Realization of quasi-quanta via the forced contraction of loops

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October 13, 2023

Abstract

The contraction of a loop on a string in the orthogonal time direction is contemplated. Its relationship to a certain mathematical concept, forcing notions, is examined. In addition, we evaluate local systems on the worldline of a particle traveling in the positive timelike direction.

1 Contracting loops

Definition 1 *A slice, s, of a manifold M, is a stationary frame $\mathfrak{F}$ whose subobjects are potentials of a gauge field.*

Let $\mathfrak{S}$ be a collection of slices of a manifold $\mathbb{R}^n$, n even, and let there be a path $\rho : inf(\mathfrak{S}) \longrightarrow sup(\mathfrak{S})$. The product, $\rho \cdot \mathfrak{S} = \{p, g\}$, defines an equivalence class of diffeotopic smooth manifolds spanning a lightcone $\mathbb{L}$ of events.

For every segment of the vector $\vec{\rho}$, define a *portable loop*, p_ℓ.

Definition 2 *A portable loop is a neighborhood about a fixed point p_i along the path spanned by $\vec{\rho}$, such that $p_\ell^{-1} \circ p_\ell$ is the identity on p_i.*

Suppose the region enclosed by some p_ℓ contains non-trivial topological (i.e., physical) data, such as a particle. Then, we say that the loop is not contractible to the point $\hat{q}$. We impose the following:

Axiom 1 *For all non-contractible portable loops, there exists either (or both) of the following:*

- *A forcing notion, $\Vdash$, such that $\hat{q} \Vdash p_\ell^{contr}$*
- *A frame $\mathfrak{F}^+$ such that $p_\ell^{contr} \in \mathfrak{F}^+$*

These essentially (although not equivalently) amount to designating a map $t^+ : p_\ell \longrightarrow \{*\}$; in other words, the successor function is applied to the dimension of time (in the second case), which *forces* the suspension of a quasi-quantum $\hat{q}$, thus transforming the non-trivial space it (virtually) occupies into a generic free variable.

Let us imagine that p_ℓ has the following properties, where $\mathcal{U}$ stands for the neighborhood it encloses:

1. Pressure increases over time as $p_\ell \longrightarrow \{*\}$
2. Temperature increases within $\mathcal{U}$ as it shrinks
3. The average number of molecules in $\mathcal{U}$ decreases as p_ℓ contracts

Then,

Theorem 1 *Boltzmann's constant, k_B, remains constant as $p_\ell \longrightarrow \{*\}$.*

Proof We have

$$k_B = \frac{PV}{TN}$$

Assuming the decrease in the number of molecules in $\mathcal{U}$ is proportional to the increase in temperature, the differences cancel out; assuming that pressure increases as the volume of $\mathcal{U}$ decreases cancels out the terms in the numerator. Thus, k_B is constant under the map $p_\ell \longrightarrow \{*\}$.

1.1 Realization

In this paper, we envision that there is a certain *semiotic* propensity of quasi-quanta (virtual particles) to become actualized (topologically realized) as a result of the satisfaction of Axiom 1. Thus, the promotion of a wavefunction to a particle can be interpreted either as a class-theoretic (mathematical) operad, or as physical kinematics occuring across time in $\mathbb{L}$. The equation:

$$\mathbb{I} \times_h \hat{q}_{pot} \longrightarrow q = \mathfrak{F}^+ = \hat{q} \Vdash p_l^{contr}$$

relates the two paradigms to the production of a particle from an operator h mediating between an interval $\mathbb{I}$ and the potential energy of a quasi-quanta. We can think of this as a sort of *crossed module*, $\mathfrak{m}$, acting on the group $\mathfrak{g}_\mathfrak{p}$ of generators for the Lie group of the particle's neighborhood along a worldline. We remark here that the world-line, $\mathfrak{W}$, is a special case of the path ρ defined above, which has been restricted to timelike distinct sections of $\mathbb{L}$.

Motion along $\mathfrak{W}$ obeys the following Leibniz rule:

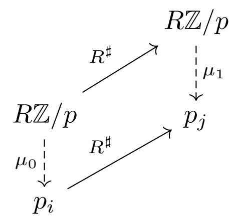
$$(\mathfrak{m}i + \mathfrak{m}j)k = \mathfrak{m}ik + \mathfrak{m}jk = \partial\omega^{-1}\mathfrak{m}ijk$$

where ω is a differential form of dimension equal to a particular Lagrangian submanifold of M. Thus, the function

$$f(\mathfrak{m}) = \mathfrak{u} \xrightarrow{\theta} \mathfrak{u}' \subset_\aleph \mathfrak{g}_\mathfrak{p}$$

is transitive for all smooth paths which non-trivially intersect covers of neighborhoods over $p_i \in M$. Clasically, $f(\mathfrak{m})$ defines a formally flat function acting on trivial transport fibers. In our case, each segment $T_x(p_i)$ tangent to the moment of a particle yields a foliation along a boundary $\partial\mathcal{U}$ which projects to a singularity $\mathfrak{b} \in \mathbb{L}$, where a measurement either does or does not occur.

We may choose to enrich each copy of $\partial\mathcal{U}$ with a connected ring of polynomials modulo a certain prime, p, giving us $R\mathbb{Z}/p$. Correspondingly, transport of the particle p_i is described as a *tilting*, $R^\sharp$ which forms an $\aleph$-cell about a wave packet.



In the above parallelogram, p_i, p_j are distinct particles which share the same wavefunction $\Psi(p,t)$, and μ_0, μ_1 are measurements, which are, respectively, projection onto the first and final coordinates of a local system. Directedness of the arrow $p_i \longrightarrow p_j$ denotes the irreversibility of time due to the second law of thermodynamics.

Definition 3 *A local system, $LocSys(h)$, is a closed, portable monoid equipped with a counting operad on lines.*

Local systems naturally come with a bundle, Bun_G, which induces a simplicial stratification over a Hausdorff convex neighborhood of a manifold M. A local-system is G-equivariant with respect to reordering (shuffling) of place values, and is uniquely determined (up to isomorphism) by a collection of paths $\vec{P}G$ out of any given point p. Thus, the identity of a local system is given by:

$$LocSys_{Id} = \int_0^{2\pi} \frac{\partial p_i}{di} \Omega G'$$

where $\Omega G'$ is space of loops of any other Lie Group. This is essentially the Yoneda lemma for Markov blankets.

Let π_η be a map of fibers over $LocSys(M)$. We denote by $Spec_\eta$ the spectral sequence:

$$\Pi : U(1) \longrightarrow \eta_{ij} \to \eta_{jk} \to \eta_{ki} \longrightarrow U(1)$$

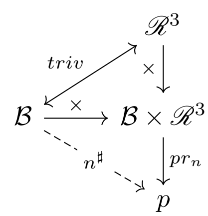
which is smooth. Denote the composition $\Pi \overset{n}{\circ} \Pi$ by $Nec_n(\Pi)$. One has that the canonical 2-morphisms, $\overset{b}{a} : (a,b) \rightrightarrows (c,d)$ are stable under the stack $\mathscr{X}_{Top}$, and the isofibrations $[\overset{b}{a}]$ are arbitrarily productive. This means that we can take the quotient $Nec_n(\Pi)/q$ and obtain a Hermitian Koszul complex, $\mathscr{K}_{osz}$, which preserves holonomy. Write

$$\mathscr{K}_{osz} = (LocSys(i) \times LocSys(j)) \xrightarrow{can} \Pi_{\tilde{\omega}}$$

Definition 4 *A Koszul complex is a global system whose interior consists of the disjoint union of the symmetric product of n local systems.*

All neighborhoods $\mathcal{U}$, and smooth covers $\{\mathcal{U}_i\}_{i \in I}$ essentially arise as rank two restrictions of Koszul complexes. That is to say, that for each stalk f of $\mathscr{K}_{osz}$, there exists an infinitesimal thickening on the points of f (call them $\tilde{f}_i$), which are thin homotopies of rank two of one another, such that $\pi_2^2(\dot{f} \in f)$ yields a conformal pullback to a site θ at which the functions $f(f)$ converge asymptotically.

Remark 1 *For a flat bundle, $\mathcal{B} \in \mathscr{R}^3$, the collection of tangent spaces over each point $x \in \mathcal{B}$ contains a space whose projection onto the nth coordinate, $x \xrightarrow{n} \mathscr{R}^3$, converges to a point $p \in \mathcal{B} \times \mathscr{R}^3$.*



The necklace, $Nec_p(\mathcal{B})$ gives the set of all maximal chains

$$\Delta \times p^{-1} \longrightarrow max|\mathcal{B}|$$

2 Creation and Transformation

Prior to the assignment of meaning to a symbol (or better yet, a symbol to a meaning), the “meaning” to be specified remains in a superposition of possible states, which we denote by $\heartsuit$. The so-called “creation map” defined below, is an exit path

$$\mathcal{EP}_\heartsuit : (x = \{\}) \longrightarrow x$$

out of the empty set, into a proposition x.

Definition 5 *The creation map, Cr shall be written*

$$Cr : \heartsuit \longrightarrow \{p\}$$

where $p \sim \{*\}$ for some zero-dimensional manifold.

Definition 6 *The transform map, T, is given by*

$$(x \to y) \leftrightarrow \exists x \vee y \to \exists y$$

where y is the top of a frame.

Remark 2 *The existential quantifier used here is classical (strong). T thus represents a map $\exists^{\bullet} \longrightarrow \exists(\sim)$. The sequence*

$$\heartsuit \xrightarrow{Cr} x \xrightarrow{T} y \xrightarrow{(Cr \circ T)^{-1}} \tilde{\heartsuit}$$

is equivalent to $f^!(x,y) \circ f_!(x)$. Further, the identity on a fixed object, x, is $Cr = T^{-1}$.

Let X and Y be subsets of Z. Then, let $x \in X$ and $y \in Y$. We have $x \in^X Z$ and $y \in^Y Z$ defining a filtered inclusion relationship, such that the superscript $\in^{\bullet}$ entails $\exists \bullet \in \sim$, where $\sim$ is the least upper bound on all $\bullet, \bullet'$.

Each creation map corresponds to an actual measurement, μ_x over the object x, and a transformation map represents a first order differential taken over μ_x.

$$T = \mu_y - \mu_x = d\mu_x$$

.

2.1 Sampling Populations of Measures

Let there be a large number of measurements taken across a sample $\mathfrak{s}$ of transform maps. We shall write

$$\frac{\Sigma(d\mu_x)}{card(\mu)} = \varphi(\mu)$$

to mean the average of the differences between each set of correlated pairs of points, x and y.

Proposition 1 *Let $t^+ : [0,1] \longrightarrow [0,1]$ be the time-step functor. We have $\underset{t^+}{lim}\, T = \underset{\mu \to \infty}{\varphi(\mu)}$.*

Proof Our argument is proved by writing:

$$\underset{\mu \to \infty}{\varphi(\mu)} = \underset{\mu \to \infty}{lim} \frac{\Sigma(d\mu_x)}{card(\mu)} = T_\infty$$

due to the fact that t^+ is essentially the functor $\mu \to \mu + 1$. As a result, the average transformation asymptotically approximates the universal average taken over an infinite population. *Q.E.D.*

2.2 Generalized transforms and their actualization

We were motivated to form a *process-based* definition of an object. In this pursuit, we have established the following:

Definition 7 *A transformation, $T(x)$, is a map $x \to ?$ such that $T^{-1}(x)$ is the identity on x.*

One may be dismayed that this definition lacks a clear-cut physical interpretation. So, let us renew this definition, this time taking into account the wavefunction on a particle x:

$$T(x) = (\Psi(x) \longrightarrow ||x||) \vee (||x|| \longrightarrow ||y||)$$

.

Call the left-hand side of the disjunction the *actualization*. This is *one type of* creation map, but it is also implicated in the transformation process. The right hand side represents the ordinary transformation of observable eigenstates. Over a small period of time-evolution, quasi-quanta may enter or exit a given eigenstate, as parameterized by a given truth value τ. The evolution of time, $\tau \rightarrow \tau + 1$, is a form of monodromy in the F-theory description, where τ is the modulus of elliptic fibers of some locus Y. This can (and has) been used to model dynamics on intersecting seven-branes. We refer the reader to [1] for more information.

3 References

[1] C. Cordova, *Decoupling gravity in F-theory*, (2011)