

Register Projection Operators

How Strand 1 (spatial) and Strand 2 (temporal) project from the Tau field to observable physics

The Tau field is a product of two strands — Strand 1 (the spatial wave, carrying energy and form) and Strand 2 (the temporal address wave, carrying identity and time). Measurable physics arises when the Tau field is projected onto one or both strands. Universal Force of Time defines two projection operators Π_1 and Π_2 that extract spatial and temporal information from any Tau-field state.

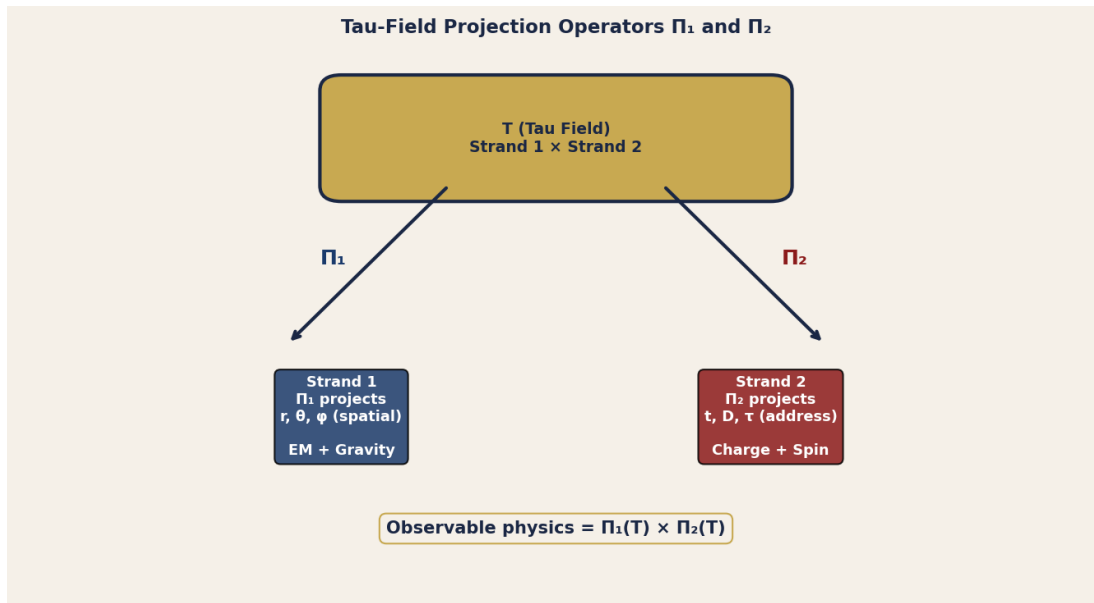


Figure 1. Projection operators Π_1 and Π_2 extract Strand 1 (spatial, blue) and Strand 2 (temporal, red) components from the unified Tau field. Observable physics is their product.

1. Strand 1 — Spatial Projection

P-PROJ-1 — Π_1 : Spatial Projection from the Tau Field

The Strand 1 projection operator Π_1 maps the Tau field onto the three spatial coordinates (r, θ, ϕ). Applying Π_1 to a Tau-register state returns the register's spatial wavefunction — the measurable density distribution of the physical object at that register level. Electromagnetism and gravitation are both Π_1 projections at different D-levels.

$$\Pi_1(T) = \Psi_{\text{spatial}}(r, \theta, \phi)$$

Π_1 at $D=+3$ (nuclear) \rightarrow nuclear potential

Π_1 at $D=-6$ (planetary) \rightarrow gravitational field

P-PROJ-2 — Π_1 Eigenvalues are Physical Constants

The eigenvalues of Π_1 are the coupling constants of the fundamental forces. At each D-level, Π_1 produces a different effective coupling — which is why electromagnetism and gravity appear to be different forces: they are the same operator at different D-levels.

$$\Pi_1(D=-1) = e^2/\hbar \text{ (fine structure coupling } \alpha = 1/137.077\dots)$$

$$\Pi_1(D=+3) = \alpha_s \text{ (strong coupling } \sim 1)$$

$$\Pi_1(D=-6) = G \text{ (Newton gravitational coupling } \sim 10^{-38} \text{ in natural units)}$$

2. Strand 2 — Temporal Projection

P-PROJ-3 — Π_2 : Temporal Address Projection

The Strand 2 projection operator Π_2 maps the Tau field onto the temporal coordinate and the register D-level address. Π_2 of a register state returns its Tau-address: the unique (D, τ) pair that identifies exactly where and when this object exists in the Tau field.

$$\Pi_2(T) = \Psi_{\text{address}}(D, \tau)$$

Π_2 eigenvalues: electric charge Q, spin s, baryon number B, lepton number L

P-PROJ-4 — Quantum Numbers as Strand-2 Projections

All conserved quantum numbers are eigenvalues of Π_2 . This explains why quantum numbers are conserved: Strand-2 addresses are permanent lattice labels — they cannot be created or destroyed, only transferred between register nodes. Charge conservation = Π_2 eigenvalue conservation. CPT theorem = Π_2 symmetry under the three inversions of charge, parity, and time.