Quaternionically-Enhanced Symbolic Non-Local Communication

Sebastian Schepis

Abstract

We extend the symbolic prime-resonance framework for non-local communication by incorporating quaternionic representations of split primes. By embedding Gaussian and Eisenstein prime factorizations into quaternionic form, we introduce twist-based precession, enhanced Bloch dynamics, and multi-dimensional resonance encoding. This new formalism unifies symbolic collapse, entropy-regulated projection, and quaternionic entanglement into a robust, geometrically grounded non-local communication system.

1 Overview

This framework extends prior work on prime-resonant symbolic communication[1] by embedding prime-based information into quaternionic form. A split prime $p \equiv 1 \mod 12$ provides both a Gaussian factor $\alpha = a + bi$ and Eisenstein factor $\beta = c + d\omega$. These can be rewritten:

$$\omega = -\tfrac{1}{2} + i\tfrac{\sqrt{3}}{2}, \quad \beta = c' + d'i$$

and embedded into a quaternion:

$$q_p = (a+bi) + j(c'+d'i) = a + bi + jc' + dk, \text{ where } k = j \cdot i$$

This quaternion becomes the carrier of symbolic structure and physical alignment.

2 Quaternionic Resonance Fields

Each prime's quaternion defines a symbolic Bloch vector:

$$\vec{n}_p = \frac{1}{\|q_p\|}(b, c', d') \in \mathbb{R}^3$$

The quaternionic resonance field is then:

$$\Psi_q(x,t) = N^{-1/2} q_p(x) \cdot \exp(i\Phi_q(x,t))$$

Symbolic transmission is enacted by quaternionic operator evolution:

$$U_p(t) = \exp(-iH_q t), \quad H_q = x\sigma_x + y\sigma_y + z\sigma_z$$

where $(x, y, z) = (b, c', d')$.

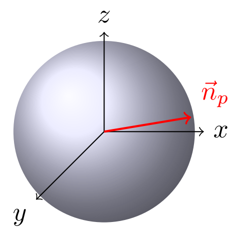
[1]See *UnifiedNonLocal.pdf*

3 Twist and Collapse Dynamics

The Eisenstein irrational $\frac{\sqrt{3}}{2}$ appears in the k component, creating precession:

$$\theta_p = \arctan\left(\frac{\mathrm{Im}(\beta)}{\mathrm{Re}(\alpha)}\right), \quad \text{Collapse occurs when } S(\Psi) < 0.3 \text{ and } \theta_p \in$$

This twist is stored symbolically in the j/k dimensions and projected during communication.



Quaternionic twist projects to Bloch vector

Figure 1: Symbolic collapse from quaternion to measurable axis

4 Quaternionic Projection Operator

We define the symbolic projection as:

$$\hat{C}_q : \mathbb{H}_p \to \mathbb{R}^2, \quad \hat{C}_q(q_p) = H_p = \begin{pmatrix} 1 & b \\ b & -1 \end{pmatrix}$$

with eigenvalues $\pm\sqrt{p}$. This reflects physical collapse into a measurable symbolic state.

5 Entangled Quaternionic Transmission

Entangled communication states are constructed as:

$$Q_{p,q} = q_p \otimes q_q, \quad \text{with joint evolution } U(t) = \exp(-iH_{pq}t)$$

The composite Hamiltonian includes twist interactions:

$$H_{pq} = H_q^{(p)} \otimes I + I \otimes H_q^{(q)} + \gamma_{pq}(\sigma_z \otimes \sigma_z)$$

where γ_{pq} encodes symbolic alignment and resonance.

6 Non-Local Synchronization via Quaternionic Phase

Synchronization is measured by:

$$\Delta\phi_q = \arg(q_p^* q_q), \quad \text{Phase locking occurs if } \Delta\phi_q \in [0, \epsilon]$$

Precession twist stabilizes symbolic collapse against low-prime noise and enables quaternionic coherence.

7 Conclusion

This quaternionic extension strengthens the non-local symbolic communication paradigm by embedding number-theoretic resonance into geometric structures. Quaternionic operators preserve both symbolic meaning and precessional dynamics, making the system more robust, multidimensional, and tunable through twist-based collapse. Future work will implement entangled tensor networks of quaternionic primes and develop hardware-aligned quaternionic logic gates.