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Discriminating Chiral Insertions from BSM for the Muon ($g-2$) by non-Abelian Zero Modes

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Abstract:

A sorting out method, between the New Physics and as vs. the Lepton Flavor Violated Chiral insertion is exposed, interpreting so the Light-by-Light scattered amplitude deviation in the muon magnetic moment, with a novel 2-color instead of 3-color in diagrams projective polarizations.

The calculation is done using an extension-detention of the muon resonance interaction internal lines (which may be generically of a non-QCD nature) such its modes' phonons decompose into instantons while the helicities are to meet the imposed polarizations. A confirmation comes out from a non-applicability of the Landau Gauge, to the one of the cases, the tri-vector-mode, giving it a double pole in its Goldstone propagator, vs. its truth in the Sudakov type with a single pole mode Goldstone propagator.

The fits between expansions of the phonon derived from slicing's, and the instanton derived from inverse arguments of differently coupled cosine's, are surprisingly proportional to their projected (2 to 3 in their extended diagrams) normalization factors paving ways into a BSM popped up selectivity method.

§1- Introduction

The muon magnetic moment anomalous Hadronic term under the Light-to-Light scattering has non-trivial diagrams, which however, as in here, when related to the coupled-uncoupled extension a

difference in the vacuum energy appears. Due the spontaneous breaking reaches a structure of coupled-decoupled resonant particles (being so a minimal model universal extension) [1].

Geometrically, an insight may be gotten from its conformal gauge variation as also can be described in a Mobius, with its edges are subject to a twist, thus leading into a difference between the partition function and the effective action, [2], that can surely accumulate till reaching a non-conformality, such that with a limiting technique, singularities are wiped-out, into an equivalent conformal deficiency (i.e. non-minimal), App. A. The interpretation of the energy difference is straightforwardly seen also from the parity separation with one extra degree of freedom in the Heisenberg-Euler Dirac sea description [3], filling into then the deficiency.

The presence of a ridge plus having the long range correlation, [4, 5], being appearing together with a saturation where survive only the quantum interferences among the short range with even interfered correlations, [6]. Meanwhile, the long ranges are the result of the odd interferences, [7], with the higher loop corrections being negligible.

This phenomenon or the similar processes occurring in the high energy expanding universe are also the agent for transmitting the fluctuations in the background vacuum energies into long range correlations causing gravitational redistributions, and whose imprinted traces remained after their cooling into the CMB fluctuations, [5].

Since the longitudinal modes are treatable classically and only the quantum corrections appear in the transverse so their parallel transport accompanied with the longitudinal modes, will shift however with discrete conserved Killing angles as the discontinuities in our approach then, the new insertions or physics necessitating the CP violations (as associated with the longitudinal modes) will appear in the limiting accumulations of discontinuities of the transverse modes so they can be

treated following a non-Gaussian classical limit viewed later on as an extended continuation between the phonons and the instantons.

One confirmation of a such logic is an off-hand estimation involving the idea of reducing the used diagrammatic extension by one side for the two different concerned configurations, that of the magnetic dipole being equivalent to a diagram of five sides and that of the electric dipole being equivalent to a diagram of six, so resulting in 6 vs. 7 diagrams which after being contracted by two for interferences gives 4 vs. 5 dof so in total a gain of 20 longitudinal correlations, from where the ratio of the Reggeized hadronic LbL (RHLbL), [8], to the anomalies subtracted Hadronic LbL, [9] should be around

$$\frac{1}{(20-1)} = \frac{1}{19} \approx \frac{13}{251} \cong \frac{1}{19.3} \text{ with an error of the order of } \frac{0.3}{19.3} \approx \frac{1}{2^6}$$

So is consistent with the interference among all the anomalies.

Further, the charm quark seems to obey more of non-linear contributions then the up quark, the thing understood via the above correlation properties when applied within the concept of the transition between Color Glass Condensate (CGC) into the plasma, [10]. Then, its similarity to LFV.

Then, an extra check comes from including the charm contribution ratio to RHLbL being

$$\frac{6}{13} = \frac{12}{26} = \frac{14-2}{2 \times 13} = \frac{2-\text{contraction in one branch}}{\text{dual branch}}$$

Since as seen in the CGC the charm (or any non-light quark) acts independently from light quarks.

The method will not favor New Physics from inert structured leptons' (most likely neutrino's) flavor violation alike in a resonant Higgs chiral insertion can stuck to its reduced LbL diagrams, [11], unless a two order of magnitudes higher search is carried out, with the fillings seen feasible by an instanton-phonon transition originating from the non-abelian QCD supra-conductor strings shifts.

The paper is divided as follows. §2 treats the deduction from the em dipole dipole energy distribution (can be Reggeized to prove its minimality) compared to when non-minimally extending with anomaly elimination. §3 deals with the double pole of the Goldstone and when that originates from single poles, so there is a need to fit the incoming phonon with the outgoing instantons. The dependences of the coupled-decoupled system sort out between the above system LFV chiral insertions from new physics.

§2. General interpretation

a- Vacuum dependent coupled system

The Cauchy-Schwartz equation is a general equation that apply to any triangular, penguin or dipolar types of diagrams as long it is kept correct the alternateness of its extra virtuality $\Delta\kappa$, [12].

Since the next combined connected topology i.e. next to resonance order, has a geometry of six sides, so for such new physics discontinuity (to appear or also when to be approached after an anomaly or a variant form factor), depends on a skip variable, as proved in [1].

The system separates into either externally coupled to the sides so being its skip and $s = 6$, or not so internally skipping sides with $s = 5$.

Due the logic that two Cauchy-Schwartz vectors are independent of the extension, then the angles can repeat on each side specifically in one direction for $(s - 1 + 1)^2 = s^2$ and in the other direction for $(s + 1)^2$, represented however, with its power divided by 4 due when taken in a ratio form such $\left(\frac{s}{s+1}\right)^i$. The formula to be considered is,

$$(1 + \cos \theta_i) = \left(\frac{s+1}{s}\right)^i (1 + \cos \theta_0) \Leftrightarrow \cos \theta_i = \left(\frac{s+1}{s}\right)^i (1 + \cos \theta_0) - 1 \quad (1)$$

The two sets are characterized respectively by their linked into coupled degrees of freedom as

$\left(\frac{6}{5}\right)^i (1 + \cos \theta_0) - 1$ Magnetic dipole moment double triangle extension loops

$\left(\frac{7}{6}\right)^i (1 + \cos \theta_0) - 1$ Electric dipole moment hexagon extension loops

View the last result being outcome from a discontinuity associated with the vacuum correction; that is the corresponding for the value $i = 1$. Then, the values for $i = 0 \times \frac{1}{2^4} = 0$ is gotten by inverting, see [13] for full derivation.

The numbers can be deduced,

	$i = 0$	$i = \frac{1}{2^4}$	$i = 2 \frac{1}{2^4}$
$\left(\frac{7}{6}\right)^i (1 + \cos \theta_0) - 1$	0.798	0.8156	0.832
$\left(\frac{6}{5}\right)^i (1 + \cos \theta_0) - 1$	0.795	0.8156	0.836

The diagrams are represented in Fig. 1 with a non-minimal (non abelian) characteristic seen in Dipole due to that $p_2 = p_1 + \gamma$ vs. $p'_2 = p'_1 + k + \gamma$, as however a change in the momentum sense (sketched as a change in arrow sense) will not change its linked to propagator double vertices due to its unique chiral insertion under an imposed magnetic field, while in the Hexagonal case it can have two chiral values at a side or another from the middle traversing line.

These matters are elaborated later eg. in §3-1 for how helicity angles coordinate with polarization.

Fig. 1 Types of triangle

extensions after a skip: Left with a base of internal vertices. Right all vertices are external. One example of the common basis side to the two half hexagon shifted with the change of the middle arrow leading to the opposite orientation (or helicity).

b- Consequences

The above reasoning is true whenever there are diagrams, taken in illustration as for the muon magnetic moment, which couple differently whether with or without any new physics since that has to do with the specified internal graph number of degrees of freedom, all can strictly be coming from those links (related to the free degrees) interacting directly with a composite Higgs magnetic resonance, that can cause then from its rising of the internal energy such it reaches higher leptonic states and by so violating the quantum number of the leptons, or ending in an LFV.

As however we can start further with details about the existence also of a new physics.

The due difference in numbers appears since, any created particle, either or not a new physics one, during its induced minimal resonance, with a selected angle (could that be induced by a magnetic phase as was derived in part I or any external interaction), will have as the determinant variation for the in-between change, being fully popping up or interacting with any graph leg, see formula (56) in [1], such like plus, when re-separated (or dismantled from the resonance) into the minimal

triangle the angle divides then being redistributed on a triangle, however, with the presence of interactions may be picking up some of the vacuum differently, if its graph is the decoupled or the coupled one.

Given also that the graph distributes such over three lattice points for the triangle-hexagon while over two points for the double-triangle-triangle, while however conserving in both the same orientations, here due to the 2-color projective polarization in the hexagon, see §3.4-5 down proofs.

§3- Coupled vs. New Physics

Given the all of the above criteria related hypothesis, the analysis can be applied on the distinctive decision on new physics, among which the Hadronic Light-by-light, [11 2nd], scattered amplitude contribution to the muon magnetic moment [11 1st], with its diagrams topological changes are displayed in Fig. 2. These facts, apply in above diagrams when taken separately, in the totally different Lagrangian. So a confirmed interpretation then concerns a helicity-polarization analytical de-extension (since 2-colors proved down prevail on 3's) as what behind the energy difference. The advantage in the method is that one has gained two order of magnitude higher in precision.

1- Simple vs. Double Poles in Goldstone Modes

One should look for an interpreted confirmation, especially in terms of an analytical resolution since an analytical de-extension was the reason behind the energy difference.

That luckily is possible due to the finding that Goldstone modes when in the form vector (later justified, as well, longitudinal) or scalar can induce double poles in their propagators except when their diagrams operators are gauged under unitary Landau $R_\xi, \xi \rightarrow 0$, where then the pole is educible to be single.

These facts, apply to the above diagrams when taken separately, in the totally different Lagrangian such containing besides the Dirac usual Lagrangian, with moments lead into by connecting to it, the magnetic dipole has $L_{FF} = \frac{1}{4} F_{\mu\nu} F^{\mu\nu}$; whilst the anomalous electric dipole has $L_{\tilde{F}F} = \tilde{\theta} \frac{\alpha_s}{8\pi} \tilde{F}_{\mu\nu} F^{\mu\nu}$, which is a total divergence, [14].

One can easily but not immediately see this, by doing a logic similar to resolving the $U(1)_A$, but bit differing since it will involve an extra skip, [1], which can be also prohibitive of one channel full correlation, since by the equivalence theorem scaling property then proved, that leads the channel to enjoy a new degree of freedom.

In fact, unlike the elimination of the $\frac{1}{q^2}$ singularity appearing in the $U(1)_A$, that was due to the lack of the gauge invariance such that that cancels by the new gauge difference.

But if a skip happens within the system, a change of sign can reverse the cancellation and that skip seemed to be into the non-suppressed Goldstone mode, [15], associated with mesons, [16], of components that are only longitudinal or scalar so they distinguish from photons.

These components are due to that the Goldstone modes in the Higgs $SU(2)$ doublet are replaced by the meson components multiplied by the Pauli matrices, whose combinations leave only the scalar and the longitudinal components.

If one think in terms of the propagator poles, that gauge is chosen to be the Landau Gauge (Unitary R_ξ gauge with $\xi \rightarrow 0$).

That would be applicable as accustomed to the mere lonely corresponding graphs derived from topologically equivalent to the ones associated with the Lagrangian $L_D + L_{FF}$, and so the double pole, of [16], becomes a single pole, unlike those of $L_D + L_{\tilde{F}F}$.

Explicitly, the Goldstone mode contributing to the propagator poles, are singly degenerate in $L_D + L_{FF}$ to the contrary as in $L_D + L_{\tilde{FF}}$ where are doubly degenerate, as checked in [17] having to assume that all unitary gauges (theirs $\xi = 1$) are equivalent as they have firmly proved. A confirmation of this result is by rechecking above claim of chirality change skip.

Thus, consider a different but more customary $A_a^0 = 0$ temporal gauge, so for $SU(2)$

$$A^i(\vec{r}) = \Omega(\vec{r})A^i(\vec{r})\Omega^{-1}(\vec{r}) + \frac{i}{g}\Omega(\vec{r})\nabla^i\Omega^{-1}(\vec{r}), \text{ whose last term hints at a vacuum solution}$$

$\Omega_n(\vec{r}) \xrightarrow{\vec{r} \rightarrow \infty} e^{2\pi i n}$, so the operator Ω_1 is a raising operator for the states $\sum_n e^{-in\theta}|n\rangle$, and when

applied in the winding number v times, one recovers the instanton relation

$$v = \bar{\theta} \frac{\alpha_s}{8\pi} \int dx^4 \tilde{F}F.$$

Defining the axial current for $SU(2)_A$, $J_{5i}^\mu = \bar{q}\gamma_5\tau_j q$; its correlation function of the Nambu-Goldstone states (having the quarks be massless) has a pole at $q^2 = 0$,

$$M_{ij}^\mu(q) = \int d^4x e^{-iqx} \langle T(J_{5i}^\mu(x), \bar{q}\gamma_5\tau_j q) \rangle \sim \frac{\langle \bar{q}q \rangle \delta_{ij} q^\mu}{q^2} + \text{non singular} \quad (2)$$

Also, similarly, for the $U(1)_A$ current, and due its $J_{5i}^\mu(x)$ is not conserved, $\partial_\mu J_5^\mu = \frac{\alpha_s}{8\pi} \tilde{F}F$ which is

defined from $\tilde{J}_5^\mu = J_5^\mu - \frac{\alpha_s}{8\pi} K^\mu$, with $\tilde{F}F = \partial_\mu K^\mu$, so

$$\tilde{M}^\mu(q) = \int d^4x e^{-iqx} \langle T(\tilde{J}_5^\mu(x), \bar{q}\gamma_5 q) \rangle \sim \frac{\langle \bar{q}q \rangle q^\mu}{q^2} + \text{non singular} \quad (2)'$$

For the conserved current $\tilde{Q}_5 = \int d^3x \tilde{J}_5^0$, it transforms as

$$\Omega_1 \tilde{Q}_5 \Omega_1 = \tilde{Q}_5 + 2 \quad (3)$$

Representing the customary elimination of the singlet current with the doublet.

As for the $n_f = 2$ the vanishing of the different flavor lepton mass at vacuum or at infinity leads to its neglecting the distinction. With the fact that the total winding or charge has changed by two

units, there can be two $v = 1$ non-abelian, [1, 18], sub-structures each with a different group, however since only the skip is applied among the inner longitudinal or scalar modes, and while the map is parity independent, the CP violation appears in the charge leading to the non-reduction of the double pole deduced from $M_{ij}^\mu(q) * \tilde{M}^\mu(Q - q)$, instead of $M_{ij}^\mu(q) * \tilde{M}^\mu(Q - q)$.

The Logic are shown also in fig. 1, where it is explained the difference in relevance to the twist between the first graph which is invariant, while for the second it is non-invariant.

The non-abelian character is confirmed up to the zero modes even when these two mere connected graph are extended to being non-connected but the gluons lines are attached getting as so the new full connected diagrams, in the application of qcd condensates (also superconductive) in the form of strings, [19], see also §3.5 the consistency confirmation down subparagraph.

2- Gradient longitudinal potential: As e.g. Meissner current phonons switched into instantons

The extension formulation was derived from a type of regularization, [1], performed on Higgs-gamma-gamma resonant particle creations. However, its link to the occurrence of the single zero emission is only true due to the perturbartion by the W-seagull, [20], such of minimal or even zero massless multi- spin 1 emissions.

Being in the configuration that of going beyond its minimal resonance, leads to the mode shifting toward collectivity with then the lowest unperturbed emitted modes are analog to the phonon. The phenomena appears because due the current has a derivative structure, [21], in the form

$$J_i(q) = \sum_{j=1}^3 K_{ij}(q) A_j(q) \quad (4)$$

Where $A_j(q)$ is the electric potential.

One can check that the different currents generated by different senses inside the hexagon will have an invariant energy as is the case if associated with the Meissner effect, which brings a difference in vacuum energy since by excluding the surrounding field, following the method described by ref.

The factor K_{ij} for free electrons divides into two pieces respectively coming:

For K_{ij}^1 from the spinor wave being transformed with the gauge $\Psi \rightarrow e^{i\alpha\tau_3}\Psi$, where τ_3 is the third component of the Pauli matrix, added to it a non-perturbative variation such instead of a conserved continuity equation it has $\frac{\partial \rho}{\partial t} + \vec{\nabla} \cdot \vec{j} = 2\Psi^\dagger \phi \tau_2 \Psi$, leading that

$$K_{ij}^1 = -\delta_{ij} \frac{e^2}{2m} (\langle 0 | [\Psi^\dagger(x), \tau_3 \Psi(x)] + \{\Psi^\dagger(x), \Psi(x)\} | 0 \rangle) \equiv K_{ij}^{1a} + K_{ij}^{1b} \quad (4)'$$

And for K_{ij}^2 it is the factor for the longitudinal potential insertion $A_j(q) = q_j \lambda(q)$, so expressible to start as a gradient.

As proved by ref. [21] author, after Fourier transforming, the factors K_{ij}^{1a} and K_{ij}^2 cancels out.

The remaining will contain the non-perturbative term

$$K_{ij}^{1b} = -\delta_{ij} \frac{e^2}{2m} (\langle 0 | \{\Psi^\dagger(x), \Psi(x)\} | 0 \rangle) \text{ whose self-vertex representation } \Gamma^b(p, p) = 2i\tau_2 \phi \quad (5)$$

Will vary as anomalous term, so the phonon of the non-conservative term opens the way for an instantonic solution as proved in App. A&B.

3- Vacuum energy variation

The above reasoning is true whenever there are diagrams, taken in illustration as for the muon magnetic moment, which couple differently whether with or without any new physics since that has to do with the specified internal graph number of degrees of freedom, all can strictly be coming from those links (related to the free degrees) interacting directly with a composite Higgs magnetic

resonance, that can cause then from its rising of the internal energy such it reaches higher leptonic states and by so violating the quantum number of the leptons, or ending in an LFV.

As however we can start further with details about the existence also of a new physics.

The due difference in numbers appears since, any created particle, either or not a new physics one, during its induced minimal resonance, with a selected angle (could that be induced by a magnetic phase or any external interaction), will have as the determinant variation for the in-between change, being fully popping up or interacting with any graph leg, see formula (56) in [1], such like

$$\delta\Delta_{\text{res}} = \frac{4}{256} = \frac{1}{64}$$

Plus, when re-separated (or dismantled from the resonance) into the minimal triangle the angle divides then being redistributed on a triangle,

$$\delta\Delta_{\text{out-res}} = \delta\Delta_{\text{res}} \times \frac{1}{2} \times 3 = \frac{3}{128} = J = \delta\theta_{\text{dbl}} \quad (6)$$

The NP guess, when assuming a zero order correctness in chiral insertion, on is that the double angle θ_{dbl} is the same as the angle $\theta_{\text{disc}} = \text{Arccos } 0.8156$, which is eliminating non-minimal effects from anomalies, and accompanying among the four on-shell gamma photons.

However, with the presence of interactions may be picking up some of the vacuum differently, if its graph is the decoupled or the coupled one.

The way to see that is the density diffusion approach, [22], $\mu(J, U) = \text{cst} \times \exp\left(\frac{2J}{\kappa} \frac{N^2}{N^2-1} \text{tr} U \text{tr} U^\dagger\right)$.

Given also due to that the graph distributes such over three lattice points for the triangle-hexagon while over two points for the double-triangle-triangle, such appears then as follows

$$\mu_{\text{decpl}} = \text{cst} \times \exp\left(\frac{2}{\kappa} J \frac{N^2}{N^2-1} \text{tr} U \text{tr} U^\dagger\right) \text{ And } \mu_{\text{cpl}} = \text{cst} \times \exp\left(\frac{2}{\kappa} \frac{3}{2} J \frac{N^2}{N^2-1} \text{tr} U \text{tr} U^\dagger\right) \text{ So } \frac{\delta\mu}{\mu} = \delta J = \frac{J}{2} \quad (7)$$

Then, taking into consideration that the δJ relates to a single leg Hamiltonian, [23], and that density

is an energy density of single legs so $\frac{1}{2} = \frac{\delta\mu}{\mu} = -\frac{\delta E}{E}$.

Therefore, if that re-enters in resonance in the new coupling, it is not just the vacuum

$$\left. \frac{\delta E}{E} \right|_{\text{cpl}} = \frac{\sin \theta_0}{\cos \theta_0} \delta \theta_0 = \frac{.003}{0.795} = 0.00377 \quad (8)$$

Which about is simply its moments change from magnetic to electric moments under a single

resonance that contains a reduction value, counted from eq. (6),

$$\left. \frac{\delta E}{E} \right|_{\text{NP}} = \frac{1}{2} \frac{\sin \theta_{\text{dbl}}}{1 + \cos \theta_{\text{dbl}}} \delta \theta_{\text{dbl}}^{\text{vac}} = \frac{1}{2} \left(\frac{0.5788}{1.8156} \right) \frac{3}{128} = 0.00373 \quad (9)$$

Being either renormalized from higher diagrams so $\frac{3}{128}$ is a multiplicity factor or stemmed from

new particle decays with $\frac{3}{128}$ is a part of the NP couplings calculated in [1].

One has to distinguish then, through that induction of $\Delta \frac{\delta E}{E} / \frac{\delta E}{E}$ of an around 1% difference, whose origin (appearing through $\delta \theta_{\text{dbl}}^{\text{vac}} = \frac{3}{128}$) is to be decided by experiment.

The advantage in the method is that one has gained two order of magnitude higher in precision.

4- Chiral insertion new parameterization

One can turn the logic around with the aim that searching for the BSM particles may be over ruled by some deviations from the Standard Model that are directly coupling-wise weaker, such an inert neutrino than the SM model but so may be stronger than the new physics particles' couplings.

By that it is meant, that the neutrino's chiral insertion angle may be the first to be reached.

That turn of logic is done by changing the hypothesis of fixing the value of $\left. \frac{\delta E}{E} \right|_{\text{NP}}$ at the value of $\left. \frac{\delta E}{E} \right|_{\text{cpl}}$

then check for the value of θ_{dbl} compared to θ_{disc} as well as its variation with respect to $\left. \frac{\delta E}{E} \right|_{\text{cpl}}$ with

the definition of $\frac{256}{3} \left. \frac{\delta E}{E} \right|_{\text{cpl}} \equiv \rho^{-1}$ such that $\rho = \frac{3}{256} \times \frac{1}{0.00377} \approx 3.108$.

$$\rho\sqrt{1 - \cos^2 \theta} = 1 + \cos \theta \Leftrightarrow \rho^2 - \rho^2 \cos^2 \theta = 1 + 2 \cos \theta + \cos^2 \theta \Leftrightarrow 0 =$$

$$(1 + \rho^2) \cos^2 \theta + 2 \cos \theta + 1 - \rho^2 \Rightarrow \Delta' = \rho^4 \text{ plus } \cos \theta_1 = -1 \text{ and } \cos \theta_2 = \frac{-1+\rho^2}{1+\rho^2} \cong 0.812 \quad (10)$$

Therefore for a differently coupled system, a minimal insertion angle at the meta-stable θ_{dbl} is

searched, by noting $\sigma \equiv \frac{\delta E}{E} \Big|_{cpl} = \frac{3}{256} \rho^{-1}$ with $\frac{\delta \sigma}{\sigma} = -\frac{\delta \rho}{\rho} = \frac{0.00004}{0.00373}$, and $\sin \theta_2 = \frac{2\rho}{1+\rho^2} = 0.583$, such

$$\begin{aligned} \sin \theta_2 \cdot \delta \theta_2 &= -\frac{2}{(1+\rho^2)^2} \times \frac{\delta \rho^2}{\rho^2} \rho^2 = \frac{\rho^2}{(1+\rho^2)^2} \frac{\delta \sigma}{\sigma} \\ \Rightarrow \delta \theta_2 &= \frac{1}{\sin \theta_2} \frac{\rho^2}{(1+\rho^2)^2} \frac{\delta \sigma}{\sigma} \approx \frac{1}{0.583} 0.340 \frac{4}{373} = 0.00115 = \frac{1}{870} \end{aligned} \quad (11)$$

As for the popping extra solution $\cos \theta_1 + 1 = 0$, it is conceivable that it is due to that the equation from the start can be written as

$$\delta[\ln(1 + \cos \theta)] = cst = \delta[\ln(1 + \cos \theta_0)] \Leftrightarrow \delta \left[\ln \frac{(1+\cos \theta)}{(1+\cos \theta_0)} \right] = 0 \Rightarrow \ln \frac{(1+\cos \theta)}{(1+\cos \theta_0)} = cst \quad (12)$$

Where it can be set the constant either null or non-null, giving then the trivial first case.

The way to interpret it is through the Cauchy-Schwartz as one expect a direct linear (chiral) insertion independent of any impact.

Given the all the above criteria related hypothesis, the analysis can be applied on the distinctive decision on new physics, among which the Hadronic Light-by-light scattered amplitude contribution to the muon magnetic moment [5], with its diagrams topological changes are displayed in Fig. 2.

That can be geometrically confirmed approximately, due the negligence of the original kink impact whose origin comes from gravity, as well it can be checked that the order of magnitude from the spread of the instanton over the Meissner field region to that of the constant field phonon are comparable. So that should be supplemented by a regularization factor. In numbers, $\theta_2 =$

$\cos^{-1}\left(\frac{-1+\rho^2}{1+\rho^2}\right) \cong \cos^{-1}(0.812) = 35.67, \theta_0^5 = \theta_0 = 37.35; \theta_1 = \cos^{-1}(.816) = 35.35$. Also, the minimal insertion angle applies on all the different coupled sides of number seven, $\delta\theta_0^6 = 7\delta\theta_2$

$$\frac{\theta_1 - \theta_0}{\theta_2 - \theta_0} (\delta\theta_0^6) \cong 1.19 \frac{7}{870} \sim \beta \frac{1}{128} \leftrightarrow \frac{\delta\theta_{dbl}^{vac}}{3} \quad (12)'$$

Getting the renormalization factor being $\beta \sim \sqrt{3/2}$.

Which is to be expected since simply, because two lower energy phonons of constant transverse waves formed from the not yet resonant slices, decayed through the derivative-like adjunction of mass formation into three instanton-like waves that which occur during the coupled resonance, being then spread in the space-like wise.

5- Important extra confirmations based on the imposed conditions

Since Gravity has had a role in the derivation, in the form of the force from dilaton-kink interaction with the Higgs, of the type $\delta\theta_0^6$ solution, being associated with a space-like structure reinstating the CP violations [1], one has then to check the satisfaction (or even the consistency) about the dilaton field being defined in the right domain. One of the solutions found, [25], since it is non-static does not have a time-like Killing vector, so all its invariants are space-like as already proved, further, such Brans-Dicke dilaton has a nude singularity-type, since its singular has no horizon, therefore there cannot be any place for the extra above-energy be hidden from which the consistency with the new extra coupled system.

Another consistency confirmation is from the other extreme of electromagnetic fields, where it was proved the non-rule out of the phononic-electronic interaction in the presence of spin fluctuations in thin Superconducting materials, [26], therefore the need for a CP helicity invariance whose proof was provided above in here.

Theoretically, the existence of the 'orientable' strings with a topological character, since the system derives from the interaction with kink-cusp like topological defects, was not ruled out but never proved assuredly. That was mentioned in the form of that a kink solution in the case of a single 1+1 scalar field is proved stable from the disconnected vacuum manifold ($\pi_0(V) \neq 1$) as a time independent solution, [27]. Now the orientation of the structure under the condition of fig. 1 leads to that with two acted on fields in the diagram have a common ground instead circular (that unlike would be the case of three colors map), then the $SU(3)$ group will go to its dual $SU(3)'$, therefore the model has the equivalent $O(3)$ group structure (of course complexified) which happens of having a stable non-trivial winding sector under the radial orbital variation, [28], which we started with as an initial generator condition from the acting topological strings into the extension mechanism, [1].

6- Polarized beams

Experimentally, in the domain of polarized beams, there appeared a full coordination between electron positron polarization as vs. their chiralities, therefore the doubling of the quasi-particles, as an electron particle-hole, applies here in the $e^- - e^+$, as shown experimentally in unpolarized beams, the left of Fig. 3 from [29], while in its center and right no correlation except for identically polarized beams, such is due for the quantum coherence barrier whose energy is two order of magnitudes higher than the phonons break energies, with the later is proved as reached above.

Appendices:

A- Deficient Solitons

Consider the non-conformal iterative skipped resolution expressed via a remainder r , such

$$e^{\gamma\omega_2} = (b\pi + r)r$$

Where γ is the real number $\ln 2$, with b is a dimensional factor for the phase variable whose

interpretation appears related to the number allowable of product spaces as, $bd \equiv 2\epsilon \Rightarrow b = \frac{2\epsilon}{d}$, for

the combined d phases, such that when the angle is larger than π , than r is negative.

The limit case values for the resolution is $-b\pi \leq r \leq b\pi$, so with n the electroweak seagull number,

$$\pi\left(\frac{2n}{d} - b\right) \leq b\pi + r \leq \pi\left(\frac{2n}{d} + b\right) \Rightarrow -b\pi^2\left(\frac{2n}{d} - b\right) \leq (b\pi + r)r \leq b\pi^2\left(\frac{2n}{d} + b\right) \quad (A1)$$

Which, for single diagram and the dimension $d = 4$, and $b = \frac{1}{2}$ turns

$$0 = -\frac{\pi^2}{2}\left(\frac{2n}{d} - \frac{\epsilon}{2}\right) \leq (b\pi + r)r = e^{\gamma\bar{k}} \leq \frac{\pi^2}{2}\left(\frac{2n}{d} + \frac{\epsilon}{2}\right) \quad (A2)$$

That accepts two conformal solutions only by the unicity of the above skip multitude

$$\epsilon = \pm 1; n = 1 \Rightarrow 0 \leq |e^{\gamma\bar{k}}| \leq \frac{\pi^2}{2} \Rightarrow e^{\gamma\bar{k}} \xrightarrow{\text{rarefication}} \pm \frac{\pi^2}{2} \quad (A3)$$

$$\epsilon = 1; n = 2 \Rightarrow -\frac{1}{2}\pi^2 \leq e^{\gamma\bar{k}} \leq \frac{3}{2}\pi^2 \Rightarrow e^{\gamma\bar{k}} \xrightarrow{\text{densification}} \frac{3}{2}\pi^2 \quad (A3-a)'$$

$$\epsilon = -1; n = 2 \Rightarrow -\frac{3}{2}\pi^2 \leq e^{\gamma\bar{k}} \leq \frac{1}{2}\pi^2 \Rightarrow e^{\gamma\bar{k}} \xrightarrow{\text{densification}} -\frac{3}{2}\pi^2 \quad (A3-b)'$$

The gotten number $\bar{k}$, or ω_2 in above notation, for the given γ , represents a width for a possible wiping out of singularities, therefore such a number can be named as a deficiency number.

B- Instantons Triple Isotropy

The instantons', proved in §3-4, can have an isotropic character as applied to perturbed created particles in the vacuum, like in App. A.

That can be proved as the regularization, in [1], was based on the fact that $M_W \leq l_\perp \leq l_l$, with non-constant integration was formed on the variable l_l . Therefore, the non-trivial $l_\perp = l_l$ relation is best manifest in its meaning as it imposes an isotropic type condition first between the longitudinal and the transverse total momentum. In the case of the final emission is made of light then also time is

isotropic to the longitudinal component making the system triply isotropic, as used in the appendix, concerning its minimal singularity kernel to the extension.

Furthermore, it can be made use the extra degree of freedom remaining in the transverse current to prove the possible generated magnetic field being constant, (as when the vectorial product of $\mathbf{j}_x = \rho_x \mathbf{v}_x$ and $\mathbf{j}_y = \rho_y \mathbf{v}_y$, where now according to [24], $\rho_y = a\rho_x^{-1}$).

References:

- 1- H.W. Maalouf Int. J. Mod. Phys. A Vol. 36, No. 10, 2150039 (2021)
- 2- O.D. Andreev and A.A. Tseytlin Nucl. Phys. B311 (1988/89) 205-252
- 3- W. Heisenberg and H. Euler, Z. Phys. 98, 714 (1936), physics/0605038
- 4- B. Srivastava (STAR Coll.), Int. J. Mod. Phys. E16, 3371 (2008)
- 5- N. Armesto, L. McLerran and C. Pajares Nucl. Phys. A 781, 201 (2007) hep-ph/0607345v1
- 6- A. Dumitru, F. Gelis, L. McLerran and R. Venugopalan arXiv:0804.3858v1 [hep-ph]
- 7- Y.V. Kovchegov and V.V. Skokov hep-ph/1802.08166
- 8- H. Li, Z-W. Lin and F. Wang hep-ph/1804.02681
- 9- F. Dominguez and C. Marquet hep-ph/1210.1141v2
- 10- G. Colangelo, F. Hagelstein, M. Hoferichter, L. Laub and P. Stoffer JHEP03 (2020) 101, 1910.13432
- 11- (Muon g-2 Coll) Phys. Rev. Lett. 126, 141801 (2021); T. Blum, N. Christ, M. Hayakawa, T. Izubuchi, L. Jin, C. Jung and Christoph Lehner Phys. Rev. Lett. 124, 132002 (2020)
- 12- H. Li, Z-W. Lin and F. Wang hep-ph/1804.02681
- 13- H.W. Maalouf A Covariant Cauchy-Schwartz Measure's, pre-submitted to journal

- 14- R. D. Peccei 9606475
- 15- G. 't. Hooft Phys. Rep. 142, No. 6 (1986) 357-387
- 16- B. Henning, D. Lombardo, M. Riembau and Francesco Riva 1812.09299v2 [hep-ph]
- 17- S-Y. Li, Z-G. Si and X-F. Zhang 1705.04941 [hep-ph]
- 18- M.S. Volkov and D.V. Gal'tsov, Phys. Rep. 319 Nbr 1-2, 1q-83 (1999).
- 19- E. Nakano, M. Nitta and T. Matsuura 0708.4096 [hep-ph].
- 20- R.W. Brown, K.L. Kowalski and S.J. Brodsky, Phys. Rev. D 28, 624 (1983); R.W. Brown, M.E. Convey and M.A. Samuel Phys. Rev. D. 49 (1994) 2290, 2297 arXiv:hep-ph/9309251
- 21- Y. Nambu Phys. Rev. V. 117, N3, Feb. 1 1960
- 22- T. Eguchi and H. Kawai, Phys. Rev. Lett. 48, 1063 (1982)
- 23- A.A. Migdal and Y.M. Makeenko, Phys. Lett. 88B, 135 (1979)
- 24- The original idea was due to D.A. Kirzhnits, Macroscopic Influence of the Spontaneous Symmetry Breaking in QFT, 18th Intern. Conf. on HEP, Vol. 2, 1976 Tbilisi USSR T5-T8 but applied in lattice form by D.J.E. Callaway Nucl. Phys. B344 (1990) 627-645 eqs. (23) and (59)
- 25- M.O. Roberts Gen. Rel. Grav. 21 (1989) 907-939.
- 26- J. Pelliciari et al. Nat. Commun. 12, 3122 (2021) also Zhang, C. et al. Ubiquitous strong electron-phonon coupling at the interface of FeSe/SrTiO₃. Nat. Commun. 8, 14468 (2017).
- 27- S. Coleman Nucl. Phys. B262 (1985) 263, also A. Achucarro and T. Vachaspati arXiv: hep-ph/9904229v2
- 28- L. Perivolaropoulos Nucl. Phys. B375 (1992) 665
- 29- J. Beyer and J. List 2105.09691v1, Fig.3.

Original connected Diagram unreduced

Reduced with a breaking of one line to reach fig.a

*Fig.a without lines:
2 reduced 1 cut*

*Fig. b without lines:
1 reduced*

Fig 2: Above graph types in a connected Diagram for the magnetic moment. The disconnected diagrams case follows also, due including gluonic lines are topologically to the connected ones.