η-DEFORMATION OF THE $\mathrm{ads}_5 \times \mathrm{s}^5$ PURE SPINOR SUPERSTRING

Hector A. Benitez, **Victor O. Rivelles**

June 2018

Universidade de São Paulo

Resume

-We present an integrable deformation of the $\mathrm{AdS}_5 \times \mathrm{S}^5$ pure spinor superstring.

-The deformed model preserves the local symmetries of the theory.

-The resulting model describes a pure spinor superstring in a η-deformed background.

η-DEFORMATION OF THE $\mathrm{AdS}_5 \times \mathrm{S}^5$ GREEN-SCHWARZ SUPERSTRING

-Superstring in $\mathrm{AdS}_5 \times \mathrm{S}^5$ can be formulated as a supercoset sigma model on

$$\frac{\mathrm{PSU}(2,2,|4)}{\mathrm{SO}(4,1)\times\mathrm{SO}(5)}\,.$$

-The superalgebra $\mathfrak{psu}(2,2|4)$ possesses a $\mathcal{Z}_4$ automorphism

$$\mathfrak{g} = \mathfrak{g}_0 + \mathfrak{g}_1 + \mathfrak{g}_2 + \mathfrak{g}_3\,.$$

-Then, the Maurer-Cartan form for an element $\mathrm{g} \in \mathrm{PSU}(2,2,|4)$, which takes values on the $\mathfrak{psu}(2,2|4)$ decomposes as

$$\mathrm{A} = -\mathrm{dg}\,\mathrm{g}^{-1} = \mathrm{A}_0 + \mathrm{A}_1 + \mathrm{A}_2 + \mathrm{A}_3\,.$$

-The classical action for the Green-Schwarz superstring in $AdS_5 \times S^5$ can be written as

$$S_{GS} = -\frac{1}{4}(g^{\mu\nu} - \epsilon^{\mu\nu}) \int 2\mathrm{Str}(A_{\mu 2} A_{\nu 2}) + \mathrm{Str}(A_{\mu 3} A_{\nu 1} - A_{\mu 1} A_{\nu 3}) \,.$$

-By introducing a linear combination of projectors on $\mathfrak{psu}(2,2|4)$ given by $d_{GS} = P_1 + 2P_2 - P3$ the action ca be written as

$$S_{GS} = -\frac{1}{4}(g^{\mu\nu} - \epsilon^{\mu\nu}) \int \mathrm{Str}(A_\mu, d_{GS} A_\nu) \,.$$

-Invariance under local κ-symmetry

$$\delta_\kappa g\, g^{-1} = \{\kappa^1_{+\mu}, A^\mu_2\} + \{\kappa^3_{-\mu}, A^\mu_2\} \,.$$

-Classical integrability: The classical equations of motion can be cast in a zero curvature representation.

-The Yang-Baxter deformation of the $\mathrm{AdS}_5 \times \mathrm{S}^5$ GS superstring (Delduc, Magro, and Vicedo 2014. [arXiv:hep-th/1309.5850])

$$\mathrm{S}_{\mathrm{GS}} = -\frac{1}{4}(\gamma^{\mu\nu} - \epsilon^{\mu\nu}) \int \mathrm{Str}\Big(\mathrm{A}_\mu, \mathrm{d}_{\mathrm{GS}} \frac{1}{1-\eta \mathrm{R}_{\mathrm{g}} \circ \mathrm{d}_{\mathrm{GS}}} \mathrm{A}_\nu\Big)\,.$$

Here $\mathrm{R}_{\mathrm{g}} = \mathrm{Ad}_{\mathrm{g}} \circ \mathrm{R} \circ \mathrm{Ad}_{\mathrm{g}}^{-1}$ where,

$$[\mathrm{R}(\mathrm{X}), \mathrm{R}(\mathrm{Y})] - \mathrm{R}([\mathrm{R}(\mathrm{X}), \mathrm{Y}] + [\mathrm{X}, \mathrm{R}(\mathrm{Y})]) = \mathrm{c}[\mathrm{X}, \mathrm{Y}]\,.$$

- The deformation preserves κ-symmetry

$$\delta_\kappa \mathrm{g}\, \mathrm{g}^{-1} = \{\kappa^1_{+\mu}, \mathrm{J}^\mu_{-2}\} + \{\kappa^3_{-\mu}, \mathrm{J}^\mu_{+2}\}\,,$$

where, we have defined the deformed currents

$$\mathrm{J}_- = \frac{1}{1-\eta \mathrm{R}_{\mathrm{g}} \circ \mathrm{d}_{\mathrm{GS}}} \mathrm{A}\,, \qquad \mathrm{J}_+ = \frac{1}{1+\eta \mathrm{R}_{\mathrm{g}} \circ \hat{\mathrm{d}}_{\mathrm{GS}}} \mathrm{A}\,.$$

-The background fields do not satisfy the type IIB supergravity equations of motion but rather a generalization (Arutyunov et al. 2016. [arXiv:hep-th/1511.05795]).

-The e.o.m depends on two vector fields instead of a scalar field.

$$\begin{aligned} \mathrm{R_{ab}} + 2\nabla_{(\mathrm{a}}\mathrm{X_{b)}} - \frac{1}{4}\mathrm{H_{acd}H_b^{cd}} &= 0\,, \\ \nabla^{\mathrm{c}}\mathrm{H_{abc}} - 2\mathrm{X^c H_{abc}} - 4\nabla_{[\mathrm{a}}\mathrm{X_{b]}} &= 0\,, \\ \nabla^{\mathrm{a}}\mathrm{X_a} - 2\mathrm{X_a X^a} + \frac{1}{12}\mathrm{H^{abc}H_{abc}} &= 0\,. \end{aligned}$$

-For the particular solution $\mathrm{X_a} = \nabla_{\mathrm{a}}\Phi$ type IIB supergravity is recovered.

-In particular for the η-model, this supergravity condition translates into an algebraic relation on the R-matrices, the so-called unimodular condition (Borsato and Wulff 2016. [arXiv:hep-th/1608.03570])

$$\mathrm{R^{AB} f_{AB}^{C}} = 0 \implies \text{Supergravity}\,.$$

THE $\mathrm{AdS}_5 \times \mathrm{S}^5$ PURE SPINOR SUPERSTRING

-The classical PS superstring action in an arbitrary background is given by (Berkovits and Howe 2002. [arXiv:hep-th/0112160])

$$\mathrm{S_{BH}} = \frac{1}{2\pi\alpha'}\int \mathrm{dz}^2\Big(\frac{1}{2}\mathrm{E^a\bar{E}^b}\eta_{\mathrm{ab}} + \frac{1}{2}\mathrm{E^A\bar{E}^B B_{AB}} + \mathrm{d}_\alpha\mathrm{\bar{E}}^\alpha + \mathrm{d}_{\hat\alpha}\mathrm{E}^{\hat\alpha} + \mathrm{d}_\alpha\mathrm{d}_{\hat\alpha}\mathrm{P}^{\alpha\hat\alpha} +$$
$$+\Omega_\alpha^\beta\lambda^\alpha\omega_\beta + \hat\Omega_{\hat\alpha}^{\hat\beta}\hat\lambda^{\hat\alpha}\hat\omega_{\hat\beta} + \lambda^\alpha\omega_\beta\hat{\mathrm{d}}_{\hat\gamma}\mathrm{C}_\alpha^{\beta\hat\gamma} + \hat\lambda^{\hat\alpha}\hat\omega_{\hat\beta}\mathrm{d}_\gamma\tilde{\mathrm{C}}_{\hat\alpha}^{\hat\beta\gamma} + \lambda^\alpha\omega_\beta\hat\lambda^{\hat\alpha}\hat\omega_{\hat\beta}\mathrm{S}_{\alpha\hat\alpha}^{\beta\hat\beta} + \mathrm{S_{gh}}\Big)\,.$$

-To present the correct number of degrees of freedom, it is required to present:

1. A Nilpotent BRST charge

$$\mathrm{Q_{BRST}} = \int \mathrm{j}_-^{\mathrm{B}} + \mathrm{j}_+^{\mathrm{B}}\,, \qquad \mathrm{j}_-^{\mathrm{B}} = \lambda^\alpha\mathrm{d}_\alpha\,, \quad \mathrm{j}_+^{\mathrm{B}} = \hat\lambda^{\hat\alpha}\mathrm{d}_{\hat\alpha}\,.$$

2. The holomorphicity of the BRST currents

$$\partial_+\mathrm{j}_-^{\mathrm{B}} = 0\,, \quad \partial_-\mathrm{j}_+^{\mathrm{B}} = 0\,.$$

-Similarly to the GS model, these requirements imply some constraints on the target superspace.

-It was proven that on-shell supergravity backgrounds satisfy these constraints.

$$\mathrm{S}_0 = \int \mathrm{Str}\left(\frac{1}{4}\mathrm{A}_+ \mathrm{d}_{\mathrm{PS}} \mathrm{A}_- + \omega_{1+}\partial_-\lambda_3 + \omega_{3-}\partial_+\lambda_1 + \mathrm{N}_{0+}\mathrm{A}_{0-} + \mathrm{N}_{0-}\mathrm{A}_{0+} - \mathrm{N}_{0-}\mathrm{N}_{0+}\right)$$

$\mathrm{d}_{\mathrm{PS}} = \mathrm{P}_1 + 2\mathrm{P}_2 + 3\mathrm{P}_3$.

-The bosonic ghosts λ^α and $\hat{\lambda}^{\hat{\alpha}}$ are constrained to satisfy the pure spinor condition

$$\lambda\gamma^{\mathrm{a}}\lambda = \hat{\lambda}\gamma^{\mathrm{a}}\hat{\lambda} = 0\,.$$

-The ghost Lorentz generators are given by

$$\mathrm{N}_{0-} = -\{\omega_{1+}, \lambda_3\}\,, \qquad \mathrm{N}_{0+} = -\{\omega_{3-}, \lambda_1\}\,.$$

-The action is BRST invariant under:

$$\begin{aligned} \epsilon\, \mathrm{Q}(\mathrm{g}) &= (\epsilon\lambda_1 + \epsilon\lambda_3)\mathrm{g}\,, \\ \epsilon\, \mathrm{Q}(\mathrm{w}_{3-}) &= -\mathrm{A}_{3-}\,, \\ \epsilon\, \mathrm{Q}(\mathrm{w}_{1+}) &= -\mathrm{A}_{1+}\,. \end{aligned}$$

$$\begin{aligned}
D_-A_{1+} &+ [A_{1-}, N_{0+}] - [N_{0-}, A_{1+}] = 0\,,\\
D_-A_{2+} &+ [A_{1-}, A_{1+}] + [A_{2-}, N_{0+}] - [N_{0-}, A_{2+}] = 0\,,\\
D_-A_{3+} &+ [A_{1-}, A_{2+}] + [A_{2-}, A_{1+}] - [A_{3-}, N_{0-}] - [N_{0-}, A_{3+}] = 0\,,\\
D_+A_{1-} &+ [A_{2+}, A_{3-}] + [A_{3+}, A_{2-}] + [A_{1-}, N_{0+}] - [N_{0-}, A_{1+}] = 0\,,\\
D_+A_{2-} &+ [A_{3+}, A_{3-}] + [A_{2-}, N_{0+}] - [N_{0-}, A_{2+}] = 0\,,\\
D_-A_{3+} &+ [A_{3-}, N_{0-}] - [N_{0-}, A_{3+}] = 0\,,\\
D_-N_{0+} &- [N_{0-}, N_{0+}] = 0\,, \qquad D_+N_{0-} - [N_{0+}, N_{0-}] = 0\,.
\end{aligned}$$

$$D_- = \partial_- + [A_{0-},\ ]\,, \qquad D_+ = \partial_+ + [A_{0+},\ ]\,,$$

-The Lax pair is given by (Vallilo 2004. [arXiv:hep-th/1203.0677])

$$\begin{aligned}
L_+(z) &= A_{0+} + z^{-3}A_{1+} + z^{-2}A_{2+} + z^{-1}A_{3+} + (z^{-4} - 1)N_{0+}\,,\\
L_-(z) &= A_{0-} + zA_{1-} + z^2A_{2-} + z^3A_{3-} + (z^4 - 1)N_{0-}\,,
\end{aligned}$$

$$\partial_-L_+ - \partial_+L_- + [L_-, L_+] = 0\,.$$

BRST DEFORMATION OF THE $\mathrm{AdS}_5 \times \mathrm{S}^5$ PURE SPINOR SUPERSTRING

-On the pure spinor side there are few examples of consistent deformations.

-A remarkable example is given by (Bedoya et al. 2011. [arXiv:hep-th/1005.0049]). In this work the $\mathrm{AdS}_5 \times \mathrm{S}^5$ pure spinor superstring was deformed in a BRST invariant way (based on the homological perturbation theory).

$$
\begin{aligned}
\mathrm{S}_{\mathrm{def}} &= \mathrm{S}_0 + \eta \int \mathrm{V}_1^2 + \eta^2 \int \mathrm{V}_2^2 + \dots\,, \\
\mathrm{Q}_{\mathrm{def}} &= \mathrm{Q}_0 + \eta \mathrm{Q}_1 + \eta^2 \mathrm{Q}_2 + \dots\,.
\end{aligned}
$$

-In this approach, the first step is to consider a massless vertex operator V[B] (which represents a physical state of the model).

$$\mathrm{V[B]}(\epsilon, \epsilon') = \mathrm{B}^{\mathrm{AB}} \left(\mathrm{g}^{-1}(\epsilon\lambda_1 - \epsilon\lambda_3)\mathrm{g}\right)_{\mathrm{A}} \left(\mathrm{g}^{-1}(\epsilon'\lambda_1 - \epsilon'\lambda_3)\mathrm{g}\right)_{\mathrm{B}} .$$

-At the linearized level, this states yields a deformation proportional to the integrated vertex operator V_1.

$$\mathrm{V}_1^2 = \frac{\eta}{4} \int \mathrm{Str}(\mathrm{Bj}_+, \mathrm{j}_-) .$$

-Once V_1 is known, the full deformation can be constructed as a series expansion in η for the action and the BRST charge

$$\begin{aligned} \mathrm{S}_{\mathrm{def}} &= \mathrm{S}_0 + \eta \int \mathrm{V}_1^2 + \eta^2 \int \mathrm{V}_2^2 + \dots , \\ \mathrm{Q}_{\mathrm{def}} &= \mathrm{Q}_0 + \eta \mathrm{Q}_1 + \eta^2 \mathrm{Q}_2 + \dots . \end{aligned}$$

-The coefficients are determined by imposing BRST invariance

$$\mathrm{Q}_{\mathrm{def}} \mathrm{S}_{\mathrm{def}} = 0 .$$

order by order in η.

-Solving order by order in η we find up to order η^3

$$\begin{aligned} \mathrm{Q}_0\mathrm{S}_0 &= 0\,, \quad \text{(by definition)} && (1)\\ \mathrm{Q}_1\mathrm{S}_0 &+ \mathrm{Q}_0\int \mathrm{V}_1 = 0\,, && (2)\\ \mathrm{Q}_2\mathrm{S}_0 &+ \mathrm{Q}_1\int \mathrm{V}_1 + \mathrm{Q}_0\int \mathrm{V}_2 = 0\,, && (3)\\ \mathrm{Q}_3\mathrm{S}_0 &+ \mathrm{Q}_2\int \mathrm{V}_1 + \mathrm{Q}_1\int \mathrm{V}_2 + \mathrm{Q}_0\int \mathrm{V}_3 = 0\,. && (4) \end{aligned}$$

-For example, the first step is to solve (2) for

$$\mathrm{V}_1^2 = \frac{\eta}{4}\int \mathrm{Str}(\mathrm{B}\mathrm{j}_+, \mathrm{j}_-)\,.$$

-The full deformation can be written as

$$\begin{aligned} \mathrm{S}_{\mathrm{def}} &= \int \Big[\frac{1}{4}\mathrm{Str}(\bar{\mathrm{A}}, \mathrm{d}_{\mathrm{PS}}\mathrm{J}_-) + \mathrm{Str}(\mathrm{N}_{0+}\mathrm{J}_{0-} + \mathrm{N}_{0-}\bar{\mathrm{J}}_{0+}) \\ &- \mathrm{Str}(\mathrm{N}_{0-}(1-4\eta\mathcal{O}^{-1}_{\mathrm{PS}-}\mathrm{B}_{\mathrm{g}})\mathrm{N}_{0+}) + \mathrm{Str}(\omega_{1+}\partial_-\lambda_3 + \omega_{3-}\partial_+\lambda_1)\Big] \,. \end{aligned}$$

-This action must be invariant under the BRST transformations

$$\begin{aligned} \mathrm{Q}(\mathrm{g}) &= \mathrm{g}\big((1-\eta\mathrm{B}_{\mathrm{g}})\lambda_1 + (1+\eta\mathrm{B}_{\mathrm{g}})\lambda_3 \,, \\ \mathrm{Q}(\mathrm{w}_{3-}) &= -\mathrm{J}_{3-} - 4\eta\mathrm{P}_3 \circ \mathcal{O}^{-1}_{\mathrm{PS}-}\mathrm{B}_{\mathrm{g}}\mathrm{N}_{0-} \,, \\ \mathrm{Q}(\mathrm{w}_{1+}) &= -\bar{\mathrm{J}}_{1+} + 4\eta\mathrm{P}_1 \circ \mathcal{O}^{-1}_{\mathrm{PS}+}\mathrm{B}_{\mathrm{g}}\mathrm{N}_{0+} \,. \end{aligned}$$

-We have defined the operators

$$\mathcal{O}_{\mathrm{PS}-} = 1 - \eta\mathrm{B}_{\mathrm{g}}\mathrm{d}_{\mathrm{PS}} \,, \quad \mathcal{O}_{\mathrm{PS}+} = 1 + \eta\mathrm{B}_{\mathrm{g}}\hat{\mathrm{d}}_{\mathrm{PS}} \,,$$

$$\mathrm{J}_- = \mathcal{O}^{-1}_{\mathrm{PS}-}\mathrm{A} \,, \qquad \mathrm{J}_+ = \mathcal{O}^{-1}_{\mathrm{PS}+}\mathrm{A} \,.$$

-B^{AB} is a R-matrix: $Q^2 = 0$ requires that the matrix B^{AB} must satisfy the mCYBE.

-Not all the vertex of the type (1) belongs to the cohomology:
It includes states transforming in the adjoint representation when B^{AB} takes the form $B^{AB} = f^{AB}_{C} A^{C}$.
This family of states corresponds to exact (non-physical) elements,

$$A^{C}\left[g^{-1}(\epsilon\lambda_1 - \epsilon\lambda_3)g, g^{-1}(\epsilon'\lambda_1 - \epsilon\lambda_3)g\right]_{C} = A^{C}\epsilon Q\left(g^{-1}(\epsilon\lambda_1 - \epsilon\lambda_3)g\right)_{C}. \quad (5)$$

-However, the trivial states (5) produce a well defined deformation.
Hence, one expect that the complete deformation presents these type of fields in its target background.

-This can be understood when we take into account conformal invariance; the vertex $V[B]$ is a primary field only when the unitary condition holds

$$B^{AB} f^{C}_{AB} = 0\,, \implies \text{conformal invariance.}$$

INTEGRABILITY

-We can write them in a more suggestive manner by defining the currents $\mathcal{J}_-$ and $\mathcal{J}_+$ as

$$\mathcal{J}_- := \mathrm{J}_- + 4\eta\mathcal{O}^{-1}_{\mathrm{PS}-}\mathrm{R_g}\mathrm{N}_{0-}\,, \qquad \mathcal{J}_+ = \bar{\mathrm{J}}_+ - 4\eta\mathcal{O}^{-1}_{\mathrm{PS}+}\mathrm{R_g}\mathrm{N}_{0+}\,,$$

then, the equations of motion are take the form

$$\begin{aligned}
\mathcal{D}_-\mathcal{J}_{1+} \quad &+ \quad [\mathcal{J}_{1-},\mathrm{N}_{0+}] - [\mathrm{N}_{0-},\mathcal{J}_{1+}] = 0\,,\\
\mathcal{D}_-\mathcal{J}_{2+} \quad &+ \quad [\mathcal{J}_{1-},\mathcal{J}_{1+}] + [\mathcal{J}_{2-},\mathrm{N}_{0+}] - [\mathrm{N}_{0-},\mathcal{J}_{2+}] = 0\,,\\
\mathcal{D}_-\mathcal{J}_{3+} \quad &+ \quad [\mathcal{J}_{1-},\mathcal{J}_{2+}] + [\mathcal{J}_{2-},\mathcal{J}_{1+}] - [\mathcal{J}_{3-},\mathrm{N}_{0-}] - [\mathrm{N}_{0-},\mathcal{J}_{3+}] = 0\,,\\
\mathcal{D}_+\mathcal{J}_{1-} \quad &+ \quad [\mathcal{J}_{2+},\mathcal{J}_{3-}] + [\mathcal{J}_{3+},\mathcal{J}_{2-}] + [\mathcal{J}_{1-},\mathrm{N}_{0+}] - [\mathrm{N}_{0-},\mathcal{J}_{1+}] = 0\,,\\
\mathcal{D}_+\mathcal{J}_{2-} \quad &+ \quad [\mathcal{J}_{3+},\mathcal{J}_{3-}] + [\mathcal{J}_{2-},\mathrm{N}_{0+}] - [\mathrm{N}_{0-},\mathcal{J}_{2+}] = 0\,,\\
\mathcal{D}_-\mathcal{J}_{3+} \quad &+ \quad [\mathcal{J}_{3-},\mathrm{N}_{0-}] - [\mathrm{N}_{0-},\mathcal{J}_{3+}] = 0\,,\\
\mathcal{D}_-\mathrm{N}_{0+} \quad &- \quad [\mathrm{N}_{0-},\mathrm{N}_{0+}] = 0\,, \qquad \mathcal{D}_+\mathrm{N}_{0-} - [\mathrm{N}_{0+},\mathrm{N}_{0-}] = 0\,.
\end{aligned}$$

-At this stage it should be clear that the ansatz for the Lax pair should be found by exchanging $\mathcal{J}_-$ and $\mathcal{J}_+$ for A_- and $\bar{\mathrm{A}}_+$ respectively, in the undeformed Lax pair.

-Moreover, the BRST density charges can be written as

$$\mathrm{j}_-^{\mathrm{B}} = \mathrm{Str}(\lambda_1, \mathcal{J}_{3-})\,, \qquad \mathrm{j}_+^{\mathrm{B}} = \mathrm{Str}(\lambda_3, \mathcal{J}_{1+})\,. \tag{6}$$

-The (anti) holomorphicity of ($\mathrm{j}_+^{\mathrm{B}}$) $\mathrm{j}_-^{\mathrm{B}}$ can be easily proven by using the above equations of motion.

READING THE TARGET SPACE FIELDS

-This is achieved by comparing the deformed model with the standard Berkovits-Howe action (Berkovits and Howe 2002. [arXiv:hep-th/0112160])

$$\mathrm{S_{BH}} = \frac{1}{2\pi\alpha'}\int \mathrm{d}z^2\Big(\frac{1}{2}\mathrm{E^a\bar{E}^b}\eta_{\mathrm{ab}} + \frac{1}{2}\mathrm{E^A\bar{E}^B B_{AB}} + \mathrm{d}_\alpha\bar{\mathrm{E}}^\alpha + \mathrm{d}_{\hat\alpha}\mathrm{E}^{\hat\alpha} + \mathrm{d}_\alpha\mathrm{d}_{\hat\alpha}\mathrm{P}^{\alpha\hat\alpha} +$$

$$+\Omega_\alpha^\beta\lambda^\alpha\omega_\beta + \hat\Omega_{\hat\alpha}^{\hat\beta}\hat\lambda^{\hat\alpha}\hat\omega_{\hat\beta} + \lambda^\alpha\omega_\beta\hat{\mathrm{d}}_{\hat\gamma}\mathrm{C}_\alpha^{\beta\hat\gamma} + \hat\lambda^{\hat\alpha}\hat\omega_{\hat\beta}\mathrm{d}_\gamma\tilde{\mathrm{C}}_{\hat\alpha}^{\hat\beta\gamma} + \lambda^\alpha\omega_\beta\hat\lambda^{\hat\alpha}\hat\omega_{\hat\beta}\mathrm{S}_{\alpha\hat\alpha}^{\beta\hat\beta} + \mathrm{S_{gh}}\Big)\,.$$

-The supervielbiens $\mathrm{E^A}$ of the deformed geometry are given by

$$\mathrm{E}_2^{\mathrm{a}} = \mathrm{J}^{\mathrm{a}}_{\mathrm{GS2+}}\,,\quad \mathrm{E}_1^\alpha = \mathrm{Ad_h J}^\alpha_{\mathrm{GS1+}}\,,\quad \mathrm{E}_3^{\hat\alpha} = \mathrm{J}^{\hat\alpha}_{\mathrm{GS3-}}\,,$$

where h is an element of the isotropy group.

-The metric and the B-field can be read from the GS sector

$$\mathrm{G_{MN}}\partial\mathrm{Z^M}\bar\partial\mathrm{Z^N} = \mathrm{Str}(\bar{\mathrm{J}}_{\mathrm{GS-}},\mathrm{J}_{\mathrm{GS-}})\,,\quad \mathrm{B} = \frac{1}{2}(\mathrm{P_1} - \mathrm{P_3} + \eta\hat{\mathrm{d}}_{\mathrm{GS}}\circ\mathrm{R_g}\circ\mathrm{d_{GS}})\,.$$

-The Ramond-Ramond bispinor

$$\mathrm{P}_{\alpha\hat\alpha} = \frac{1}{2}(\mathrm{P_1}\circ\vartheta_+\mathrm{P_1}\circ\mathrm{Ad_h^{-1}})_\alpha^\beta\mathcal{K}_{\hat\alpha\beta}\,.$$

CONCLUSION

-In this work we have found an integrable deformation of the PS model in $AdS_5 \times S^5$.

-The GS η-model and the pure spinor deformation of $AdS_5 \times S^5$, develop the same geometry and target space content, which implies an extended supergravity background.

-Moreover, we expect that the central charge of the theory should be proportional to the unimodular condition on the R-matrices.

-Having found that BRST symmetry allows an extended supergravity background, it would be interesting to understand how the BRST constraints imply the correct equations of motion for extended supergravity as they were obtained from kappa-symmetry in the GS formulation Borsato and Wulff 2016. [arXiv:hep-th/1608.03570].