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Phonology Based Qubit State Representation: Insights from Sanskrit Grammar

Santosh Ramesh Jadhav.

HOD, Prototyping, Advandes Pvt Ltd, Pune, Maharashtra State, Bharat.

ABSTRACT

Classical computers operate on binary states—zeros and ones. In contrast, quantum computing leverages the quantum bit (qubit), which, due to the wave-like nature of subatomic particles, can exist in a superposition of multiple states at once. Upon measurement, this superposition collapses into a definitive state of either 0 or 1. (1) Based on this, the study introduces a conceptual measurement model involving two observers positioned along the positive and negative z-axes of a qubit. This results in four possible outcomes: (0,0), (0,1), (1,0), and (1,1). Although both observers measure the qubit at different coordinates and times under identical conditions, the probability amplitude is ultimately calculated by considering a single observer, accounting for the measurement aspects of the other.

Traditionally, qubit manipulation is achieved through quantum gates. Both Sanskrit and quantum physics share an intrinsic connection to the concept of waves. This research hypothesizes that Sanskrit phonology provides a novel framework for representing qubits —four possible outcomes—states and associated probability amplitudes on a sphere with help of mathematical representation, inspired by the structured arrangement of Sanskrit alphabets. Drawing from the Aṣṭādhyāyī—an ancient Sanskrit grammar text containing approximately 3,995 algorithmically organized Sutras or rules—the study assigns the first three outcomes to primary Sanskrit vowels, incorporating their use in Sanskrit words. Corresponding probability amplitudes for these states are represented by the Greek letters alpha (α), iota (ι), and upsilon (υ), to represent the qubit state on a sphere. For the state (1,1), an interpretation is proposed using principles from Sanskrit grammar and the coherent properties of electromagnetic waves, offering an alternative method for calculating probability amplitudes.

This paper offers a unique intersection of ancient Indian linguistic logic and modern computational techniques, which may be useful in specific quantum computational tasks.

Keywords: Sanskrit, Aṣṭādhyāyī, Phonology based Quantum Gates, Wave Function, Quantum Computing

Introduction

- **Background on Quantum Computing**

Quantum computing represents a paradigm shift from classical computing, which operates on binary bits of 0s and 1s. Quantum bits, or qubits, can exist in multiple states simultaneously due to the principle of superposition, allowing for the representation and processing of more complex information. Quantum gates manipulate these qubits, enabling operations that classical computers cannot efficiently perform. In quantum mechanics, the state of a particle is described by a wave function, assigning a complex number, known as the probability amplitude, to each possible measurement outcome. These amplitudes determine the likelihood of a qubit collapsing to either 0 or 1 upon measurement. (1)

- **Trigonometry in the Bloch Sphere**

In trigonometry, the cosine values at 90 degrees and 270 degrees equal 0. This suggests that, in the context of the Bloch sphere representation, when a qubit transitions from the state $|0\rangle$ or $|1\rangle$ to a polar angle θ of 90 degrees, the magnitudes of the probability amplitudes α and β alone may not be sufficient to fully describe the state. The magnitude of the "great circle" on the unit-radius Bloch sphere should also be taken into account. While α and β remain complex numbers with magnitudes corresponding to probabilities, the great circle provides an additional layer of information about the qubit's position on the sphere, beyond just linear distances.

- **Connecting Sanskrit Phonology to Quantum States**

Both Sanskrit and quantum physics share an intrinsic connection to the concept of waves, making this intersection particularly intriguing. This study explores the potential of using Sanskrit phonology as a framework for representing quantum states. The primary vowels **'अ' (a), 'इ' (i), and 'उ' (u)** possess phonological properties that correspond to indicating **non or absence, lower, and higher states**. In this context, these vowels are mapped to the concepts of the **great circle, the south pole, and the north pole** of the qubit on a unit-radius sphere, respectively. This approach aims to leverage the unique phonological features of these vowels to effectively map and manipulate qubit states based on Sanskrit grammar rules, offering a novel perspective on quantum state representation.

Current approach to represent qubit

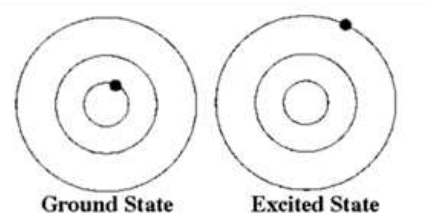

Figure 1: Ground state and Excited state of Electron

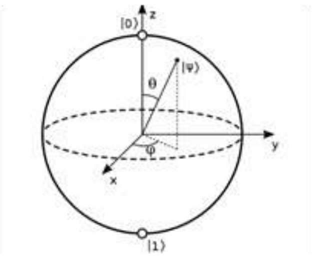

Figure 2: Bloch Sphere

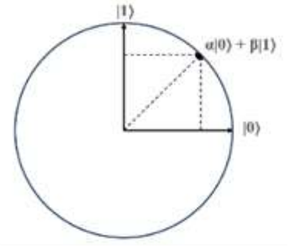

Figure 3: Qubit visualisation on the Complex plane

- Figure 1 shows the ground and excited states of an electron. In general, an electron is a quantum system that may exist in a linear superposition of the ground and excited states. It is in the ground state (0) with probability amplitude α and in the excited state (1) with probability amplitude β.
- As shown in Figure 2, in the Bloch sphere representation, the surface of a sphere with a unit radius corresponds to the set of all possible states of a qubit. The two angles, denoted as the polar angle θ and the azimuth angle φ, are used to parameterize the qubit's state on the sphere. (1)
- Generally, qubit states are expressed as $\alpha + i\beta = 1$, with α and β as probability amplitudes satisfying $|\alpha|^2 + |\beta|^2 = 1$. As shown in Figure 3, on the complex plane with a unit radius, the real part (α) aligns with the x-axis, and the imaginary part (β) aligns with the y-axis, perpendicular to each other. (1)

Key Feature In the Collaborative measurement setup

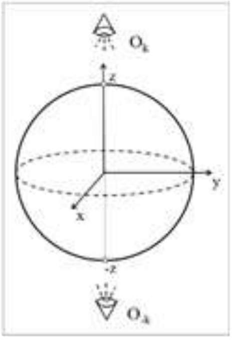

Figure 4: Observer and measurement coordinates

- **Observers**
  - Qubits can exist in multiple states simultaneously due to superposition, but upon measurement, they collapse to either 0 or 1. Building on this, two observers, O_k and O_{-k}, could be taken into account for the measurements.
- **3-diamensional Coordinates**
  - In the Bloch sphere representation, the polar angle θ get measured from positive z-axis of qubit, based on this Observer O_k, positioned along the positive z-axis, measures the qubit's state at coordinates (0, 0, 1), while observer O_{-k}, positioned along the negative z-axis, measures the qubit's state at coordinates (0, 0, -1) to capture probabilistic nature of qubits.
- **Measurement:**
  - In the context of collaborative measurement regarding the occupation of the qubit's state in the upper and lower halves, these measurements done by two observers, O_k and O_{-k}, can be arranged in a row format.
  - In this row representation, the first entry is the measurement taken by observer O_k at coordinates (0, 0, 1), and the second entry is the measurement taken by observer O_{-k} at coordinates (0, 0, -1) of the qubit.
- **Probabilities: (0,0), (0,1), (1,0) and (1,1)**

- With two measurement coordinates and two possible states qubit can collapse, 0⟩ and |1⟩, four different probabilities can occur and can be represented in a row format: (0,0), (0,1), (1,0), and (1,1).

This methodology supports representing characteristics of Sanskrit primary vowels inspired by the *Aṣṭādhyāyī* and also lays the foundation for determining probability amplitude using the three complex numbers in trigonometric function, to place the qubit in a certain state.

Śiva·sūtra: Arrangement of sound waves in the Sanskrit Phonology

Shiva sutra or Maheshwar Sutra, is a series of fourteen aphorisms arranged in a specific order by Maharshi Panini for understanding suffixes in Sanskrit grammar.

1. अइउण् a i u ṇ
2. ऋऌक् r̥ l̥ k
3. एओङ् e o ṅ
4. ऐऔच् ai au c
5. हयवरट् ha ya va ra ṭ
6. लण् la ṇ
7. ञमङणनम् ña ma ṅa ṇa na m
8. झभञ् jha bha ñ
9. घढधष् gha ḍha dha ṣ
10. जबगडदश् ja ba ga ḍa da ś
11. खफछठथचटतव् kha pha cha ṭha tha ca ṭa ta v
12. कपय् ka pa y
13. शषसर् śa ṣa sa r
14. हल् ha l

The last pure consonant letter of each aphorism serves as an indicator (इत् it) and is used solely to denote the end of the sūtra, not as part of the alphabet list. Maharshi Panini suggested a method for selecting alphabets from these groups to form representative words. By choosing an alphabet from any group and then selecting the last (indicatory) alphabet, either from the same group or another group in ascending order, a word consisting of only two alphabets is produced. These words represent groups that include all the alphabets appearing in that series. For example, 'अण्' (a ṇ) represents the group अ, इ, and उ (a, i, and u), while 'अक्' (a k) represents the group अ, इ, उ, ऋ, and ऌ (a, i, u, r̥, and l̥). Each group signifies the initial entity or parts of the suffix. (2)

By describing words in this manner, he was able to interpret and specify the rules for particular sets of alphabets to generate words with specific meanings or uses, accounting for variations in form and function. While many groups could be formed, Maharshi Panini recommended only a select few that adhere to the mathematical laws of grammar. In this system, the alphabets from Sutras 5 to 14 are presented with the inherent "a" sound (excluding 'इत्' or *it,* the indicatory alphabet). However, when applying grammatical rules, only the pure consonants—h, y, v, r, l, ñ, etc.—should be used, rather than their extended forms like ha, ya, va, ra, la, ña, etc.

Metaphor: Sanskrit Vowels as Representation of Qubit States

- **'अ' (a)**
  - **Pronunciation and Duration:**

'अ' (a) is the first and foundational vowel in Sanskrit, pronounced with a single unit of time.

- **Sanskrit Grammar and Symbolism:**

The vowel 'अ' (a) in Sanskrit and many Indian languages can serve as a prefix to convey negation or absence, similar to how 'dis-' or 'un-' functions in English. When added at the start of a word, 'अ' often changes the meaning to imply "not" or "without." However, it typically negates or reverses the meaning of the base word rather than indicating "lessness" in a general sense.

- **Metaphorical Representation:** In the context of qubit states, 'अ' (a) symbolizes the absence of occupation in either the lower or upper hemisphere of the Bloch sphere. It suggests a state of '**absence**' during measurement at the both observer's direction.

- **'इ' (i)**
- **Pronunciation and Duration:**

'इ' (i) is the second primary vowel in the Sanskrit language, pronounced with a single unit of time.

  - **Sanskrit Grammar and Symbolism:**

The term 'इत्' (it) signifies termination or disappearance, suggesting **a state that is transient or subtle**.

According to Aṣṭādhyāyī (Chapter 1, Section 2, Sutra 30), a vowel articulated using the **lower part** of the vocal tract is termed 'अनुदात्त' (anudātta), **indicating a low pitch or subdued effort**. (2) (3)

  - **Metaphorical Representation:** Given its qualities, 'इ' (i) symbolizes the lower state of a qubit, metaphorically occupying a position in the lower hemisphere of the Bloch sphere during measurement. This suggests a qubit state associated with lower energy or a "**downward**" tendency, analogous to a subdued or low-effort phonation.

- **'उ' (u)**
  - **Pronunciation and Duration:**

'उ' (u) is the third primary vowel in Sanskrit, also pronounced with a single unit of time.

  - **Sanskrit Grammar and Symbolism:**

The prefix 'उत्' (ut) conveys meanings such as **elevation, energy, and enthusiasm**.

As described in the Aṣṭādhyāyī (Chapter 1, Section 2, Sutra 29), a vowel articulated using the upper part of the vocal tract is termed 'उदात्त' (udātta), **implying a high pitch or elevated effort.** (2) (3)

  - **Metaphorical Representation:** 'उ' (u) represents the higher state of a qubit, metaphorically occupying a position in the upper hemisphere of the Bloch sphere during measurement. This corresponds to a qubit state with higher energy or an "**upward**" tendency, similar to the elevated effort required for the phonation of 'उ' (u).

- **Summary:** These Sanskrit vowels — 'अ' (a), 'इ' (i), and 'उ' (u)— are used as metaphors to conceptualize the states of a qubit. The lower vowel 'इ' (i) represents the lower-energy state, the higher vowel 'उ' (u) represents the higher-energy state, and the neutral vowel 'अ' (a) symbolizes a state of indeterminacy or non-presence during measurement at the observer's direction.

The Signature Work of Maharshi Panini

The **Aṣṭādhyāyī**, authored by Maharshi Pāṇini in the 6th century BCE, is a comprehensive grammar text of Sanskrit known for its systematic and algorithmic approach.

Aphorisms numbers 5 and 6, **हयवरट्** (ha ya va ra ṭ) and **लण्** (la ṇ), are prime examples of Maharshi Pāṇini's seminal work. This arrangement demonstrates how changing the sequence of combinations of vowels and their wavelengths, while maintaining the pronunciation duration of the generated semivowels as short (equal to **one measure** or matra), can help understand the relationship between the generated semivowels— **य्, व्, र्,** and **ल्** (y, v, r, and l)—and the vowels **'अ'** (a), **'इ'** (i), **'उ'** (u), **'ऋ'** (ṛ), and **'ऌ'** (ḷ).

- **इको यणचि (Ikō yaṇaci, Ashtadhyayi / chapter 6/ section 1/ sutra 77)**

Maharshi Pāṇini expresses a grammatical rule regarding compound words and their uncombined forms. The rule is expressed as इकः यण् अचि (ikaḥ + yaṇ + aci).

  - In this rule, इकः (ikaḥ) is in the genitive case, indicating 'that which is to be replaced.'
  - अचि (aci) is in the locative case, indicating the item to be replaced.
  - यण् (yaṇ) is in the nominative case, indicating the replacement.

What Maharshi Pāṇini is suggesting that when forming a compound word, if the vowels 'इ, उ, ऋ, and ऌ' (i, u, ṛ, and ḷ) are followed by dissimilar vowels 'अ, इ, उ, ऋ, ऌ, ए, ओ, ऐ, and औ' (a, i, u, ṛ, ḷ, e, o, ai, and au), they should be replaced by the corresponding consonants 'य्, व्, र्, and ल्' (y, v, r, and l) respectively based on matra or measure.

If we rearrange the alphabet of first, second, fifth and sixth sutras from the Shiva sutra, which are going to replace and with which alphabets, the rearrangement of will appear like given below relatively:

अ (a)	इ(i)	उ(u)	ऋ(ṛ)	ऌ (ḷ)
ह (ha)	य (ya)	व (va)	र (ra)	ल (la)

- **' ह् ' (h)**
  - **Pronunciation and Duration:** ह् (h) is a short-length pronunciation consonant.

Even though the alphabet ह (ha) should appears as the first semivowel in the fifth sutra (हयवरट्, ha ya va ra ṭ) based on the alphabetical order and arrangement in the Shiva Sutras, it is not considered when forming the 'Pratyaya' (suffix) according to Sanskrit grammar; instead, it is regarded as the last alphabet in the Shiva Sutras and as a consonant.

- **Interpretation:**

An affirmative sentence is any sentence that expresses a positive statement. In Marathi and Hindi, languages that originated from Sanskrit, the sound 'ह्' (ha) is a building block of a concept that signifies and represents affirmativeness (होकारार्थी, Hōkārārthī). It is possible that the characteristics of 'ह' (ha) are related to the vowel 'अ' (a) through a reduction in the pronunciation duration or wavelength of 'अ' (a) by half, aligning it with a one-unit duration by pronouncing 'अ' (a) twice.

Although 'ह' (ha) does not sound exactly like the repetition of two 'अ' (a) sounds within a single unit duration, the pattern of alphabets in the Shiva Sutras suggests a mathematical alignment. This alignment may imply that when we multiply a negative by a negative, we obtain a positive, as the two negative signs cancel each other out. In this context, the vowel 'अ' (a), which represents 'non' or 'absence', when multiplied by 'अ' (a) again, can be expressed as 'ह्' (ha), '**affirmativeness**', or '**prevalent**'.

Intersection of Conventional and Sanskrit Phonology based Methodology

In exploring Sanskrit phonology-based quantum computing, the logic for representing qubit states should align with the ancient linguistic logic found in Sanskrit and also be consistent with modern quantum physics. As discussed in the previous section, the proposed measurement setup allows for not just two possible outcomes—$|0\rangle$ or $|1\rangle$—but for four possible outcomes: (0,0), (0,1), (1,0), and (1,1).

- **Hybrid Methodology: State (0,1) and (1,0)**
  - **State (0,1)**: This state occurs when observer O_k measures the qubit in state 0 while observer O_{-k} measures it in state 1. It is associated with the concept of '**downward**' in collaborative measurement.
  - **State (1,0)**: This state occurs when observer O_k measures the qubit in state 1 while observer O_{-k} measures it in state 0. It represents the concept of '**upward**' in collaborative measurement.

Drawing from the representative meanings of Sanskrit alphabets in the Aṣṭādhyāyī aphorisms, the vowels '**इ**' (i) and '**उ**' (u)—which signify '**downward**' and '**upward**,' respectively—have been selected to represent the states (0,1) and (1,0) in these collaborative measurements. The associated probability amplitudes for placing a qubit in these states can be symbolized by integrating the Greek letters iota (ι) and upsilon (υ) as $\mathbf{A}_\iota$ for the downward state and $\mathbf{A}_\upsilon$ for the upward state, respectively.

- **State (0,0)**

A hybrid methodology posits that the Sanskrit vowel 'अ' (a), which signifies '**absence**,' and the concept of a '**great circle**,' which is **not considered part of either half of the sphere**, represent similar aspects that can be applied in phonology-based quantum computing. According to this methodology, when a qubit transitions from state $|0\rangle$ to state $|1\rangle$, it traverses through the phase of a 'great circle' within a trigonometric function before reaching state $|1\rangle$, or vice versa. This 'great circle' factor should be considered when calculating the complex numbers that position the qubit in the desired linear combination of the pure states $|0\rangle$ and $|1\rangle$ during the manipulation of the qubit's state.

  - **State (0,0):** In the phonology-based interpretation of qubit states, state (0,0) occurs when observer O_k measures the qubit in state 0, and observer O_{-k} also measures it in state 0. This state is associated with the concept of 'absence' in collaborative measurements.

Drawing from the representative meaning of Sanskrit alphabets in the **Aṣṭādhyāyī** aphorisms, the vowel '**अ**' (a)—which signifies '**absence**'—has been chosen to represent state (0,0) in this context. The probability amplitude associated with placing a qubit in this state can be symbolized by the Greek letter alpha (α), denoted as $\mathbf{A}_\alpha$

- **Interpretation of State (1,1)**

As discussed earlier, considering the characteristics of 'ह्' (h), it can be associated with the vowel 'अ' (a) by reducing its pronunciation duration or wavelength by half. In the context of electromagnetic waves, since frequency and amplitude are directly proportional to energy, and the probability of obtaining a particular measurement outcome is proportional to the square of the corresponding amplitude, the proportional amplitude for placing a qubit in the state (1,1) can be calculated by multiplying the amplitude $\mathbf{A\alpha}$, which represents the characteristics of the vowel 'अ' (a) or the state (0,0), by a **factor of √2**. Additionally, the alphabets present in the thirteenth and fourteenth aphorisms are considered *ushma varna* (sounds that produce heat during the act of pronunciation).

State (1,1): The consonant '**ह्**' (a)—which signifies '**affirmativeness**' or '**prevalent**' —has been chosen to represent state (1,1) in this context. The probability amplitude associated with placing a qubit in this state can be symbolized by the English letter 'h', denoted as $\mathbf{A}_\mathbf{h}$

Involving Complex Numbers With The Probability Amplitude

In classical computing, probability vectors are the vectors whose entries are non-negative real numbers that sum to one, with each entry representing a probability. In quantum computing, probability amplitudes, denoted by α and β, are complex numbers whose squared magnitudes correspond to the probabilities of different outcomes. Typically, the probability amplitude α is associated with the qubit being in the state $|0\rangle$, often aligned with the positive z-axis in the Bloch sphere representation, while β corresponds to the qubit being in the state $|1\rangle$, aligned with the negative z-axis. The probability of observing each state is given by $|\alpha|^2$ and $|\beta|^2$, respectively, and they satisfy the normalization condition $|\alpha|^2 + |\beta|^2 = 1$.

However, in a methodology inspired by Sanskrit phonology, states are interpreted differently. Here, presenting the concept of collaborative measurement, in which the state of a qubit can be represented based on the probabilities can occur because of the measurement setup and mathematical representation.

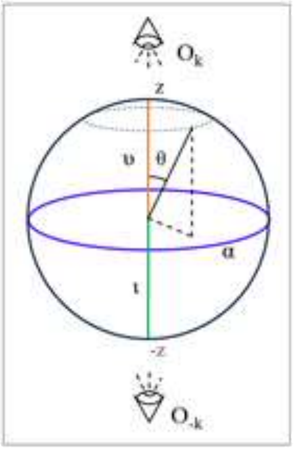

Figure 5: Complex numbers involve in probability Amplitude

- **Figure 5**
  - **Overview:**

In Figure 5, observer, O_k is aligned with the positive and negative z-axes of a unit-radius sphere, representing a qubit. The sphere is divided into two equal halves—upper and lower—by a blue **great circle** or latitude line labelled ***α***, which has a unit distance magnitude.

  - **Key Elements:**

Two lines, each with a unit distance magnitude and colored saffron and green, are labelled υ and ι, respectively. These lines are aligned with the positive and negative z-axes. The latitude line labelled α is orthogonal to the lines υ and ι.

  - **Polar Angle θ:**

A line is drawn from the center to the surface of the sphere with a magnitude of 1, defining a dotted black latitude line. The angle that defines this black latitude line, measured from the positive z-axis, is labelled as the polar angle θ. This angle can be used to parameterize the probabilistic collapse of the qubit.

  - **Probability Amplitudes Representation:**

The latitude line α represents a complex number and component of a probability amplitude, associated with positioning the qubit's state towards the great circle. In contrast, the lines υ and ι represent two complex numbers that position the qubit's state towards the observers O_k or O_{-k}, during measurements.

- **Normalizing Condition**
  - **Upper Hemisphere:** $|\sin\theta \cdot \alpha|^2 + |\cos\theta \cdot \upsilon|^2 = 1$
    - **Lower Hemisphere:** $|\sin(180° - \theta) \cdot \alpha|^2 + |\cos(180° - \theta) \cdot \iota|^2 = 1$
- **Probability Amplitude**

In quantum mechanics, the concept of a particle being in two places at the same time cannot be directly observed; only a measurement can determine its state. (1) Building on the unique characteristics of primary vowels, the proposed measurement setup, trigonometry, and the concept of a great circle, it is possible to interpret complex numbers as probability amplitudes derived from components of three distinct complex numbers. This interpretation can determine the state into which a qubit will collapse, considering both observers associated with either the upper or lower hemisphere of the qubit. This relationship can be visually represented using a unit-radius sphere, where the qubit's state, indicated by the polar angle θ, is measured from the positive z-axis.

For a qubit with two possible states—0 or 1—there are four joint probabilities that can occur, given two measurement coordinates, (0, 0, 1) and (0, 0, -1. By considering the states (0,0), (0,1), and (1,0) as basic states, these can be associated with the primary vowels 'अ' (a), 'इ' (i), and 'उ' (u) in the context of the polar angle, θ, measured from the positive z-axis. The probability amplitudes for the probabilistic collapse of the qubit can be calculated using a collaborative measurement methodology with three complex numbers—α, ι, and υ—according to the following equation:

$$P(A) = \sqrt{\frac{|\sin\theta\,\cdot\,\alpha|^2 \;+\; |\cos\theta\,\cdot\,\upsilon|^2}{2} + \frac{|\sin(180^\circ \,-\, \theta)\,\cdot\,\alpha|^2 \;+\; |\cos(180^\circ \,-\, \theta)\,\cdot\,\iota|^2}{2}}$$

Here:

- ***P(A)*** represents the probability amplitude of a given outcome.
- **θ** is the polar angle measured from the positive z-axis.
- ***α*, ι, and υ** are complex numbers corresponding to different probability amplitudes influenced by the measurement methodology for qubit states measurements.
- The equation considers contributions from both the upper hemisphere (first term) and the lower hemisphere (second term) of the qubit's representation on a unit-radius sphere.

This formula provides a way to calculate the probability amplitude of a qubit collapsing into a particular state as a function of the polar angle and the associated complex numbers. A further simplification yields:

$$P(A) = \sqrt{\frac{(\cos\theta)^2 \cdot |\upsilon^2 + \iota^2| + 2(sin\theta)^2 \cdot |\alpha|^2}{2}}$$

This simplified equation shows the contributions from the cosine and sine terms associated with the respective complex numbers, providing a more compact representation of the probability amplitude for a given outcome.

Expected measurements, based on alphabets are used for such suggestive words in the Aṣṭādhyāyī.

- **अ (a): (0,0): Amplitude A_α**

When amplitude α, a complex number which proportionally equals $\sqrt{\frac{2|\alpha|^2}{2}}$ or simply α, is considered during measurement:

- Measured by observer O_k at coordinates (0, 0, 1): 0
- Measured by observer O_{-k} at coordinates (0, 0, -1): 0

Result: (0, 0). This state represents ‘**absence**’ in the collaborative measurement results.

- **इ (i): (0,1): Amplitude A_ι**

When amplitude Aι, a complex number which proportionally equals $\sqrt{\frac{|-\upsilon^2-\iota^2|}{2}}$, is considered during measurement:

- Measured by observer O_k at coordinates (0, 0, 1): 0 **(pure state |0⟩, in the context of single observer O_k)**
- Measured by observer O_{-}k at coordinates (0, 0, -1): 1

Result: (0, 1). This state represents ‘**downward**’ in the collaborative measurement results.

- **उ (u): (1,0): Amplitude A_υ**

When amplitude A_υ, a complex number which proportionally equals to $\sqrt{\frac{|\upsilon^2+\iota^2|}{2}}$, is considered during measurement:

Measured by observer O_k at coordinates (0, 0, 1): 1 **(pure state |1⟩, in the context of single observer O_k)**

Measured by O_{-k} at coordinates (0, 0, -1): 0

Result: (1, 0). This state represents ‘**upward**’ in the collaborative measurement results.

- **ह् (h): (1,1): Amplitude A_h**

When amplitude A_h, a complex number which proportionally equals to $\sqrt{2 \cdot \alpha^2}$, can take in account during the measurement,

Measured by observer O_k at coordinates (0, 0, 1): 1

Measured by O_{-k} at coordinates (0, 0, -1): 1

Result: (1, 1). This state represents '**affirmativeness**' or ‘**prevalent**’ in the collaborative measurement results.

Further Scope

In computing, scientific correctness is not determined solely by how a phenomenon is represented mathematically through logic. The future scope of this research lies in exploring connections across different disciplines and drawing insights from these relationships.

- **Qubit State Representation: Insights from Phonology**

The concept of *dhātus* in Sanskrit spans multiple disciplines—elements in physics, the seven fundamental tissues in biology, and verb roots in grammar, which are divided into ten *gaṇas* (sections) and further classified by tense (past, present, and future), action, command, and possibility—all using the same alphabetic framework. Analogous to how Sanskrit words are formed through multiple transformations by combining *dhātus* via grammatical rules, the hypothesis suggests that, with further study, quantum wave functions could be manipulated in a similar way. The transformations a word undergoes before reaching its final form can be correlated with the probabilities associated with the collapse of a qubit within the context of a corresponding wave function, using linguistic logic.

References

1. Lala, Parag K. Quantum Computing A Beginner's introduction. 2020. Chennai : McGraw Hill, 2019. ISBN 93-90385-26-1.

2. Jha, Dr. Naresh. Ashtaadhyayi of Maharshi Panini. Varanasi : Chaukhamba Surbharati Prakashan, 2022.

3. Joshi, Vishwanath. Ayurveda Pathyakrame Sanskritadhyayanam. Delhi : Chaukhamba Sanskrit Pratishthan, 2022. ISBN: 978-81-7084-610-9.

4. Griffiths, David J. and Schroeter, Darrel F. Introduction to Quantum Mechanics. third edition. New Delhi : Cambridge University Press, 2018. ISBN 978-1-108-79110-6.