# Constructing particle generator schemes including supersymmetry for cycles of string vibrations through genus of hypercomplex manifolds

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## Abstract

Considering the origin of the particles an approach has been provided to show the origin of Bosons, Fermions along with supersymmetry (SUSY) from string vibrations in $g \geq 1$ genus of a hypercomplex manifold through $\eta \times \eta$ matrix for the generator $\nabla_{(p,q)}$.

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## Methodology

A topological hypercomplex manifold $T^{\star}$ having genus $g \geq 1$ such that $M \subset T^{\star}$ where $M$ represents the hyperbolic ring of a genus $g$ for the codimension inside the genus being represented as $d$ which in essence is[1],

$$g = \{\phi\}$$

There exists the $n$-dimensions of the hypercomplex manifold $T^{\star}$ having the spacetime coordinate $(\sigma, \rho)$ it can be shown that there exists a defective unit $\epsilon$ for each genus having a signature $(\sigma, \rho)|_{\epsilon}$ where $\epsilon$ depends on odd or even cycles of each strings $s$ having a summation of their coherent structure to be represented as,

$$\sum_{s}$$

Determines the genus signature of $n$-dimensions for the defective unit $\epsilon$ taking the sub $i, j$ for a scheme $\mu$ such that,

$$\ln \epsilon_{ij} = \begin{cases} i = j \text{ for } \mu = \text{ odd or even} \\ i \neq j \text{ for } \mu = \text{ reciprocal} \end{cases}$$

Where the genus signature can be spotted over a multiple sequence of ‘in’ and ‘out’ fibrations in such a way that[2][3],

For the coherent fibre O which in essence determines the summation of the strings $\sum_s$ there exists a factor of coherent fibre length J that determines the length of the cycle $\ell$ that is exactly the length of the fibre determines the length of the ‘in’ and ‘out’ cycle between the genus $g \geq 1$ to input the defective unit $\epsilon_{ij}$ where this can be easily shown that the cycle $\ell$ is given for the matrix $\eta \times \eta$,

$$\textit{for chirality } \mathrm{L}^{+} \begin{pmatrix} \partial & & & & & & & & & & & & \\ & \bar{\partial} & & & & & & & & & & & \\ & & \partial & & & & & & & & & & \\ & & & \bar{\partial} & & & & & & & & & \\ & & & & \ddots & & & & & & & & \\ & & & & & \ddots & & & & & & & \\ & & & & & & \bar{\partial}\partial & & & & & & \\ & & & & & & & \partial\bar{\partial} & & & & & \\ & & & & & & & & \bar{\partial}\partial & & & & \\ & & & & & & & & & \partial\bar{\partial} & & & \\ & & & & & & & & & & \ddots & & \\ & & & & & & & & & & & \ddots & \\ & & & & & & & & & & & & k \end{pmatrix}_{\eta \times \eta} \equiv \epsilon_{ij} \textit{ for } i = j$$

$$\xrightarrow{\Rightarrow \mathrm{Tr}\,(\partial + \bar{\partial} +, \ldots\ldots, k)} \frac{1}{2} (2\pi i) \oint_{\ell} \mathrm{O} \oint_{\ell} \mathrm{O} \oint_{\ell} \mathrm{O}, \ldots\ldots\ldots, \oint_{\ell} \mathrm{O}_k d\mathrm{J} d\mathrm{J} d\mathrm{J} \ldots\ldots\ldots d\mathrm{J}_k \approx \partial \rho$$

Where $\mathrm{L}^{+} \cong \mathrm{L}^{-}$ for $\epsilon_{ij}$ for $i = j$ where $\mathrm{L}^{-}$ can be shown to have the opposite identity but still equal in terms of defect unit for the matrix depiction,

$$\text{for chirality } \mathrm{L}^{-} \begin{pmatrix} \bar{\partial} &&&&&&&&&&&& \\ & \partial &&&&&&&&&&& \\ && \bar{\partial} &&&&&&&&&& \\ &&& \partial &&&&&&&&& \\ &&&& \ddots &&&&&&&& \\ &&&&& \ddots &&&&&&& \\ &&&&&& \partial\bar{\partial} &&&&&& \\ &&&&&&& \bar{\partial}\partial &&&&& \\ &&&&&&&& \partial\bar{\partial} &&&& \\ &&&&&&&&& \bar{\partial}\partial &&& \\ &&&&&&&&&& \ddots && \\ &&&&&&&&&&& \ddots & \\ &&&&&&&&&&&& k \end{pmatrix}_{\eta\times\eta} \equiv \epsilon_{ij} \text{ for } i=j$$

$$\xrightarrow{\Rightarrow \mathrm{Tr}\,(\bar{\partial}+\partial+,\ldots\ldots,k)} \frac{1}{2}(-2\pi i)\oint_{\ell}\mathrm{O}\oint_{\ell}\mathrm{O}\oint_{\ell}\mathrm{O},\ldots\ldots\ldots,\oint_{\ell}\mathrm{O}_{k}dJdJdJ\ldots\ldots\ldots dJ_{k}\approx\partial\rho$$

Where the alternative form having the defect parameter $\epsilon_{ij}$ for $i \neq j$ can be given to represent a chirality $\mathrm{L}^{\pm}$,

$$\text{for chirality } \mathrm{L}^{\pm} \begin{pmatrix} \partial &&&&&&&&&&&& \\ & \bar{\partial} &&&&&&&&&&& \\ && \partial &&&&&&&&&& \\ &&& \bar{\partial} &&&&&&&&& \\ &&&& \ddots &&&&&&&& \\ &&&&& \bar{\partial}\partial &&&&&&& \\ &&&&&& \partial\bar{\partial} &&&&&& \\ &&&&&&& \bar{\partial}\partial &&&&& \\ &&&&&&&& \ddots &&&& \\ &&&&&&&&& \partial\partial &&& \\ &&&&&&&&&& \partial\partial && \\ &&&&&&&&&&& \ddots & \\ &&&&&&&&&&&& k \end{pmatrix}_{\eta\times\eta} \equiv \epsilon_{ij} \text{for } i \neq j$$

$$\xrightarrow{\Rightarrow \mathrm{Tr}\,(\partial+\bar{\partial}+,\ldots\ldots,k)} \frac{1}{2}(2\pi i)\oint_{\ell}\mathrm{O}\oint_{\ell}\mathrm{O}\oint_{\ell}\mathrm{O},\ldots\ldots\ldots,\oint_{\ell}\mathrm{O}_{k}-\frac{1}{2}(2\pi i)\oint_{\ell}\bar{\mathrm{O}}\oint_{\ell}\bar{\mathrm{O}}\oint_{\ell}\bar{\mathrm{O}},\ldots\ldots,\oint_{\ell}\bar{\mathrm{O}}_{k}$$

$$\bar{d}J\bar{d}J\bar{d}J\bar{d}J\bar{d}J\bar{d}J\ldots\ldots\ldots\bar{d}J_{k+} \approx \partial\rho^{-1}$$

Another alternative form is found representing the chirality $L^{\mp}$ for the defect unit $\epsilon_{ij}$ for $i \neq j$,

$$for\ chirality\ L^{\mp} \begin{pmatrix} \bar{\partial} & & & & & & & & & & & & \\ & \partial & & & & & & & & & & & \\ & & \bar{\partial} & & & & & & & & & & \\ & & & \partial & & & & & & & & & \\ & & & & \ddots & & & & & & & & \\ & & & & & \partial\bar{\partial} & & & & & & & \\ & & & & & & \bar{\partial}\partial & & & & & & \\ & & & & & & & \partial\bar{\partial} & & & & & \\ & & & & & & & & \ddots & & & & \\ & & & & & & & & & \bar{\partial}\bar{\partial} & & & \\ & & & & & & & & & & \bar{\partial}\bar{\partial} & & \\ & & & & & & & & & & & \ddots & \\ & & & & & & & & & & & & k \end{pmatrix}_{\eta\times\eta} \equiv \epsilon_{ij} for\ i \neq j$$

$$\xrightarrow{\Rightarrow \mathrm{Tr}\,(\bar{\partial}+\partial+,\ldots\ldots,k)} \frac{1}{2}(2\pi i) \oint_{\ell} O \oint_{\ell} O \oint_{\ell} O,\ldots\ldots\ldots, \oint_{\ell} O_{k+} \frac{1}{2}(2\pi i) \oint_{\ell} \bar{O} \oint_{\ell} \bar{O} \oint_{\ell} \bar{O},\ldots\ldots, \oint_{\ell} \bar{O}_{k}$$

$$\bar{d}J\bar{d}J\bar{d}J\bar{d}J\bar{d}J\bar{d}J\ldots\ldots\ldots\bar{d}J_{k+} \approx \partial\rho^{+1}$$

The bar '—' over O and J has been given to satisfy the equations of the potentials $\partial\rho^{-1}$ with $\partial\rho^{+1}$ and $\partial\rho^{+0}$ with $\partial\rho^{-0}$ to be given below:

1. Two peculiar instances can be found when the cycles will undergo without an 'out' formation and always in 'in' formation and another instances can be found when the cycles will go without an 'in' formation but always an 'out' formation to be depicted in the matrix below which will arise another two conditions,
    1. Either this continue or evolve to any one of the potentials in among this scenario which may contains jumping from one state to another or including its own or eliminating to fall its own potential in the total possibility of its evolution which will carry on for an infinite amount of time representing $\left\{T^{\infty} \nearrow\right\}$ for the $\nearrow$ representing the evolution parameter for the orbit[4],
    $\sum_{I} \cong\ cycles\ I_{(p,q|\rho)}$

Where $\rho$ is a component of time occurs over the potential $\partial^{6}\rho\rho\rho^{+1}\rho^{-1}\rho^{+0}\rho^{-0}$ in two domains that mixed in the infinite evolution $\left\{T^{\infty} \nearrow\right\}$ governing the process of spacetime $(\sigma, \rho)$ with normal space $\sigma$ and frozen space $/_{\sigma}$: more precisely a mixture to be given where there are two possibilities,

1. $I_{\sigma} \not\subseteq \sigma$
2. $I_{\sigma} \subseteq \sigma$

Therefore, the frozen in either of the Points [1 or 2] whichever takes place can be represented via the below matrix,

$$\sigma, \rho|_{I_\sigma} \cong \begin{cases} \text{for chirality } \mathcal{L}^{++} \begin{pmatrix} \ddots & & & & \\ & \partial\partial & & & \\ & & \partial\partial & & \\ & & & \partial\partial & \\ & & & & \ddots \\ & & & & & k \end{pmatrix} \xrightarrow{\Rightarrow} \partial\rho^{+0} \\ \\ \text{for chirality } \mathcal{L}^{--} \begin{pmatrix} \ddots & & & & \\ & \bar{\partial}\bar{\partial} & & & \\ & & \bar{\partial}\bar{\partial} & & \\ & & & \bar{\partial}\bar{\partial} & \\ & & & & \ddots \\ & & & & & k \end{pmatrix} \xrightarrow{\Rightarrow} \partial\rho^{-0} \end{cases}$$

Thus, the cycle can be denoted as,

$$\begin{array}{ccccccccccc} \longrightarrow & \longrightarrow & L^{+} & \longrightarrow & \longrightarrow & L^{\pm} & \longrightarrow & \longrightarrow & L^{++} & \longrightarrow & \longrightarrow \\ \uparrow & & & & & & & & & & \downarrow \\ \uparrow & & & & & & & & & & \downarrow \\ \uparrow & & & & & & & & & & \downarrow \\ \longleftarrow & \longleftarrow & L^{-} & \longleftarrow & \longleftarrow & L^{--} & \longleftarrow & \longleftarrow & L^{\mp} & \longleftarrow & \longleftarrow \end{array} \cong \sum_{I} I_{(p,q)}$$

Where $(p, q)$ denotes the + and – respectively in all of the chirality where in cases the time coordinate $\rho$ appears because of the infinite temporal evolution $\left\{T^{\infty} \nearrow\right\}$ to formulate $I_{(p,q|\rho)}$.

Here in the genus signature $(\sigma, \rho)|_{\epsilon}$ – there is a differential operator $\epsilon$ for the entire hypercomplex manifold $T^{*}$: this particular operator singles out each genus from the previous genus and act correspondingly over a summation of all genera with respect to the fibration cycle $\sum_{I} I_{(p,q)} \equiv \psi$ for each genus such that thee exists the above depicted chain where the independency of the genus is preserved with the connecting operator – the gap between two hyperbolic rings of the genus[5],

$$\kappa \equiv \sum_{m=1}^{\infty} g_m - \sum_{n=1}^{\infty} g_n \exists m \neq n$$

For the differential operator $\epsilon$ to take the value that has been closed through,

$$\coprod_{\psi \in (\Sigma\kappa)} \int_{\epsilon_{(\Sigma\kappa)}} / \sim$$

Thus, for,

$$\int_{\psi} \text{with} \coprod_{\psi \in (\Sigma\kappa)} \int_{\epsilon_{(\Sigma\kappa)}} / \sim$$

It is easy to determine the $(p, q)$ norms of the vibration cycle $\sum_{l} l_{(p,q)} \equiv \psi$ one can determine the types of particles being generated where this can be deduced as the generator of $(p, q)$ $\nabla_{(p,q)}$ for $p = +$ and $q = -$ where if we take $\partial \equiv p = +$ and $\bar{\partial} \equiv q = -$: The generator can be introduced via the $\eta \times \eta$ matrix – one gets the boson, fermion and supersymmetry as,

$$\left\{ \nabla_{(p,q)} \Longrightarrow \left| \begin{array}{lll} \partial\partial & \hookrightarrow & \textit{generates Boson} \\ \bar{\partial}\bar{\partial} & \hookrightarrow & \textit{generates Fermion} \\ \partial\bar{\partial} & \hookrightarrow & \textit{generates Fermion for every Boson } (SUSY) \\ \bar{\partial}\partial & \hookrightarrow & \textit{generates Boson for every Fermion } (SUSY) \end{array} \right. \right\}$$

## Conclusions

The origin of particles has been shown to represent the scenario for the creation of supersymmetry through the chiral operators L and $\eta \times \eta$ matrix that in essence creates the generator $\nabla_{\pm} \cong \nabla_{(p,q)}$ for the hypercomplex potential $\partial^{(6)} \rho\rho\rho^{+1}\rho^{-1}\rho^{+0}\rho^{-0}$ to represent $(p, q)$ norms for the particle creation through the permutation cycle of the vibrations $\psi$ via the differential operator $\epsilon$ in four–possible ways: $\partial\partial$, $\bar{\partial}\bar{\partial}$, $\partial\bar{\partial}$, $\bar{\partial}\partial$.

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