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# Correction, Alignment, Restoration and Re-Composition of Quantum Mechanical Fields of Particles by Path Integrals and Their Applications

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## 1. Introduction

In the universe all the phenomena of physical, energetic and mental nature coexist of functional and harmonic management, since they are interdependent ones; for example to quantum level a particle have a harmonic relation with other or others, that is to say, each particle has a correlation energy defined by their energy density  $K_{\alpha\beta}$ , which relates the transition states  $\phi_{\alpha}$  and  $\phi_{\beta}$ , of a particle to along of the time.

There is an infinite number of paths of this kind  $\Gamma$ , in the space-time of the phenomena to quantum scale, that permits the transition or impermanence of the particles, that is to say, these can change from wave to particle and vice versa, or suffer energetic transmutations due to the existing relation between matter and energy, and of themselves in their infinity of the states of energy. Of this form we can realize calculations, which take us to the determination of amplitudes of transition inside a range of temporary equilibrium of the particles, that is to say, under the constant action of a field, which in this regime, remains invariant under proper movements in the space-time. Then exist a *Feynman integral* that extends on the space of continuous paths or re-walked  $\Gamma$ , that joins both correlated transition states. Likewise, if  $\mathbb{R}^d \times I_t$  is the space-time where happens these transitions, and  $u, v$ , are elements of this space, the integral of all the continuous possible paths in  $\mathbb{R}^d \times I_t$  is

$$\mathfrak{J}(L, x(t)) = \int_{C^{u,v}[0,t]} \exp\left\{\frac{i}{\hbar}(\text{Action})(x)\right\} Dx, \quad (1)$$

where  $\hbar$ , is the constant of Max Planck, and the  $(\text{Action})$ , is the realized by their *Lagrangian*  $L$ . Nevertheless, this temporal equilibrium due to the space-time between particles can turn aside, and even get lost (suffer scattering) in the expansion of the space-time when the trajectory that joins the transition states gets lost, this due to the absence of correlation of the particles, or of an adequate correlation, whose transition states do not turn out to be related, or turn out to be related in incorrect form. From a deep point of view of the knowledge of the matter, this succeeds when the chemical links between the atoms weaken and break, or get lost for lack of an electronic exchange adapted between these (*process electrons emission-*

reception). All this brings with it a disharmony matter-energy producing *collateral damage* between the immensity of interacting particles whose effects are a distortion of the field created by them. Finally these effects become visible in the matter under structural deformations or production of defective matter.

To eliminate this distortion of the field is necessary to remember the paths and to continue them of a systematised form through of *certain path or route integrals* (that belongs to a class of integral of the type (1)), that re-establishes normal course of the particles, re-integrating their field (realising the sum of all the trajectories that conform the movement of the particle), eliminating the deviations (that can derive in knots or ruptures in the space-time) that previously provoked this disequilibrium. These knots or ruptures in the space-time will be called singularities of the field.

In quantum mechanics, the spectral and vibration knowledge of the field of particles in the space, facilitates the application of corrective and restorer actions on the same field using their space of energy states through of the meaning of their electromagnetic potentials studied in quantum theory (*Aharonov-Bohm effect*). Thus these electromagnetic potentials can be re-interpreted in a spectral and vibration space that can be formulated in a set of continuous paths or re-walked, with the goal of realising corrective and restorers applications of the field, stretch to stretch, section for section, and that is inherent in this combined effect of all the possible trajectories to carry a particle from a point to other. By gauge theory is licit and consistent to manipulate the actions of correction and restoration of the field through of electromagnetic field, which ones are gauge fields of several types of interactions both strong and weak. In this last point is necessary to mention that in the class of equivalence of the electrodynamics potentials can be precisely re-interpreted like a connection on a trivial bundle of lines of  $SU(2)$  (*non-Abelian part of the gauge theory using electromagnetic fields*), and admitting non-trivial bundles of lines with connection provided with more general fields (as for example, the of curvature, or the corresponding to  $SU(3)$  (*the strong interactions*)). In both cases they are considered to be the phases of the corresponding functions of wave local variables and constant actions can be established across of their correspondents Lagrangians. *The path integrals* to these cases are of the same form that (1), except from the consideration of the potential states in each case. Into of this electromagnetic context and from the point of view of the solution of the wave equation through the alignments of lines of field, we can use the corresponding homogeneous bundle of lines that are used to give adequate potentials (potential module gauge, for example, those who come from the *cohomology* of  $O(n-2)$ ,  $n \geq 1$  (Bulnes & Shapiro, 2007). Of this management we can establish that  $\{\text{set of fields of particles}\} \cong I^{\alpha\beta}(H^1(PM^\pm, O(-n-2)))$ , where  $\{\text{potentials}\}/\{\text{gauge}\} \cong H^1(PM^\pm, O(-n-2))$ , (Bulnes & Shapiro, 2007). Here  $I^{\alpha\beta}(H^1(PM^\pm, O(-n-2)))$ , is the *cohomological class of the spectral images of the integrals of line* on the corresponding homogeneous bundle  $O(-n-2)$ .

Generalising the path integrals (1), we can establish that an evaluation of a global action  $\mathfrak{I}$ , due to the law of movement established for an operator  $L$ , that act on the space of particles  $x(s)$ , comes given for

$$\mathfrak{I}: x(s) \mapsto \int_M L(X(s))d(x(s)), \quad (2)$$

where  $M (\cong \mathbb{R}^d \times I_t)$ , is the space-time of the transitions of the particles  $x(s)$ .

In particular, if we want the evaluation of this action to along of certain elected trajectory (path), inside of the field of minimal trajectories that governs the principle of minimal action

established by  $L$ , in our integrals (2), we have the execution of the action in a path  $\Gamma$ , given, to know

$$\text{Exe} : \mathfrak{Z}(x(s)) \mapsto \int_{\Gamma} \left\{ \int_M L(X(s)) d(x(s)) \right\} \mu_s = \int_{\Gamma} \mathfrak{Z}(x(s)) \mu_s, \quad (3)$$

where  $\mu_s$ , the corresponding measure on the path or trajectory  $\Gamma$ , in  $M$ , is. The study of this integrals and their applications in the re-composition, alignment, correction and restoration of fields due to their particles are the objective of this chapter. We define as correction of a field  $X$ , to a re-composition or alignment of  $X$ . Is re-composition if is a re-structure or re-definition of  $X$ , is to say, it is realize changes of their alignment and transition states. The corrective action is an alignment only, if  $X$ , presents a deviation or deformation in one of their force lines or energy channels. A restoration is a re-establishment of the field, strengthening their force lines.

If we consider to the trajectory  $\Gamma_j$ , in terms of their deviation  $\theta x(s)$ , of the classic path  $x_c(s)$ , of their harmonic oscillator of  $L(x(s))$ , we can establish that the harmonic oscillator propagator has total action accord with our quantum model of correction and restoration action of the path integrals studied in quantum mechanics, (Bulnes et al., 2010, 2011):

$$\mathfrak{Z}(x(s)) = \text{correction} + \text{restoration} = \mathfrak{Z}(\theta x(s)) + \mathfrak{Z}(x_c(s)) = \mathfrak{Z}(Id) + \int_{\Gamma} \mathfrak{Z}(x(s)) \mu_s, \quad (4)$$

Observe that the term  $\mathfrak{Z}(\theta x(t))$ , corresponds to the actions that is realised using rotations. This term belongs to space  $\text{Hom}_{\mathbb{C}}(X(M), L(M)) = \alpha Id$ , being  $Id$ , the identity and  $\alpha \in \mathbb{R}$ , (Bulnes, 2005), in the dual space of a restoration action of the field.

Now well, the relation between field and matter is realised through a quantum jump and only to this level succeeds. In the quantum mechanics, all the particles like pockets of energy works like points of transformation (states defined by energy densities). The field in the matter of a space-time of particles is evident like answer between these energy states, as it is explained in the *Feynman diagrams*. Due to that exist duality between wave and particle, a duality also exists between field and matter in the nature sense. Both dualities are isomorphic in the sense of interchange answers of interaction of a field. The answers between densities are realized in accordance with the correlation densities established in certain commutative diagrams that can be shaped by spaces  $L^2$ , on the space-time of the particles (Oppenheim et al., 1983). Coding this region of transition states of the corresponding Feynman diagram on a logic algebra  $\mathcal{A}(\cap, \cup, -)$  (like full states or empty of electrons like particle/wave, is to say,  $\phi(0) = 0$ , (is not the particle electron, but is like wave)  $\phi(1) = 1$ , (is not the wave electron, but is like particle) and their complements), where the given actions in (2), are applied and re-interpreting the region of the space-time of the particles like a electronic complex of a hypothetical logic nano- floodgate (is to say, like a space  $L^2$ , with a logic given by  $\mathcal{A}(\cap, \cup, -)$ , on their transition states), we can define the *Feynman-Bulnes integrals*, as those that establish the transition amplitude of our systems of particles through of a binary code that realize the action of correction and restoration of the field established in (4). Likewise a Feynman-Bulnes integral (Bulnes, 2006c; Bulnes et al., 2010), is a *path integral of digital spectra* with the composition of the fast Fourier transform of densities of states of the corresponding Feynman diagrams. Thus, if  $\phi_1, \phi_2, \phi_3$  and  $\phi_4$ , are four transitive states corresponding to a Feynman diagram of the field  $X(M)$ , then the path integral of Feynman-Bulnes is:


$$I = \int_{\phi^-}^{\phi^+} \phi_{n_1} F(n_1) \phi_{n_2} F(n_2) \phi_{n_3} F(n_3) \phi_{n_4} F(n_4) = 0001101001\dots, \quad (5)$$

The integrals of Feynman-Bulnes, establish the amplitude of transition to that the input of a system with signal  $x(t)$ , can be moved through a synergic action of electronic charges  $\mathfrak{I}$ , doing through pre-determined waves functions by  $L(x(t))$ , and encoded in a binary algebra (pre-defined by states  $\phi(0)$ , and  $\phi(1)$ ), (in the *kernel* the space of solutions of the wave equation  $\partial_X \Delta_F^{AA'} = \nabla^{AA'} \delta(x - x')$ , (Bulnes & Shapiro, 2007) of a point to other into a circuit  $\Gamma_j$ . Their integral is extended to all space of paths or re-walked included into the region of

Lagrangian action  $\Gamma (= \bigcup_j^k \left( \bigcap_j^k \Gamma_j \right))$ , with a topology of signals in  $L^2(\cap, \cup, \setminus)$  (Bulnes et al.,

2011). If we want corrective actions for stretch  $\Gamma_j$ , of a path  $\Gamma$ , we can realize them using diagrams of strings of corrective action using the direct codification of path integrals with states of emission-reception of electrons (*by means of one symbolic cohomology of strings*) (Bulnes et al., 2011). Then the evaluation of the Feynman-Bulnes integrals reduces to the evaluation of the integrals:  $I(\Gamma, \Omega) = \int_{C_r^0(\Psi)} \omega(\Gamma)$ , where  $\Omega$ , is the orientation of  $C_r^0(\Psi)$ ,  $\Psi$ , is

the corresponding model of graph used to correct after identifying the singularity of the field  $X$ , that distorts it. For example, observe that it can vanish the corrective action of erroneous encoding through a sub-graph:  $\int_{\Gamma_0} \omega(\Gamma) = 1 \cup -1 \cup 0 \cup [\phi(0) \cup 0 \setminus \phi(1)] \cup 1 = 0 \setminus \phi(1) \cup 1 = -1 \cup 1 = 1 + (-1) = 0$ . The corresponding equation in the cohomology of strings is (Watanabe, 2007; Bulnes et al., 2011):



$$= 0 \quad (6)$$

The total correction of a field requires the action to a deep level as the established in (2), and developing in (4), and only this action can be defined by a logic that organises and correlates all and each one of the movements of the particles  $x(s)$ , *through codes given by (5), in a beautiful symphony that orders the field*. Finally we give an application to medicine obtaining the cure and organic regeneration to nano-metric level by quantum medicine methods programming our Path Integrals. Also, we give some applications to nano-materials.

## 2. The classic and non-classic Feynman integrals and their fundamental properties. The synergic and holistic principles

We consider a space of quantum particles under a regime of permanent energy defined by an operator of conservation called the Lagrangian, which establishes a field action on any trajectory of constant type. A particle has energy of interrelation defined by their energy density which relates the states of energy of the particle over to along of time considering the path or trajectory that joins both states in the space - time of their trajectories. Thus an infinite number of possible paths exist in the space - time that can take the particle to define their transition or impermanence in the space - time, the above mentioned due to the constant action of the field in all the possible trajectories of their space - time. In fact, the

particle transits in simultaneous form all the possible trajectories that define their movement. Likewise, if  $\Omega(\Gamma) \subset \mathbb{R}^3 \times I_t$ , is the set of these trajectories subject to a field  $X$ , whose action  $\mathfrak{I}_\Gamma$ , satisfies for any of their trajectories that  $\delta(\mathfrak{I}_\Gamma) = 0$ , then their Lagrangian  $L$ , acts in such a form that the particle minimizes their movement energy for any trajectory that takes in the space  $\Omega(\Gamma)$ , doing it in a combined effect of all the possible trajectories to go from one point to another considering a statistical weight calculated on the base of the statistical mechanics. This is the exposition of Feynman known as exposition of the added trajectories (Feynman, 1967). Come to this point, the classic conception of the movement of a particle question: How can a particle continue different trajectories simultaneously and make an infinite number of them?

In the quantum conception the perspective different from the movement of a particle in the space - time answers the previous question enunciating:

*"The trajectory of movement of a particle is this that does not manage to be annulled in the combined effect of all the possible trajectories to go from one point to on other in the space - time"*

## 2.1 Classic Feynman integrals and their properties

We consider  $M \cong \mathbb{R}^3 \times I_t$ , the space - time of certain particles  $x(s)$ , in movement, and be  $L$ , an operator that expresses certain law of movement that governs the movement of the set of particles in  $M$ , in such a way that the energy conservation law is applied for the entire action of each of his particles. The movement of all the particles of the space  $M$ , comes given geometrically by their tangent vector bundle  $TM$ . Then the action due to  $L$ , on  $M$ , comes defined as (Marsden et al., 1983):

$$\mathfrak{I}_L : TM \rightarrow \mathbb{R}, \quad (7)$$

with rule of correspondence

$$\mathfrak{I}(x(s)) = FluxL(x(s))x(s), \quad (8)$$

and whose energy due to the movement is

$$E = \mathfrak{I} - L, \quad (9)$$

But this energy is due to their Lagrangian  $L$ , defined as (Sokolnikoff, 1964)

$$L(x(s), \dot{x}(s), s) = T(x(s), \dot{x}(s), s) - V(x(s), \dot{x}(s), s), \quad (10)$$

If we want to calculate the action defined in (7) and (8), along a given path  $\Gamma = x(s)$ , we have that the action is

$$\mathfrak{I}_\Gamma = \int_\Gamma L(x(s), \dot{x}(s), s) ds, \quad (11)$$

For a classic trajectory, it is observed that the action is an extreme (minimum), namely,

$$\delta(\mathfrak{I}_\Gamma) = \delta \left( \int_{s(p_0)}^{s(p_1)} L(x(s), \dot{x}(s), s) ds \right) = 0, \quad (12)$$



Thus there are obtained the famous equations of Euler-Lagrange equivalent to the movement equations of Newton,

$$\left\{ \frac{d}{dt} \left( \frac{\partial L}{\partial \dot{x}} \right) - \frac{\partial L}{\partial x} \right\}_{\Gamma_{classic}} = 0, \quad s_0 \leq s \leq s_f, \quad (13)$$

That is to say, we have obtained a differential equation of the second order in the time for the freedom grade  $x(s)$ . This generalizes for a system of  $N$  grades of freedom or particles, with  $N$ , equations eventually connected. An alternative to solve a system of differential equations as the described one is to reduce their order across the formulation of Hamilton-Jacobi that thinks about how to solve the equivalent problem of  $2N$  equations of the first order in the time (Marsden et al., 1983). Identifying the momentum as

$$p_i = \frac{\partial L}{\partial \dot{x}}, \quad (14)$$

we define the Hamiltonian or energy operator to the  $i$ th-momentum  $p_i$ , as:

$$\mathcal{H} = \sum_i^n p_i \dot{x}_i - L, \quad (15)$$

and Hamilton's equations are obtained

$$\dot{p}_i = \frac{\partial \mathcal{H}}{\partial x_i}, \quad \dot{x}_i = \frac{\partial \mathcal{H}}{\partial p_i}, \quad (16)$$

Nevertheless, it is not there clear justification of this extreme principle that happens in the classic systems, since any of the infinite trajectories that fulfill the minimal variation principle, the particle can transit, investing the same energy. Nevertheless the Feynman exposition establishes that it is possible to determine the specific trajectory that the particle has elected as the most propitious for their movement to go from  $s(p_0)$ , to  $s(p_1)$ , in the space-time being this one the one that is not annulled in the combined effect of all. Thus the quantum mechanics justifies the extreme principle affirming that the trajectory of movement of a particle is the product of the minimal action of a field that involves to the whole space- time where infinite minimal trajectories, that is to say, exist where the extreme condition exists, but that statistically is the most real. Likewise, the nature saves energy in their design of the movement, since the above mentioned trajectory belongs to an infinite set of minimal trajectories that fulfill the principle of minimal action established in (12).

The concrete Feynman proposal is that the trajectory or real path of movement continued by a particle to go from one point to another in the space-time is the amplitude of interference of all the possible paths that fulfill the condition of extreme happened in (12) (to see figure 1 a)). Now then, this proposal is based on the probability amplitude that comes from a sum of all the possible actions due to the infinite possible trajectories that set off initially in  $x_0$ , to end then in  $x_f$ .

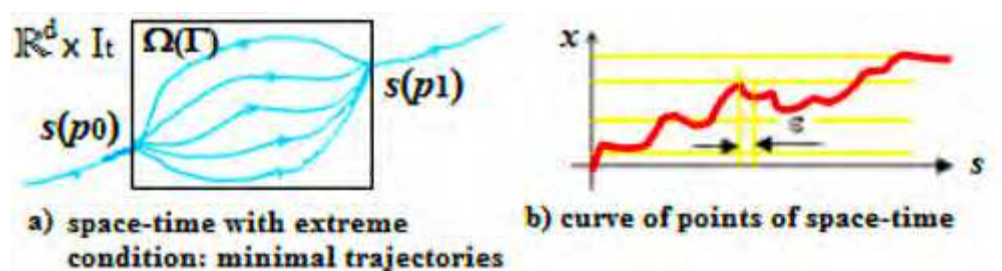


Fig. 1. a). The extreme condition in paths of the space  $\Omega(\Gamma)$ . b). Curve of the space-time in the  $\mathbb{R}^3 \times I_t$ .

Using the duality principle of the quantum mechanics we find that the particle as wave satisfies for this superposition

$$\psi(x, s) = A(s) \sum_{\gamma} \exp\left(\frac{i\mathfrak{I}}{\hbar}\right), \quad (17)$$

where the term  $A(s)$ , comes from the standardization condition in functional analysis (Simon & Reed 1980)

$$\int_{-\infty}^{+\infty} |\psi(x, t)|^2 dx = 1, \quad (18)$$

where to two arbitrary points in the space-time  $(s_0, x_0)$ , and  $(s_f, x_f)$ , whose amplitude takes the form  $A' = \sqrt{\frac{m}{2\pi i \hbar (s_f - s_0)}}$ . In effect, we approximate the probability amplitude taking only the classic trajectory. Of this way a Green function is had (propagator of  $x_0, s_0$  to  $x_f, s_f$ ) of the form:

$$D_F(x_f, s_f; x_0, s_0) = A' \exp\left(\frac{i\mathfrak{I}_{cl}}{\hbar}\right), \quad (19)$$

Then we consider to this classic trajectory:

$$x(s) = x_0 \frac{x_f - x_0}{s_f - s_0} (s - s_0), \quad (20)$$

$$v(s) = \frac{x_f - x_0}{s_f - s_0}, \quad (21)$$

Of this manner, the action on this covered comes given for

$$\mathfrak{I}_{clásica} = \int_{s_0}^{s_f} L(s) ds = \frac{m}{2} \frac{(x_f - x_0)^2}{s_f - s_0}, \quad (22)$$

It reduces us to calculate then the standardization term  $A'$ , for it we must bear in mind the following limit that in our case happens in the probability amplitude for  $s_f \rightarrow s_0$ :



$$\delta(x_f - x_0) = \lim_{\Delta \rightarrow 0} \frac{1}{(\pi\Delta^2)^{1/2}} \exp\left[-\frac{(x - x_0)^2}{\Delta^2}\right], \quad (23)$$

Identifying then to term of normalization like  $A' = \Delta$ , in (23) and using (22) it is had:

$$A' = \left( \frac{m}{2\pi i \hbar (s_f - s_0)} \right)^{1/2}, \quad (24)$$

Therefore, the exact expression is had in the probability amplitude

$$D_F(x_f, s_f; x_0, s_0) = \left( \frac{m}{2\pi i (s_f - s_0)} \right)^{1/2} \exp\left( i \frac{m}{2\hbar} \frac{(x_f - x_0)^2}{s - s_0} \right), \quad (25)$$

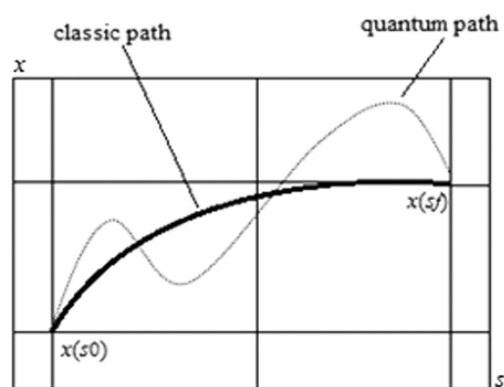


Fig. 2. Trajectories in the space-time plane, the continuous line corresponds to a classic trajectory while the pointed line corresponds to a possible quantum trajectory.

This type of exact results from the Feynman expression can also be obtained for potentials of the form:

$$V(x, \dot{x}, s) = a + bx + cx^2 + d\dot{x} + e\dot{x}^2, \quad (26)$$

But the condition given in (12), establishes that the paths that minimize the action are those who fulfill with the sum of paths given in terms of a functional integral, that is to say, those paths on the space  $\Omega(\Gamma) \subset \mathbb{R}^3 \times I_t$ , to know:

$$\sum_{\gamma} \exp\left(\frac{i\mathfrak{I}}{\hbar}\right) \longrightarrow \int_{\Omega(\Gamma)} \exp[i\mathfrak{I}_{x(s)} / \hbar] d(x(s)) = \int_{\Omega} \omega(\Gamma), \quad (27)$$

An interesting option that we can bear in mind here is to discrete the time (figure 2). Thus if the number of temporary intervals from  $s_0$  to  $s_f$  is  $N$ , then the temporary increase is  $\delta s = (s_f - s_0)/N$ , which implies that  $s_n = s_0 + n\delta s$ . We express for  $x_n$ , to the coordinate  $x$ , to the time  $s_n$ , that is to say  $x_n = x(s_n)$ . Then for the case of a free particle, it had that the action is given like:

$$\mathfrak{I} = \int_{s_0}^{s_f} L(s) ds = \frac{m}{2} \dot{x}^2, \quad (28)$$

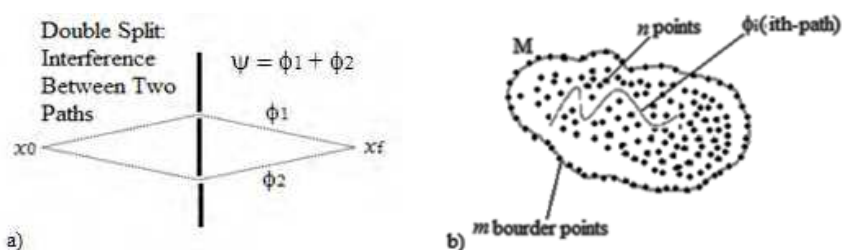


Fig. 3. a) Possible trajectories in an experiment of double split. The final amplitude result of the interference in between paths. b) The configuration space  $C_{n,m}$  is the model created by the due action to each corresponding trajectory to the different splits. It is clear here that it must be had in mind all the paths in the space-time  $M$ , that contributes to the interference amplitude in this space.

Thus, on a possible path  $\gamma$ , it is had:

$$\mathfrak{I}_{\gamma} = \sum_{n=0}^{N-1} \frac{m}{2} \left( \frac{x_{n+1} - x_n}{\delta s} \right)^2 \delta s, \quad (29)$$

Thus it is observed that the propagator  $D_F$ , will be given for:

$$D_F(x_f, s_N, x_0, s_0) = \lim_{\substack{N \rightarrow \infty \\ \delta s \rightarrow 0}} A \int_{-\infty}^{+\infty} dx_1 \cdots \int_{-\infty}^{+\infty} dx_{N-1} \exp \left[ \frac{im}{2\hbar} \sum_{n=0}^{N-1} \frac{(x_{n+1} - x_n)^2}{\delta s} \right], \quad (30)$$

Realizing the change  $y_n = \left[ \frac{m}{2\hbar\delta s} \right]^2 x_n$ , we re-write:

$$D_F = \lim_{\substack{N \rightarrow \infty \\ \delta s \rightarrow 0}} A' \int_{-\infty}^{+\infty} dy_1 \cdots \int_{-\infty}^{+\infty} dy_{N-1} \exp \left[ - \sum_{n=0}^{N-1} \frac{(y_{n+1} - y_n)^2}{i} \right], \quad (31)$$

where  $y_n = \left[ \frac{2\hbar\delta T}{M} \right]^{(N-1)/2} A$ . Developing the first integral of (31), we have

$$\int_{-\infty}^{+\infty} dy_1 \exp \left[ - \frac{(y_2 - y_1)^2 - (y_1 - y_0)^2}{i} \right] = \left( \frac{i\pi}{2} \right)^{1/2} \exp \left[ - \frac{(y_2 - y_0)^2}{2i} \right], \quad (32)$$

Then integrating for  $y_2$ , we consider the second member of (32) and the following one,  $(y_3 - y_2)^2$ :

$$\left( \frac{i\pi}{2} \right)^{1/2} \int_{-\infty}^{+\infty} dy_2 \exp \left[ - \frac{(y_3 - y_2)^2}{i} \right] \exp \left[ - \frac{(y_2 - y_0)^2}{2i} \right] = \left( \frac{i\pi}{3} \right)^{1/2} \exp \left[ - \frac{(y_3 - y_0)^2}{3i} \right], \quad (33)$$

Then a recurrence has in the integrals of such form that we can express the general term as  $\frac{(i\pi)^{(N-1)/2}}{N^{1/2}} \exp \left[ - \frac{(y_N - y_0)^2}{Ni} \right]$ . Therefore it is had for the propagator (30), which

$$D_F(x_N, s_N, x_0, s_0) = A \left( \frac{2\pi\hbar\delta s}{m} \right)^{(N-1)/2} \exp \left[ \frac{m(x_N - x_0)^2}{2\hbar N \delta s} \right], \quad (34)$$

identifying in this case:

$$A = \frac{1}{B} = \left[ \frac{2\pi\hbar i \delta s}{m} \right]^{1/2}, \quad (35)$$

it is had that the integration in paths is given for:

$$\int_{\Omega(\Gamma)} \omega(x(s)) = \lim_{\substack{N \rightarrow \infty \\ \delta s \rightarrow 0}} \frac{1}{B} \int_{-\infty}^{+\infty} \frac{dx_1}{B} \dots \int_{-\infty}^{+\infty} \frac{dx_{N-1}}{B}, \quad (36)$$

where in the first member of (36) we have expressed the Feynman integral using the form of volume  $\omega(x(s))$ , of the space of all the paths that join in  $\Omega(\Gamma)$ , to obtain the real path of the particle (therefore we can choose also quantized trajectories (see figure 2)). Remember that the sum of all these paths is the interference amplitude between paths that happens under an action whose Lagrangian is  $\omega(x(s)) = \mathfrak{L}_{x(s)} dx(s)$ , where, if  $\Omega(M)$ , is a complex with  $M$ , the space-time, and  $C(M)$ , is a complex or configuration space on  $M$ , (*interfered paths in the experiment given by multiple split (see the figure 3, to case of double split)*), endowed with a pairing

$$\int : C(M) \times \Omega^*(M) \rightarrow \mathbb{R}, \quad (37)$$

where  $\Omega^*(M)$ , is some dual complex ("forms on configuration spaces"), that is to say. such that "Stokes theorem" holds:

$$\int_{\Omega \times C} \omega = \langle \mathfrak{L}, d\omega \rangle, \quad (38)$$

then the integrals given by (36) we can be write (to  $m$ -border points and  $n$ -inner points (see figure 3 b))) as:

$$\int_{\Omega(\Gamma)} \mathfrak{L}(x(s)) dx(s) = \int_{\Gamma_1 \times \dots \times \Gamma_m \times \dots} \mathfrak{L}_q dx_1^{m_1} \dots dx_n^{m_n} = \int_{\Gamma_1} \left( \int_{\Gamma_2} \dots \left( \int_{\Gamma_m} \mathfrak{L} dx_1^{m_1} \right) \dots dx_n^{m_n} \right), \quad (39)$$

This is due to the infiltration in the space-time by the direct action  $\mathfrak{L}$ , that happens in the space  $\Omega \times C$ , to each component of the space  $\Omega(\Gamma)$ , through the expressed Lagrangian in this case by  $\omega$ . In (39), the integration of the space realises with the infiltration of the time.

Two versions of (36), that use the evolution operator and their unitarity are their differential version and numerical version of Trotter-Suzuki<sup>1</sup> (numerical version of (36)). The first version is re-obtain the Schrödinger equation from the Feynman path integral. In this case the wave function involves the corresponding electronic propagator given in (30) with a temporal step  $\delta s$ , to pass from  $\psi(x, 0)$ , to  $\psi(x, \delta s)$ , having the amplitude (Holstein, 1991)

$$^1 D_F(s, s_0) = \theta(s - s_0) \lim_{N \rightarrow \infty} \int_{-\infty}^{+\infty} dx_1 \dots \int_{-\infty}^{+\infty} dx_{N-1} \prod_{j=0}^{N-1} \left\langle x_{j+1} \left| e^{-\frac{i\lambda T}{N}} e^{-\frac{i\lambda V}{N}} \right| x_j \right\rangle.$$

Here,  $T$ , and  $V$ , are kinetic and potential energies in discrete form using their separate evolutions in slices.  $\theta(s - s_0)$ , is the weight of compensation in numerical compute.

$$\psi(x, \delta s) = \left[ \frac{m}{2\pi i \hbar \delta s} \right] \int_{-\infty}^{+\infty} \exp \left[ i \frac{m \delta x^2}{2 \hbar \delta s} \right] \left[ 1 - i \frac{\delta s}{\hbar} V(x, 0) + \delta x \frac{\partial}{\partial x} + \frac{\delta s^2}{2} \frac{\partial^2}{\partial x^2} \right] \psi(x, 0) d\delta x, \quad (40)$$

Realising the integral we obtain the differential version of the Feynman integral (36).

Let  $H$ , be the Hopf algebra (*associative algebra used to the quantized action in the space-time*) (Kac, 1990), of a class of Feynman graphs  $\mathcal{G}$  (Barry, 2005). If  $\Gamma$ , is such a graph, then configurations are attached to its vertices, while momentum are attached to edges in the two dual representations (Feynman rules in position and momentum spaces). This duality is represented by a pairing between a “configuration functor” (typically  $C_\Gamma$ , (configuration space of subgraphs and strings (Watanabe, 2007), and a “Lagrangian” (e.g.  $\omega$ , determined by its value on an edge, e.g. by a propagator  $D_F$ ). Together with the pairing (typically integration) representing the action, they are thought as part of the Feynman model of the state space of a quantum system.

Since it has been argued in (Ionescu, 2004), this *Feynman picture* is more general than the manifold based “Riemannian picture”, since it models in a more direct way the observable aspects of quantum phenomena (“interactions” modeled by a class of graphs), without the assumption of a continuity (or even the existence) of the interaction or propagation process in an ambient “space-time”, the later being clearly only an artificial model useful to relate with the classical physics, i.e. convenient for “quantization purposes”.

Likewise, an action on  $\mathcal{G}$  (“ $\mathfrak{Z}_{\text{int}}$ ”), is a character  $\mathfrak{Z}_{\text{int}} : H \rightarrow \mathbb{R}$ , (defined similarly to the given in (7)) which is a cocycle in the associated  $D\mathcal{G}$ -co-algebra  $(T(H^*), D)$ , that is to say, the action in this context is an endomorphism (matrix) of transition of the certain densities of field given by  $\phi$ .

A QFT (*Quantum Field Theory*) defined via Feynman Path Integral quantization method is based on a graded class of Feynman graphs. For specific implementation purposes these can be 1-dimensional CW-complexes or combinatorial objects. For definiteness we will consider the class of Kontsevich graphs  $\Gamma \in \mathcal{G}_n$ , the admissible graphs from (Kontsevich, 2003). Nevertheless we claim that the results are much more general, and suited for a generalisation suited for an axiomatic approach; a Feynman graph will be thought of both as an object in a category of Feynman graphs (categorical point of view), as well as a *co-bordism* between their boundary vertices (TQFT point of view). The main assumption the class of Feynman graphs needs to satisfy the existence of subgraphs and quotients.

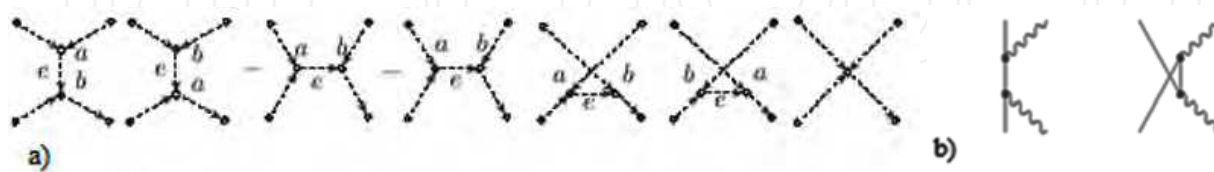


Fig. 4. The Kontsevich class is the quantized class used by the Feynman rules.

Example 1. In the compute of path integrals on the graph configuration space  $C_\square(\Omega)$ , The graphs  $\Gamma \in \mathcal{G}_n$ , will be used in the string schemes given by BRST-quantization on gauge theory. For example, the BRST-quantization is always nilpotent around a vertex:  $Q_{BRST} \bullet \nu = \oint dz j_{BRST}(z) \nu(0) = 0$ . The Kontsevich class not has loops everywhere (figure 4 a)). The Feynman diagrams (figure 4 b)) conforms a subclass in the Kontsevich class, that is

to say, restricted in the deformation quantization in respective micro-local structure of the Riemannian manifold (Kontsevich, 2003).

While the concept of subgraph of  $\gamma$ , is clear (will be modeled after that of a subcategory), we will define the quotient of  $\Gamma$ , by the subgraph  $\gamma$  as the graph  $\Gamma/\gamma$ , obtained by collapsing  $\gamma$ , (vertices and internal edges) to a vertex of the quotient. Then it satisfies the graph class succession under *Hom*, that will define all the types of graphs with connecting arrows:

$$\gamma \rightarrow \Gamma \rightarrow \Gamma/\gamma, \quad (41)$$

We enunciate the following basic properties of the classic Feynman integrals. Let  $\gamma, \gamma' \in \Gamma$ , where  $\Gamma \in \mathcal{G}$ , and  $\omega(\Gamma)$ , their corresponding Lagrangian with the property like in (38). We consider the path integral  $I_\Gamma$ , like a map given in (37). Let  $D_F$ , their corresponding propagator (the value of  $\omega(\Gamma)$ , in the corresponding edge  $\gamma$ ). Then are valid the following properties:

- $\forall D_F$ , propagator there is an unique extension to a Feynman rule on (39), that is to say  $\omega(\Gamma) = \omega(\gamma) \wedge \omega(\gamma')$ , with  $\Gamma/\gamma = \gamma'$ .
- If  $\omega(\Gamma)$ , is a Lagrangian on (41) with  $\Gamma/\gamma = \gamma'$ , then

$$\int \omega(\Gamma) = \int \omega(\gamma) \wedge \omega(\gamma'), \quad (42)$$

- From (38)  $\int_{\partial C} \omega = \mathfrak{Z} \circ D_F$ , then  $\forall$  extension (41),

$$\int_{\partial \gamma \mathfrak{Z}(\Gamma)} \omega(\Gamma) = \mathfrak{Z}(\gamma) \bullet \mathfrak{Z}(\gamma'), \quad (43)$$

- $\forall \Gamma \in \mathcal{G}$  (Feynman graph),

$$\sum_{e \in \Gamma_{\text{int}}} \int_{\partial e \bar{C}_\Gamma} \omega(\Gamma) \mathfrak{Z}(\text{d}^{\text{int}} \Gamma), \quad (44)$$

where  $e$ , is a simple sub-graph of  $\Gamma$ , without boundary.

- As consequence of the integral (44), we have the composition formulas

$$\mathfrak{Z} \circ D_{F_e} = \mathfrak{Z} \circ \text{d}^{\text{int}}, \quad \mathfrak{Z} \circ D_{F(i-e)}, \quad (45)$$

- Feynman integrals over codimension one strata corresponding to non-normal subgraphs vanish. A graph  $\Gamma \in \mathcal{G}$ , is normal if the corresponding quotient  $\Gamma/\gamma$ , belongs to the same class of Feynman graphs  $\mathcal{G}$ .
- The remaining terms corresponding to normal proper subgraphs meeting the boundary  $[m]$ , of  $\Gamma \in \mathcal{G}_a$ , yield a forest formula, like  $\text{intM}$  (figure 3, b)) corresponding to the co-product  $D_{F_b}$ , of  $\mathcal{G}$ . Then for a Feynman graph  $\Gamma \in \mathcal{G}_a$ :

$$\sum_{\gamma \rightarrow \Gamma \rightarrow \Gamma/\gamma^{\text{int}} \in \mathcal{G}} \int_{\partial \gamma \bar{C}_\Gamma} \omega(\Gamma) \mathfrak{Z}(D_{F_b}, \Gamma), \quad (46)$$

where the proper normal subgraph  $\gamma$ , meets non-trivially the boundary of  $\Gamma$ .

- If the Lagrangian  $\omega(\Gamma)$ , is a closed form then the corresponding Feynman integral  $\mathfrak{Z}$ , is a cocycle. Then

$$\int_{\partial \bar{C}_r} \omega(\Gamma) = \int_{\bar{C}_r} d\omega(\Gamma) = 0, \quad (47)$$

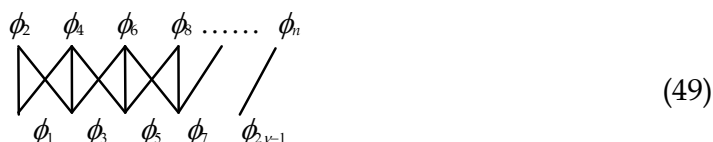
## 2.2 Non-classic Feynman integrals and their properties

### 2.2.1 Twistor version (Bulnes & Shapiro, 2007)

Consider the space of hypercomplex coordinates (coordinates in the  $m$ -dimensional complex projective space  $\mathbb{P}^m$ ) that determine through the position, quantum states of particles in free state  $Z_1^a, Z_2^a, \dots, Z_m^a$ , and we define the functional space of Feynman

$$\Phi_D = \{ F_U \mid F_U(z) = \int d^n z \, \phi_1(z) \phi_2(z) \dots \phi_n(z) = 000 \dots 0\text{-box diagram} \}, \quad (48)$$

This space is the corresponding to the group of Feynman  $\phi^n$ -integral for the 000 ... 0-box diagram (that is to say,  $C(M)$  given in the before section) with certain configuration space  $C_{n,m}$ , like was defined in section 1. 2, (with  $n$ -states  $\phi_i$ , and  $m$ -edges or lines) with arrange



This functional belongs to the integral operator cohomology on homogeneous bundles of lines  $H^1(\mathbb{P}\mathcal{T}, \mathcal{O}(-2,2))$ , where  $\mathbb{P}\mathcal{T} = \mathbb{P}\mathcal{T}^+ \cup \mathbb{P}\mathcal{T}^-$  for example, for  $n = 4$ , one has the diagram of Feynman for the  $\phi^4$ -integral one that corresponds to the 0000-box diagram



The elements  $F_U$ , can be expressed in a low unique way the map in the complex manifold  $\mathbb{P}^m$ , like

$$\Phi_D \rightarrow \mathcal{L}(\mathbb{P}^m(\mathbb{C}), \mathbb{C}), \quad (51)$$

with rule of correspondence

$$\int d^n z \, \phi_1(z) \phi_2(z) \dots \phi_n(z) \mapsto \int d^n Z^\alpha W_\alpha \, \phi_1(Z^\alpha W_\alpha) \phi_2(Z^\alpha W_\alpha) \dots \phi_n(Z^\alpha W_\alpha), \quad (52)$$

that allows us to identify  $\Phi_D$ , with  $\mathcal{L}(\mathbb{P}^m(X), X)$ . Building the twistor space  $\mathcal{T} = \{[x]_U \mid [x]_U = \dots + (x)_{-2} + (x)_{-1} + (x)_0 + (x)_1 + \dots\}$ , where  $(x)_{-n} = (x)^{-n}/n!$  (contours with opposite  $x = 0$ ) and  $(x)_{n+1} = -n!(x)^{-n-1}/2\pi i$  (in an environment around  $x = 0$ ). This twistor space satisfies that  $\mathcal{T} \cong \mathcal{L}(\mathbb{P}^m(\mathbb{C}), \mathbb{C})$ . Then  $\int d^n z \, \phi_1(z) \phi_2(z) \dots \phi_n(z) = \oint [x]_U \forall x \in \mathbb{C}^m$ . Then these integrals have their equivalent ones as integral of contour in the cohomology of contours  $H^d(\Pi - Y, \mathbb{C})$ , where  $\Pi$ , it is the product of all the twistor spaces (and dual twistor) and it is the subspaces union



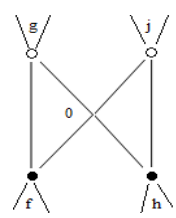
on those which the factor  $(Z^a W_a)^{-1}$ , are singular. To check this course with demonstrating, for the case  $m = 1$ , and using the integral operator of Cauchy has more than enough contours (jointly with the residue theorem) that the integral  $\int d^n z \phi_1(z) \phi_2(z) \dots \phi_n(z)$  takes the form of the formalism of Sparling given by the integral one

$$\oint[x]_U = \left\{ \oint_0^\infty + \oint \right\} \frac{e^z}{(x+z)} dz, \quad (53)$$

which bears to the isomorphism among the cohomological spaces

$$H^1(\mathbb{P}(\mathbb{C}), \Omega) \cong H^1(\mathbb{P}\mathcal{T}, \mathcal{O}(-2-2)), \quad (54)$$

which would be a quaternion version of these integrals? It would be the one given for integral of type Cauchy of functions of  $\mathbb{H}$ -modules (Shapiro & Kravchenko, 1996), on opened  $D$ , that turn out to be Liapunov domains in  $\mathbb{R}^n$ . Since one has the you make twistor projective bundle  $S^2 \setminus \mathbb{P}^3(\mathbb{C}) \rightarrow \mathbb{P}(\mathbb{H}) \cong S^4$ , and  $H^1(\mathbb{P}\mathcal{T}, \mathcal{O}(-2-2)) \cong H^1(\mathbb{P}(\mathbb{C}), \Omega)$ , then the cohomology  $H^1(\mathbb{P}(\mathbb{C}), \Omega) \cong H^1(\mathbb{P}(\mathbb{C}), \text{space in corresponding differential forms})$ . But  $S^1 \rightarrow \mathbb{P}^3(\mathbb{C}) \rightarrow \mathbb{P}(\mathbb{C})$ , it is a principal bundle with  $\mathbb{P}(\mathbb{C}) \rightarrow S^2$ , and since  $S^1$ , and  $S^3$ , are the underlying groups in the structure of the hyper-complexes and quaternion ( $\mathbb{H} \cong \mathbb{C}^2$ ) then  $S^1 \rightarrow S^3 \rightarrow S^2$ , represents in quantum mechanics a spin system  $\frac{1}{2}$  which can be represented by the cohomology of a diagram formed as an alternating chain of 0-lines and 2-lines, that is;  $H^1(\mathbb{P}\mathcal{T}^\pm, \mathcal{O}(-n-2))$ , that is to say for the system of quantum state of spin  $\frac{1}{2}$  that is the corresponding to a 4-integral one given by the 0000-box diagram



$$= \iint d^4x d^4y \phi(x) \psi_A(x) \leq_x D_F^{AA'}(x-y) \psi_{A'}(y) \theta(y), \quad (55)$$

But this cohomology of diagrams of contour integrals is applicable to 1-functions for  $\mathbb{P}(\mathbb{C})$ , in  $\mathbb{P}\mathcal{T}^\pm$ , that which is not chance, since it is a consequence of the  $G$ -structure of the manifold  $\mathbb{F}$ , (where they are defined these quantum phenomena) which is induced in the  $S^3$ -structure of the underlying spinors (Penrose & Rindler, 1986).

If we consider that the for-according complex manifolds have a pseudo-Hermitian complex structure not symmetrical and induced by the sheaf of quadratic forms  $\mathcal{O}(8^2 T^*(M))$ , it can expand the symmetry according classic of the diagrams of Feynman from their contour integrals to the construction of according structures that can be induced to the pseudo-Hermitian complex structure of the mentioned manifolds, giving the possibility to obtain a single integral operators cohomology of Feynman type for analytic manifolds (Huggett, 1990).

### 2.2.2 Instanton version

The Feynman integrals are invariants in  $\mathbb{R}^3$ , under rotations of Wick, that is to say

$$\int_{\Omega(\Gamma)} \exp[i\Im[\phi]]D[\phi] \mapsto \int_{\Omega(\Gamma)} \exp[-\Im[\phi]]D[\phi], \quad (56)$$

to a coordinates system in  $E^4$ , given by  $(x_0, x_1, x_2, x_3)$ , with  $x_0 = s$ , then  $\forall$  coordinates transformation given by  $s \rightarrow i\tau$ , we have that

$$M \rightarrow E^4, \quad (57)$$

then  $\Omega(\Gamma)$ , represents a region  $W(C)$ , in  $E^4$  (a Wick region in the space time). This action has place in  $S^4$ , to the solutions of the Yang-Mills equations on  $S^4$ . The action realised in this transformation has Euclidean action

$$\Im_E = \int_{\tau_1}^{\tau_2} \left( \frac{1}{2} m \dot{x}(\tau)^2 + V(x) \right) d\tau, \quad (58)$$

where the potential energy  $V(x)$ , changes to  $-V(x)$ , with the Wick rotation.

### 2.2.3 Feynman-Bulnes version

Considers a microelectronic device that is fundamented in the functional space  $L^2(\cup, \cap, /)$  encoding in a logic algebra  $\mathcal{M}_{1,0}$ . The corresponding functional equation to inputs and outputs of information signals using certain liberty based in the artificial process of thought to create “intelligent” computers needs the use of path to plantee their solution (Bulnes, 2006c). Then extrapoling the Feynman integrals to calculate the amplitud of interference of the many paths (criteria) to resolve a automation problem that designs a cybernetic complex that at least to theoretical level has a quantum programming with Feynman rules and an adequate neuronal net<sup>2</sup>.

**Def. 1 (Path Integrals of Feynman-Bulnes).** A integral of Feynman-Bulnes is a path integral of digital spectra with composition with Fast Transform of densities of state of Feynman diagrams.

If  $\phi_1, \phi_2, \phi_3$ , and  $\phi_4$ , are four densities of states corresponding to the Feynman diagrams to the poles of field  $X(M)$ , then the path integral of Feynman-Bulnes is:

$$I_{FB} = \int_{Z^-}^{Z^+} \phi_{n_1} F(n_1) \phi_{n_2} F(n_2) \phi_{n_3} F(n_3) \phi_{n_4} F(n_4), \quad (59)$$

<sup>2</sup> The integrals of Feynman-Bulnes give solution to the functional equation of a automatic micro-device to control (micro-processor)  $F(XZ^+, YZ^-) = 0$  (Bulnes, 2006c). The informatics theory assign a cybernetic complex to  $\mathbb{C}$ , (Gorbatov, 1986) and each cube in this cybernetic net establish a path on the which exist a vector of input  $XZ^+$ , and a vector of output  $YZ^-$ , signed with a time of transition  $\tau$ , to carry a information given in  $XZ^+$ , on a curve  $\gamma_\tau$  (path) to a state  $YZ^-$ , through logic certain (conscience), that include all the circuit  $\mathbb{C}$  (Bulnes, 2006c). In the case of  $\mathbb{C}$ , the logic is the real conscience of interpretation of  $\mathbb{C}$ , (criteria of  $\mathbb{C}$ ). As  $\mathbb{C}$ , has a real conscience of recognition; into of their corrective action and reexpert, elect the adequate path to the application of the corrective action. For it, the integrals of Feynman-Bulnes can be explained on the electable model  $\Psi_\beta$ , (path, see figure 1 a)) as:

$$correcci\grave{o}n = \int_{Z^-}^{Z^+} D_F(z(t)) \mu_{n_1} F(n_1) d(z(t)) = \sum_n^N \delta(\Psi_\alpha - \Psi_\beta) \phi(\Psi_\alpha).$$

3. Combination of quantum factors and programming diagrams of path integrals: The coding and encoding problems

Since a duality exists between wave and particle, a duality also exists between field and matter in the natural sense (Schwinger, 1998). Both dualities are isomorphic in the sense of the exchange of states of quantum particles and the interaction of a field. Indeed in this quantum exchange of information of the particles, that happen in the space-time  $\Omega(\Gamma)$  region, the pertinent transformations are due to realise to correct, restore, align or re-compose (put together) a field  $X$ .

Elements of fiel	Nano-metric application	Effect obtained on field
0-lines	localization of anomalous points	encoding nodes to application
1-lines	application of electronic propagator	alignment of lines of field
-1-lines	inversion of actions*	reflections of restoration

\* Creation of contours around of points of application

Table 1. Combination of quantum factors of the field  $X$ .


Any anomalous declaration in a quantum field shows like a distortion, deviation, non-definition or not existence of the field in the space-time where this must exist like physical declaration of the matter (existence of quantum particles in the space). The quantum particles are transition states of the material particles. We remember that from the point of mathematical view, a singularity of the space  $X(M)$ , is a discontinuity of the flux of energy, where  $FluxD_{Fj}(z)z \neq 0, \forall z \in M$  (Marsden et al., 1983). This discontinuity creates a space of disconnection where the alignment atoms stay unenhanced due to not have electrons that they do unify them under the different chemical links that exist and through the ionic interchange foreseen in the space  $TM^{\pm,3}$ (Landau & Lifshitz, 1987), (vector bundle of the particles in  $M$ , and responsible of the geometrical configuration of the field in  $M$ , and that promote the ionic restoration in  $X(M)$ , (*Gauge theory*). In a topological sense of the field, the detection of these anomalies of the field  $X$  will do through anomalies in the trajectories of flux  $\gamma(z)$ , such that  $FluxD_{Fj}(z)z \neq 0, \forall z \in \gamma(z) \subset M$ .

**Def. 2.** [10] If  $Flux: \mathbb{R} \times M \rightarrow M$ , is a flux and  $z \in M$ , the curve  $\gamma_z : \mathbb{R} \rightarrow M$ , with rule of correspondence  $t \mapsto \phi_t(z) = \phi(t, z)$ , is a line of flux.

A anomaly in a trajectory and thus in  $M$ , will be a singular point which can be a knot (multiform points), a discontinuity (a hole (source or fall hole)) in  $M$ ) or a indeterminate point (without information of the field in whose point or region in  $M$ ). But we require their electromagnetic mean into the context of  $X$ , for we obtain their corresponding diagnosis using an electromagnetic device that establish an univocal correspondence between detected anomalies and Feynman diagrams used to the spectral encoding through of the integrals of Feynman-Bulnes.

If we consider the space  $C^0_{\Gamma}(\psi)$  (Watanabe, 2007), as space of configuration associate with sub-graph  $(\Gamma, \psi)$ , where  $\psi$ , is the corresponding smooth embedding to  $n$ -knot that which is identified as a  $\infty$ , in an integral as the given in (6), we can define rules to sub-graphs that coincides with the rules of signs in the calculate of integrals like (36). Thus we can identify the three fundamental forms given for  $\omega(\Gamma) = \Pi sgn(z)$ , (figure 5).

<sup>3</sup>  $X(M)$ , is a section of  $TM^{\pm}$ , in a mathematical sense (Marsden et al., 1983).

In this study the path integrals and their applications in the re-composition, alignment, correction and restoration of fields due to their particles realise using certain rules of fundamental electronic state and their sub-graphs, through considering the identification. We define as correction of a field  $X$ , to a re-composition or alignment of  $X$ . Is re-composition if it is a re-structure or re-definition of  $X$ , is to say, it is realize changes of their alignment and transition states (properties of the table 1 and additional properties with the algebra  $\mathcal{M}_{0,1}$ ). The corrective action is an alignment only, if  $X$ , present a deviation or deformation in one of their force lines or energy channels (properties of contours on particles: ). A restoration is a re-establishment of the field, strengthening their force lines (properties of the Dirac and Heaviside function on particles: with  $t \geq s$ ,  $w(s, t)\phi(-1) \leq \phi(1)U_0(s, t)$ , etc) (Fujita, 1983). Consider the following corrective action by the string diagrams to the states of emission-receptor of electrons (see figure 5 a)). The evaluating of the integrals of Feynman-Bulnes is reduced to evaluating the integrals:

$I(\Gamma;\Omega) = \int_{C^0_{\Gamma}(\Psi)} \omega(\Gamma)$ , where  $\Omega$ , is the orientation on  $C^0_{\Gamma}(\Psi)$ , where  $\Psi$ , is the corresponding model of graph used to correct and identify the anomaly and  $\Gamma$ , the corresponding sub-graph of the transitive graph determined by a re-composition field treatment. The space  $\mathcal{M}_{0,1}$ , conforms a reticular sub-algebra in mathematical logic. In the figure 5 b), the corrective action in the memory of an Euclidean portion of the space time  $\Omega(\Gamma)$ , through a sub-graph  $\Gamma$ , of strings, in the re-composition of the alignment of field comes given as:  $z_j = \int_{C^0_{\Gamma}(\Psi)} \theta_1 \theta_2 \theta_3 \theta_4 = <[1 \cup \phi(1)] \cup 0 \cup \phi(1) > \cup 1 = 1$ , (Bulnes, 2006c). Observe that it can vanish the corrective action of encoding memory through another sub-graph:  $\int_{\Gamma_0} 1 \cup -1 \cup 0 \cup [\phi(0) \cup 0 \cup \phi(1)] \cup 1 = 0 \cup \phi(1) \cup 1 = -1 \cup 1 = 1 + (-1) = 0$  (see the equation (6)).

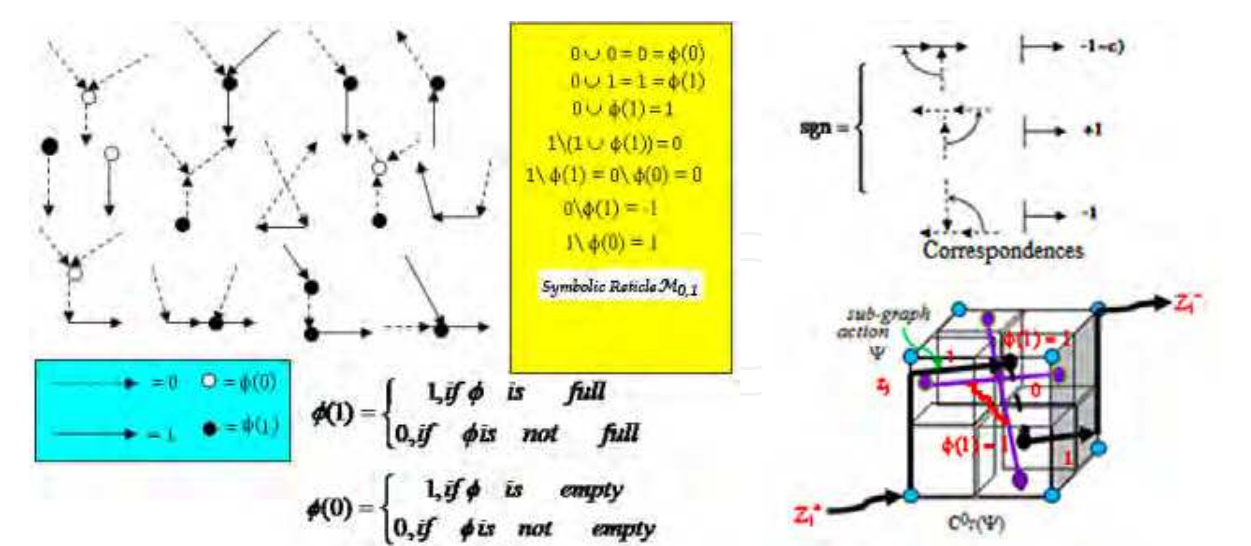


Fig. 5. a) String diagrams of corrective action using direct encoding by path integral. b) Euclidean portion of the space time  $\Omega(\Gamma)$ .

All anomalies in the space-time produce scattering effects that can be measured by the proper states using the following rules, considering these anomalies like a process of scattering risked by the particle with negative potential effect of energy:

	Particle $\phi(1)$	Anti-particle $\phi(-1)$
Input	$\phi(1) \bullet \longrightarrow \circ$ Positive future	$\phi(1) \bullet \longleftarrow \circ$ negative future
Output	$\phi(1) \circ \longrightarrow \bullet$ Positive past	$-\phi(1) \circ \longleftarrow \bullet$ negative past

Table 2. Past and future in the scattering effect of the field X.

The negative actions in one perturbation created by an anomaly in the quantum field X, acts deviating and decreasing the action of the “healthy” quantum energy states  $\phi_i$  ( $i = 1, 2, \dots$ ), in the re-composition of field (see the example explained in the figure 6).

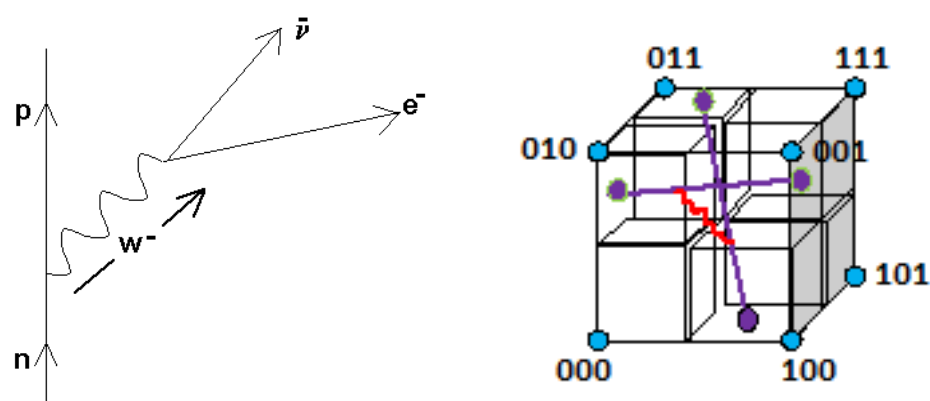


Fig. 6. a) Feynman diagram to a negative boson field. b) Cube of the net of the configuration space.

Example 2. The energy in this Feynman diagram is the given by  $E_{\text{output}} = W^- = -E$ , (negative boson in the field  $\mathfrak{b}_{\mu\nu}^a$ (of interactions given in  $SU(3)$ ) (Holstein, 1991). Then their path integral to output energy is:  $I^{\alpha\beta} = \int_{C^0(\Gamma)} \phi = -1$  (see figure 6 a)). For other side, the cube of the net of the configuration space  $C^0_\Gamma(\Psi)$  of the space-time  $\Omega(\Gamma)$  is the 3-dimensional cube to arrangements in 000-box (see figure 6 b)).

4. On a fundamental theorem to correction and restoring of fields and their corollaries

One result that explains and generalises all actions of correction and restoring of a quantum field including the electromagnetic effects that observes with vector tomography is:

**Theorem 1 (F. Bulnes)** (Bulnes et al., 2010). Be  $M = X(M) \setminus M$ . Be a set of singular points of  $M$ , such that the states of  $X(M)$ , in these points are distorted states of the field  $X$ . An integral of line  $I_{\alpha\beta} \in H^1(PM^\pm; O(-k))$ , to  $k$  a helicity in  $M$ , determine an answer of the transformation  $I_{\alpha\beta}X(M)$ , that it is an appropriate width to correct the field  $X(M)$ , under the action of the operator  $D_F(M)$ , such that (10) is satisfied, then the integral of line that re-establishes the field and recomposes the part  $X(M)$  comes given for

$$I^{\alpha\beta} = \int \left[ \iint_{\gamma \subset M} D_F(x(s)) X(Z^\alpha, W_\alpha, X^\alpha, Y) \omega \right] \mu_s,$$



The effect on the field is re-construct and re-establish their lines of field (channels of enery) by synergic action (see figure 8).  
*Proof.* (Bulnes, 2006a; Huggett, 1990).

The fundamental consequences are great, and they have to do with the reinterpretation of the anomalies of the field in an electromagnetic spectra (Schwinger, 1998), (see the figure 7), which we can measure across detectors of electromagnetic radiation, detectors and meters of current, voltage or amperage calibrated in micro or nano-units (Bulnes et al., 2011).

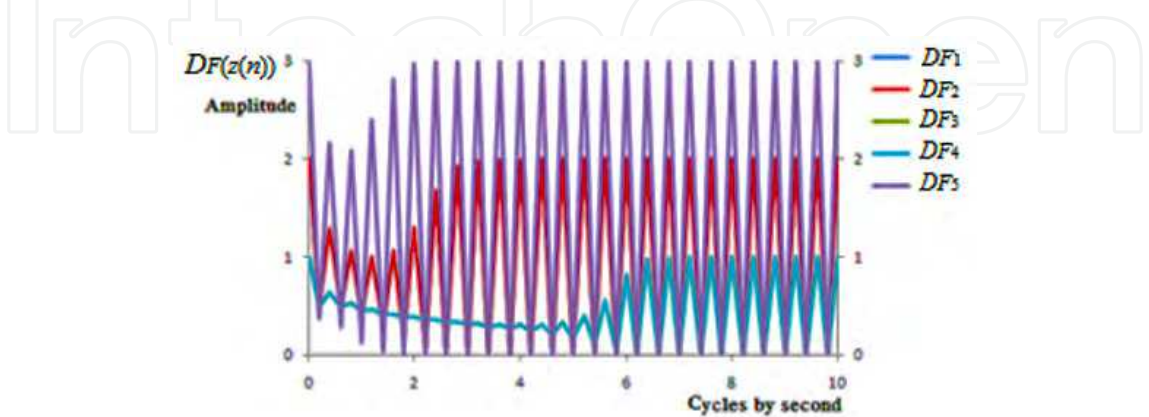


Fig. 7. Electronic propagators measuring corrective and restorer actions.

An important result (that can be a consequence in a sense of the previous one (for example in integral geometry and gauge theory)) that applies the vector tomography to electromagnetic fields used to measure fields of another nature and classify the anomalies by their electromagnetic resonance (at least in the first approach) is given by:

**Theorem 2 (Bulnes, F)** (Bulnes, 2006b). If the Radon transform (tomography on  $X(M)$ ) is not defined, is infinite or has the value of zero, the corresponding pathologies are: great emission of electromagnetic radiation, current or voltage (points unless polarity *due to the atomic degradation (isotopes)*, have a node with variation not bounded of current, voltage or resistance (it is loose or is much (*ponds of energy*)) *due to an existence of positron states* (like the defined in table 2)), has a peak or is a node, due to that have not unique value or this is indeterminate (not have determined direction, can have a *source of increase scattering*).  
*Proof.* (Bulnes, 2006a).

In the demonstration of the theorem 1, the Stokes theorem guarantees the invariance of the value of the integrals of path under the application of an electromagnetic field (Landau & Lifshitz, 1987), like gauge of a quantum field, since the value of these integrals does not depend on the contour measured for the detection of a field anomaly (Bulnes et al., 2011).

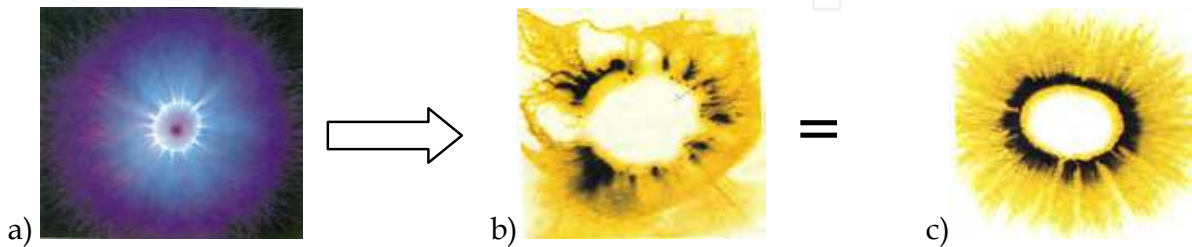


Fig. 8. The field in a) is the radiation electromagnetic spectra to recompose and restore the field  $X$ , given in b). The corresponding image in c), is the field restored and corrected after the application a) in b).



5. Some applications to nano-medicine, nano-engineering and nano-materials

5.1 Application to nanomedicine

In nanomedicine the applications of the corrective actions and restorers of a field are essential and they are provided by the called integral medicine, which bases their methods on the regeneration of the codes of cellular energy across the conduits of energy of the vital field that keeps healthy the human body, the above mentioned for the duality principle of mind-body. But the transformations are realised in the quantum area of the mind of the body, that is to say the electronic memory of the healthy body. The mono-pharmacists of integral medicine contain codes of electronic memory at atomic level that return the information that the organs have lost for an atomic collateral damage.

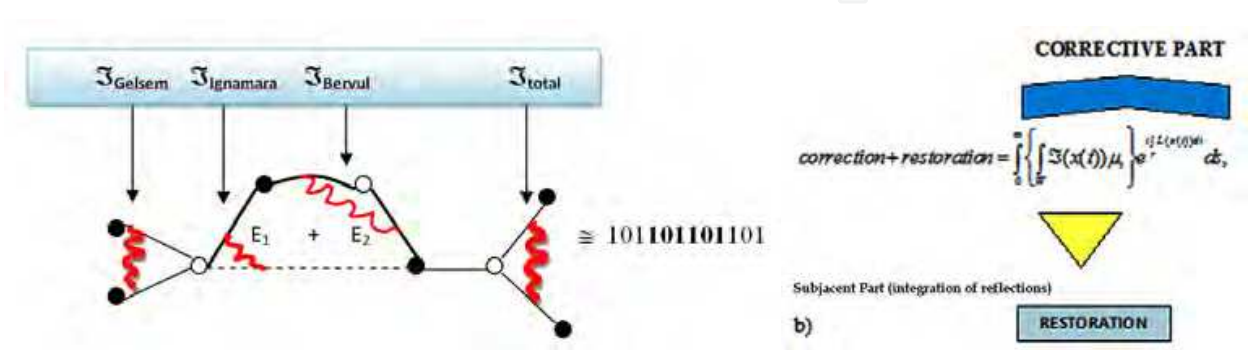


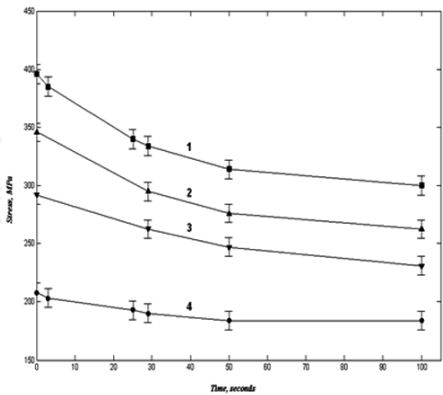
Fig. 9. Diagram of strings and path integrals of intelligence code of cure.

Diagram of strings belonging to the cohomology of strings equivalent to the code of electronic memory spilled to a patient sick with the duodenum (Bulnes et al., 2011) (see figure 9 a)). In nanomedicine, the path integrals are intelligence codes of corrective and restoration actions to cure all sicknesses. In the (see figure 9 b),  $W$ , is the topological group of the necessary reflections to the recognition of the object space of the cure (Bulnes et al., 2010). This recompose the amplitude of the wave defined in the spectra  $I^{\alpha\beta}X(B)$ , (with  $B$ , the human body) in the context of the space-time that to our nano-metric scale this space is constituted of pure energy. Into this space transits the geodesics or paths, to each particle where to each one of those paths exist a factor of weight given by  $\exp(i\mathfrak{I}/\hbar)$ , with  $\hbar$ , the constant of Max Planck and  $\mathfrak{I}$ , is the classical action associate to each path (see figure 8 b)).

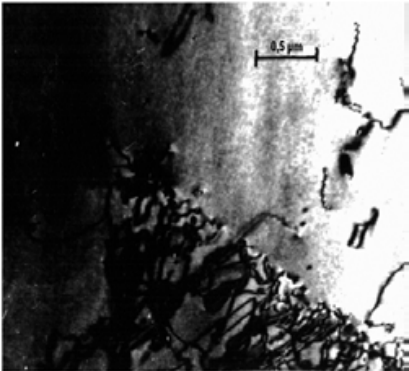
5.2 Application to nanomaterials

The study of the resultant energy due to the meta-stables conditions that it is obtains in the quasi-relaxation phenomena establishes clearly their plastic nature for the suffered deformations on the specimen. Nevertheless their study can to require the evaluation of the field of plastic deformation on determined sections to a detailed study on the liberated energy in the produced dislocations when the field of plastic deformation acts. Thus, it is doing necessary the introduction of certain evaluations of the actions of the field to along of the dislocation trajectories in mono-crystals of the metals with properties of asymptotic relaxation. Then we consider like specimens, mono-crystals of *Molybdenum* (Mo), (see figure 10) subject to stress tensor that produce the plastic deformation given by the action inside of path integral

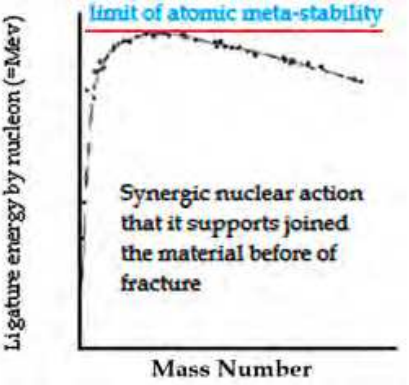
$$\int_M L\varepsilon(t)d(\varepsilon(t)) = \int_0^{+\infty} \left[ \int_M d\varepsilon_{PT} \right] \varphi(\tau)e^{-\tau t} d\tau, \quad (60)$$



i)



ii)



iii)

Fig. 10. i). Quasi-relaxation curves for Molybdenum single crystal: 1.-  $\sigma_0 = 396$  MPa, 2.-  $\sigma_0 = 346$  MPa, 3.-  $\sigma_0 = 292$  MPa, 4.-  $\sigma_0 = 208$  MPa. Mo  $\langle 100 \rangle \{100\}$ , at  $T = 293$  °C. ii). Image of the electronic microscope of high voltage, HVTEM of Molybdenum single crystal in regime of quasi-relaxation. iii). Atomic meta-stability condition.

By the theorem of Bulnes-Yermishkin (Bulnes, 2008), all functional of stress-deformation to along of the time must satisfy for hereditary integrals in the quasi-relaxation phenomena that have considered the foreseen actions inside of trajectory of quasi-relaxation like path integrals measuring field actions on crystal particles of metals:

$$\Gamma(\sigma - \varepsilon, t) = \int_0^{+\infty} \left[ \int_0^t \sigma(t) d\varepsilon(t) \right] \varphi(\tau) e^{-\tau t} d\tau, \quad (61)$$

The square bracket in (60), is the one differential form  $\omega(\Gamma_\varepsilon)$ , using the property (42), on the space-time  $\Omega(\Gamma)$ . The figure 10 iii), establish the behavior to atomic level in the tendency of the mono-crystals to be joined in meta-stability regime (Alonso & Finn, 1968).

### 5.3 Nanoengineering and nanosciences

Since it has been mentioned previously if we consider a set of particles in the space  $E$ , under certain law of movement defined by their Lagrangian  $L$ , we have that the action defined by a field that expires with this movement law and that causes it is defined by the map:

$$\mathfrak{I} : TE \rightarrow \mathbb{R},$$

with rule of correspondence as given in (8), we can establish that the global action in a particles system with instantaneous action can be re-interpreted locally as a permanent action of the field considering the synergy of the instantaneous temporary actions under this permanent action of the field. This passes to the following principle:

**Principle.** The temporary or instantaneous action on a global scale can be measured like a local permanent action.

The previous proposition together with certain laws of *synchronicity of events* in the space-time will shape one of the governing principles of the nanotechnology, why? Because at microscopic level the permanence of a field is constant in proportion to the permanence and the interminable state of energy that exists in the atoms. As a result of it a nanotechnology process will be directed to the manipulation of the microstructures of the components of the matter using this principle of "intentional" action. Then supposing that the field  $X$ , can control under finite actions like the described ones for  $\mathfrak{I}$ , and under the established principle, we can execute an action on a microstructure always and when the sum of the actions of all the particles is major than their algebraic sum (*to give an order to only one particle so that the others continue it*). How to obtain this combined effect of all the particles that move and that is wanted realise a coordinated action (of tidy effect) and simultaneously (synchronicity), with the only effect?

Inside the universe of minimal trajectories that satisfies the variation functional (12) we can choose a  $\gamma_t \in \Omega(\Gamma)$ , such that

$$\text{Exe} \mu_t = \int_{\gamma_t} \left( \int_{p_1}^{p_2} L(x(s)) d(x(s)) \right) \mu_{\gamma_t}, \quad (62)$$

which is not arbitrary, since we can define any action on  $\gamma_t$ , like

$$\mathfrak{I}_{\gamma_t} = \int_{p_1}^{p_2} L(x(s), \dot{x}(s), s) ds, \quad (63)$$

that is to say, there exists an intention defined by the field action that infiltrates into the whole space of the particles influencing or "infecting" the temporary or instantaneous actions doing that the particles arrange themselves all and with added actions not in the

algebraic sense, but in the holistic sense. This action is the "conscience" that has the field to exercise their action in "intelligent" form that is to say, in organized form across his path integrals like the already described ones. Then extending the above mentioned integral to the whole space  $\Omega(\Gamma)$ , we have the synergic principle of the whole field  $X$ ,

$$\mathfrak{I}_{TOTAL} \geq \sum_j \int_{\gamma_t} \mathfrak{I}_j(x(s))d(x(s)), \tag{64}$$

the length and breadth of  $\mathbb{E}$ . The order conscience is described by the operator of execution of a finite action of a field  $X$ , on a target (region of space that must be infiltrated by the action of the field which is that for which we realise our re-walked  $\Omega(\Gamma)$ ). How to measure this transference of conscience of transformation due to the field  $X$ , on an object defined by a portion of the space  $\Omega(\Gamma)$ ? What is the limit of this supported action or transference of conscience so that it supplies effect in the portion of the space  $\Omega(\Gamma)$ , and the temporary or instantaneous actions for every particle  $x^i$ , are founded on only one synergic global action on  $\Omega$ ?

We measure this transference of conscience (or intention) of  $X$ , on a particle  $x(s)$ , by means of the value of the integral of the intelligence spilled (path integral) given like (Bulnes et al., 2008):

$$\langle \tau_\alpha X(x(s)), x_\gamma \rangle = \int_{\Omega(\Gamma)} \mathfrak{I}(x_\delta \circ x_\sigma \circ x_\delta^{-1})(\phi_\sigma(x_\eta)\phi_\sigma(x_\gamma)\phi_\sigma^{-1}(x_\eta))\mu_\sigma, \tag{65}$$

We let at level conjecture and based on our investigations of nanotechnology and advanced quantum mechanics, that a sensor for the quantum sensitisation of any particle that receives an instruction given by a field  $X$ , must satisfy the inequality of Hilbert type (Bicheng, 2009), for this transference of conscience defined in (65) on the region  $\Omega(\Gamma)$ , to know (see figure 11 c)):

$$\langle \tau_\alpha X(x(s))t_\gamma, \rangle \leq \|\log \phi_\sigma(x_\eta)\|^a \|\log \mathfrak{I}(x_\sigma)\|^b, con \quad a = b = 2, \tag{66}$$

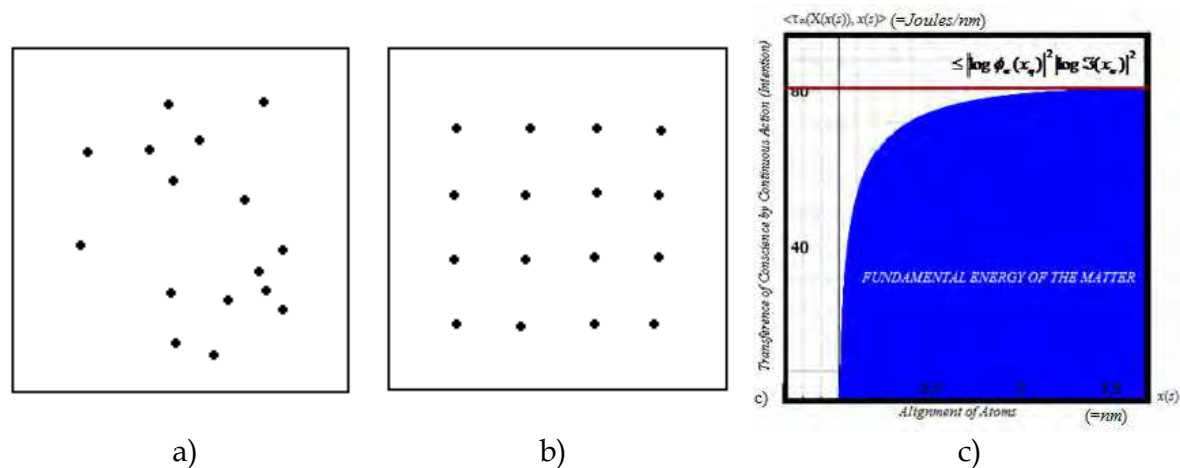


Fig. 11. a) Free particles. b) Transference of conscience in the particles. c) Transference of conscience by continuous action.

Example 3. A force is spilled  $F(x(s))$ , generated by a field that generates a "conscience" of order given by their Lagrangian. For it does not have to forget the principle of energy

conservation re-interpreted in the equations of Lagrange, and given for this force

like  $\frac{d}{dt} \left( \frac{\partial T}{\partial \dot{x}^j} \right) - \frac{\partial T}{\partial x^j} = F^j(x(s))$ , (also acquaintances as “living forces”) transmitting their

momentum in each  $i$ th-particle of the space  $\mathbb{E}$ , creating a region infiltrated by path integrals of trajectories  $\Omega(\Gamma)$ , where the actions have effect. Here  $T$ , is their kinetic energy. It was considered to be a transference of conscience (intention) given by the product  $\langle \tau_\alpha \mathfrak{I}(x(s)), x(s) \rangle = [(\log(x) + 2)^2][(\log(x) - 4.00000005)^2]$ . Observe that the object obtains their finished transformation in an established limit. The above mentioned actions of alignment might be realised by displacements in ( $= nm$ ) (see figure 11 b)).

## 6. Conclusions

Finally and based on the development that the quantum mechanics has had along their history, we can affirm that the classic quantum mechanics evolves to the advanced quantum mechanics (created by Feynman) and known like quantum electrodynamics reducing the uncertainty of Heisenberg of the frame of the classic quantum mechanics, on having established and having determined a path or trajectory of the region of space-time where a particle transits. Therefore the following step will demand the evolution of the quantum mechanics of Feynman to a synchronous quantum mechanics that should establish rules of path integrals that they bear to an effect of simultaneity and coordination of temporary actions on a set of particles that must behave under the same intensity that could be programmed across their "revisited" path integrals, producing a joint effect called synergy. The time and the space they are interchangeable in the quantum area as we can observe it in the integrals (61). Where a particle will be and when it will be there, are aspects that go together. This way the energy is not separated from the space-time and forms with them only one piece in the mosaic of the universe.

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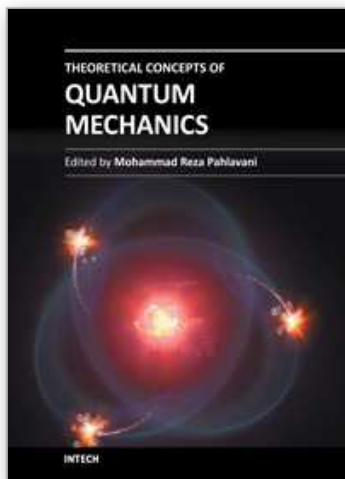
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