen Hawking, arises from the quantum fluctuations near the event horizon of a black hole. These fluctuations involve particle-antiparticle pairs, such as electron-positron pairs. In regions of intense gravitational fields, particle entanglement plays a significant role. Due to the weaker entanglement of electrons and positrons compared to quarks, these particle-antiparticle pairs can become separated, with one escaping while the other falls into the black hole.

The separation of these pairs leads to the emission of radiation, often in the form of photons, which carry energy away from the black hole. This process is a result of the unique entanglement properties of electrons and positrons, as well as their interaction with the strong gravitational field near the black hole's event horizon.

\*\*5. Ordering of Gravitational Eigenvalues\*\*

The final gravitational eigenvalues, ordered from highest to lowest, correspond to the particles with the highest total mass per particle having the highest eigenvalues, with the smallest particles having the least gravitational influence. In this arrangement, quarks dominate the gravitational eigenvalue, followed by electrons and photons. The vector of gravitational eigenvalues reflects the gravitational strength of entangled particles based on their total mass per particle, with quarks being the most influential.

\*\*6. Conclusion\*\*

This document provides an overview of the mathematical foundations of gravitational entanglement eigenvalues and vectors, along with the explanation of Haw