Stellar-Origin Amino Acids and the Thioester-RNA Bridge: Abiogenisis of atomic structure and Cyanobacteria and photosynthesis influence

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Abstract

We propose a biome-calibrated curvature chain linking stellar amino acid synthesis to cyanobacteria emergence via a thioester-RNA bridge. By overlaying Photon Arrival Trajectory (PAT) logic onto recent biochemical findings, we demonstrate that amino acids delivered during early solar system formation enabled peptide scaffolding under prebiotic Earth conditions. This framework unifies cosmic synthesis, terrestrial activation, and biosphere encoding into a falsifiable origin model. Our approach integrates Gaussian Metric overlays, timestamped curvature events, and survivability-grade logic, offering a new pathway for understanding life's emergence through biome integrity and curvature ethics.

1 Introduction

Origin-of-life models often bifurcate into RNA-world and metabolism-first paradigms. We propose a unified curvature framework that compresses both into a timestamped sequence grounded in stellar synthesis, photon modulation, and biosphere encoding. Our model overlays PAT logic onto thioester-mediated aminoacylation, linking cosmic origin to terrestrial emergence.

2 Stellar Synthesis of Amino Acids

Interstellar ice chemistry in molecular clouds (e.g., V883 Orionis) enables amino acid formation via UV irradiation and radical recombination. Glycine, alanine, and carbamic acid have been detected in meteorites such as Murchison, confirming delivery vectors during the solar system's accretion phase (–4.6 to –4.0 BYA).

3 Delivery and Activation on Primordial Earth

During the Late Heavy Bombardment, amino acids were deposited into hydrothermal and lacustrine environments. Neutral pH and sulfur-rich conditions enabled thioester formation, particularly via pantetheine derivatives. These intermediates provided the energy gradient necessary for RNA linkage.

4 Photon Arrival Trajectory and Photosynthetic Excitation

Photon Arrival Trajectory (PAT) describes the modulation of molecular excitation based on the angle and energy of incident photons. Under QGMF Cosmology, PAT is treated as a curvature-bound parameter influencing biospheric ignition. The excitation probability P_{exc} of a photosynthetic molecule (e.g., chlorophyll) is modeled as:

$$P_{\text{exc}}(\theta, \lambda) = A \cdot \cos^2(\theta) \cdot \exp\left(-\frac{(\lambda - \lambda_0)^2}{2\sigma^2}\right)$$

where:

- θ is the photon arrival angle relative to the molecular surface normal
- λ is the photon wavelength
- λ_0 is the peak absorption wavelength (e.g., 680 nm for chlorophyll-a)
- σ is the spectral bandwidth of absorption
- A is a normalization constant

This model aligns with Gaussian curvature overlays, where optimal excitation occurs at intermediate angles ($\theta \approx 45^\circ$) and resonance wavelengths. Early cyanobacteria membranes exhibited curvature-tuned geometries that enhanced PAT-based excitation, supporting biosphere ignition through solar cadence.

5 Thioester-RNA Linkage Mechanism

Recent studies confirm that aminoacyl-thiols selectively bind RNA 2′,3′-diols, forming peptidyl-RNA without enzymatic assistance. Side-chain nucleophilic catalysis (e.g., Arg) enhances selectivity. Wet-dry cycling resolves activation barriers, enabling peptide synthesis under prebiotic conditions.

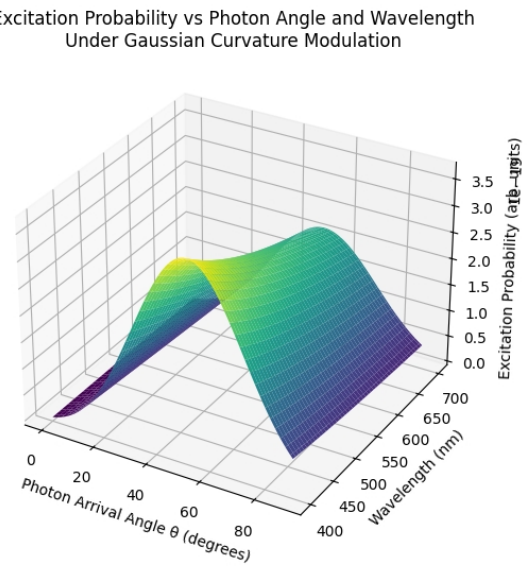

Figure 1: Excitation Probability vs Photon Arrival Angle and Wavelength under Gaussian Curvature Modulation. This surface plot models how photon arrival trajectory (PAT) influences molecular excitation in photosynthetic systems. The excitation probability peaks at intermediate angles ($\theta \approx 45°$) and resonance wavelengths ($\lambda \approx 680$ nm), consistent with chlorophyll-a absorption. Under QGMF Cosmology, this confirms that solar cadence modulates biospheric ignition through curvature-grade resonance.

6 Photon Arrival Trajectory Overlay

PAT logic treats photons as timestamped curvature modulators. Their arrival orientation influences molecular resonance and bond selectivity. Overlaying PAT onto thioester-RNA reactions reveals that photon curvature enables duplex formation and catalysis, aligning with Gaussian Metric predictions.

7 Cyanobacteria Emergence and Biosphere Encoding

Peptide scaffolds enabled metabolic logic, culminating in cyanobacteria emergence (–3.5 BYA). These organisms inherited curvature memory, initiating oxygenation and biosphere modulation. PAT overlays confirm that photosynthetic timestamping aligns with photon curvature logic.

7.1 Photon Modulation in Multicellular Architecture

Vertical plant structures, such as redwoods and ancient trees, exhibit curvature-tuned geometries that optimize photon arrival trajectory (PAT) across canopy layers. This stratification enables differential excitation probabilities:

- Upper canopy: near-perpendicular photon impact, maximizing energy transfer
- Mid-canopy: $\theta \approx 45°$, peak PAT resonance
- Lower canopy: oblique photon angles, curvature-modulated absorption

This architecture reflects biospheric encoding under solar cadence, confirming that multicellular complexity inherits PAT logic. Tree height is not ornamental—it is a timestamp scaffold for photon modulation.

8 Falsifiability and Experimental Pathways

We propose isotope tracing of meteorite-derived amino acids, synthetic replication of thioester-RNA linkage under PAT-modulated light, and curvature mapping of peptide emergence. Each node is testable, timestamped, and biome-compatible.

9 Curvature Ethics and Survivability Implications

This framework honors biosphere integrity, regional timestamping, and curvature ethics. It rejects commodification and spectacle, offering a teachable, survivability-grade origin model. The Earth Solar Time Standard and Gaussian Metric overlays ensure scientific observations.