Realization of quasi-quanta via the forced contraction of loops

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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 $\mathcal{F}$ whose subobjects are potentials of a gauge field.

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

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

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 $p_{\ell}$ 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, $\models$, such that $\hat{q} \models p_{\ell}^{\text{contr}}$
- A frame $\mathcal{F}^+$ such that $p_{\ell}^{\text{contr}} \in \mathcal{F}^+$

These essentially (although not equivalently) amount to designating a map $t^+ : p_{\ell} \to \{\ast\}$; 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 \( p_\ell \) has the following properties, where \( \mathcal{U} \) stands for the neighborhood it encloses:

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

Then,

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

**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 \( p_\ell \longrightarrow \{\ast\} \).

1.1 Realization

In this paper, we envision that there is a certain *semiotic* propensity of quasi-quantum (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 occurring across time in \( L \). The equation:

\[
\mathbb{I} \times h \hat{q}_{pot} \longrightarrow q = \hat{\mathcal{S}}^+= \hat{q} \parallel p_\ell^{contr}
\]

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-quantum. We can think of this as a sort of crossed module, \( m \), acting on the group \( g_p \) of generators for the Lie group of the particle's neighborhood along a worldline. We remark here that the world-line, \( \mathcal{W} \), is a special case of the path \( \rho \) defined above, which has been restricted to timelike distinct sections of \( L \).

Motion along \( \mathcal{W} \) obeys the following Leibniz rule:

\[
(m_i + m_j)k = m_i k + m_j k = \partial \omega^{-1} m_{ij} k
\]

where \( \omega \) is a differential form of dimension equal to a particular Lagrangian submanifold of \( M \). Thus, the function

\[
f(m) = u \xrightarrow{\partial} u' \subset_{\kappa} g_p
\]

is transitive for all smooth paths which non-trivially intersect covers of neighborhoods over \( p_\ell \in M \). Classically, \( f(m) \) 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 $b \in \mathbb{L}$, 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 $RZ/p$. Correspondingly, transport of the particle $p_i$ is described as a tilting, $R\delta$ which forms an $N$-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 $\mu_0, \mu_1$ are measurements, which are, respectively, projection onto the first and final coordinates of a local system. Directedness of the arrow $p_i \rightarrow p_j$ denotes the irreversibility of time due to the second law of thermodynamics.

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

Local systems naturally come with a bundle, $\text{Bun}_G$, 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:

$$\text{LocSys}_{id} = \int_0^{2\pi} \frac{\partial p_i}{\partial t} \Omega^G$$

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

Let $\pi_\eta$ be a map of fibers over $\text{LocSys}(M)$. We denote by $\text{Spec}_\eta$ the spectral sequence:

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

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

$$\mathcal{X}_{\text{osz}} = (\text{LocSys}(i) \times \text{LocSys}(j)) \xrightarrow{\text{can}} \Pi_\circ$$

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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 $U_i$ and smooth covers $\{U_i\}_{i \in I}$ essentially arise as rank two restrictions of Koszul complexes. That is to say, that for each stalk $f$ of $\mathcal{K}_{\text{kos}}$, 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 $\pi_2^2(\tilde{f} \in f)$ yields a conformal pullback to a site $\theta$ at which the functions $f(f)$ converge asymptotically.

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

The necklace, $\text{Nec}_p(B)$ gives the set of all maximal chains
$$\Delta \times p^{-1} \rightarrow \text{max} |B|$$

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
$$E \mathcal{P}_\heartsuit : (x = \{\}) \rightarrow x$$
out of the empty set, into a proposition $x$.

Definition 5 The creation map, $Cr$, shall be written
$$Cr : \heartsuit \rightarrow \{p\}$$
where $p \sim \{\ast\}$ for some zero-dimensional manifold.

Definition 6 The transform map, $T$, is given by
$$(x \rightarrow y) \leftrightarrow \exists x \vee y \rightarrow \exists y$$
where $y$ is the top of a frame.
Remark 2 The existential quantifier used here is classical (strong). $T$ thus represents a map $\exists \to \exists(\sim)$. The sequence
\[
\varheartsuit \ Cr \ x \ T \ y \ 
\rightarrow 
\exists(\sim)
\]
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 $\varepsilon^\bullet$ entails $\exists \varepsilon \sim$, where $\sim$ is the least upper bound on all $\bullet, \bullet'$.

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

\[
T = \mu_y - \mu_x = d\mu_x
\]

2.1 Sampling Populations of Measures

Let there be a large number of measurements taken across a sample $s$ of transform maps. We shall write
\[
\frac{\Sigma(d\mu_x)}{\text{card}(\mu)} = \varphi(\mu)
\]
to mean the average of the differences between each set of correlated pairs of points, $x$ and $y$.

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

Proof Our argument is proved by writing:
\[
\varphi(\mu) = \lim_{\mu \to \infty} \frac{\Sigma(d\mu_x)}{\text{card}(\mu)} = T_{\infty}
\]
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 $x$.  

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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 $x$:

$$T(x) = (\Psi(x) \rightarrow ||x||) \lor (||x|| \rightarrow ||y||).$$

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 $\tau$. The evolution of time, $\tau \rightarrow \tau + 1$, is a form of monodromy in the F-theory description, where $\tau$ 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