Comments on tensionless strings

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Aim:

understand tensionless string limit of AdS_5/CFT_4

– relation to HS theories, etc.

superstring in $AdS_5 \times S^5 \quad \sim \quad SU(N)\ \mathcal{N}=4$ **SYM**

string parameters: tension T and string coupling g_s

$$\mathrm{T} = \frac{R^2}{2\pi\alpha'} = \frac{\sqrt{\lambda}}{2\pi}\,, \qquad g_s = g^2_{\rm YM} = \frac{\lambda}{N}\,, \qquad \lambda = g^2_{\rm YM} N$$

’t Hooft limit: large N, fixed λ

$\lambda \to 0$: “zero-tension” limit $\mathrm{T} \to 0$ is subtle

• does not mean $R \to 0$ or renormalization of string tension [would contradict what is now known about duality from integrability, supersymmetry and localization – exact BMN disperison relation, exact results for BPS Wilson loops, Konishi operator anomalous dimension]

• should correspond to theory in AdS_5: free SYM is CFT – should be dual to massless+ massive higher-spin theory in AdS_5

• $\mathrm{T} \to 0$ is strong-coupling limit in world sheet theory:
should be taken in quantum string theory –
start with exact string spectrum in $AdS_5 \times S^5$ for fixed λ,
then take $\lambda \to 0$ in global AdS energy
$\to$ match dimensions of primary operators in free SYM CFT

• same for correlation functions:
computed in AdS, finite in $\lambda \to 0$,
overall coefficients controlled by $G_N \sim N^{-2}$
(modulo normalization to account for
spectrum degeneracy in $\mathrm{T} \to 0$ limit)

• still: attempt to take $\mathrm{T} \to 0$ directly in string action?
need to fix some charge – e.g. l.c. gauge momentum
$P^+ = \sqrt{\lambda} p^+$=fixed or J= S^5 angular momentum

• $AdS_5 \times S^5$ l.c. gauge Lagrangian [Metsaev, Thorn, AT 02]

$$\mathcal{L} = P^+ \Big[\dot{x}_\perp^2 + (\dot{Z}^M - \mathrm{i}\eta_i \rho^{MNi}{}_j \eta^j Z_N Z^{-2})^2 + \mathrm{i}(\theta^i \dot{\theta}_i + \eta^i \dot{\eta}_i - h.c.)$$

$$- Z^{-2}(\eta^2)^2 - \ \mathrm{T}^2 Z^{-4}(p^+)^{-2}(x'^2_\perp + Z'^M Z'^M) \Big]$$

$$- \mathrm{T}\Big[\ |Z|^{-3}\eta^i \rho^M_{ij} Z^M (\theta'^j - \mathrm{i}\sqrt{2}|Z|^{-1}\eta^j x') + h.c. \Big]$$

$x_\perp = x_1 + ix_2$ transverse coordinates of Poincare patch
$ds^2 = Z^{-2}(dx_m dx_m + dZ_M dZ_M), \ \ Z^M = Zn_M, \ n_M n_M = 1$
• $\mathrm{T} \to 0$: drop all σ derivatives in $\quad I = \int d\tau \int d\sigma \ \mathcal{L}$
parameter $P^+ = \sqrt{\lambda} p^+$ plays role of $\hbar^{-1}$ [AT 02]

$$I_{\mathrm{T}\to 0} = P^+ \int d\tau \int d\sigma \ \Big[\dot{x}_\perp^2 + \mathrm{i}(\theta^i \dot{\theta}_i + \theta_i \dot{\theta}^i) + \mathrm{i}(\eta^i \dot{\eta}_i + \eta_i \dot{\eta}^i)$$

$$+ (\dot{Z}^M - \mathrm{i}\eta_i \rho^{MNi}{}_j \eta^j Z_N Z^{-2})^2 - Z^{-2}(\eta^2)^2 \Big]$$

• $\lambda = 0$ action describes collection of particles ("string bits") moving in AdS: integrable classical dynamics (geodesics)

• no ∂_σ: huge degeneracy in spectrum – seen e.g. in pp-wave case [Metsaev, AT 02; Lindstrom, Wulff et al 04] leads to divergence in free partition function and correlators: divide by gauge volume or consider ratios of corr. functions

• should be reflecting new gauge symmetry at $\lambda = 0$ in SYM: ∞ set of conserved HS currents $\rightarrow$ massless HS fields in AdS [Sundborg 00; Witten 00]

• spectrum: "leading" Regge trajectory of massless HS fields + higher trajectories of massive fields in AdS

• massless HS subsector: AdS_5 Vasiliev-type theory dual to bilinear cons. currents $J_s \sim \mathrm{tr}(\Phi \partial^s \Phi),\ \mathrm{tr}(F_{mn} \partial^s F_{mn})$, etc.

• infinite set of extra massive fields dual to "long" SYM ops: $n > 2$ free fields $\mathcal{O}_{n,s} \sim \mathrm{tr}(\Phi \partial^{s_1} \Phi ... \partial^{s_2} \Phi)$

• symbolic action of AdS dual for adjoint free field CFT:

$$S = N^2 \int \sum \left[\phi_s(\nabla^2+...)\phi_s+\phi_s^3+...+\psi_{n,s}(\nabla^2+M_{n,s}^2)\psi_{n,s}+...\right]$$

ψ_{ns} – massive fields dual operators $\mathcal{O}_{n,s}$ with n fields

• puzzling feature: for $N = \infty$ have any $n < N = \infty$

but for finite N number of elementary fields is finite $n < N$:

trace factorizes (get multi-particle states) –

finite no. of "Regge trajectories"

• the coupling $1/N^2$ is not just as an overall Planck constant?

local action description is not appropriate unless $N = \infty$?

• similar simpler model – adjoint $U(N)$ scalar CFT$_d$

AdS_{d+1} theory: massless HS sector + ∞ set of massive fields;

can be also described as "zero-tension" limit

of some bosonic theory in AdS_{d+1} (no critical dim for $\mathrm{T} = 0$)?

• even simpler model: vectorial AdS/CFT – no massive states

Taking zero-tension limit:

alternative: static or l.c. gauge adapted to BMN vacuum

$t = \tau$ and momentum along $S^1 \subset S^5$ fixed: $\quad p_\varphi = \mathcal{J}$

(i) for fixed $J = \sqrt{\lambda}\mathcal{J}$ can take $\mathrm{T} = \frac{\sqrt{\lambda}}{2\pi} \to 0$ limit

– dropping all σ-derivatives;

(ii) only remaining parameter is overall J factor

e.g. bosonic part of string action in $R_t \times S^n$

$$L_S = -\tfrac{1}{2}\Big[G(y)\partial^a\varphi\partial_a\varphi + F(y)\partial^a y_s\partial_a y_s\Big]$$

$$G = \frac{(1-\frac{1}{4}y_s^2)^2}{(1+\frac{1}{4}y_s^2)^2}\,, \qquad\qquad F = \frac{1}{(1+\frac{1}{4}y_s^2)^2}$$

to fix $p_\varphi = \mathcal{J}$ gauge apply first T-duality $\varphi \to \widetilde{\varphi}$

and then fix static gauge $t = \kappa\tau, \;\; \widetilde{\varphi} = \mathcal{J}\sigma$

$$I = -\sqrt{\lambda} \int d\tau \int \frac{d\sigma}{2\pi} \sqrt{h}$$

$$h = \left[1 - F(y)\dot{y}_r^2\right]\left[\mathcal{J}^2 G^{-1}(y) + F(y) y_s'^2\right] + \left[F(y)\dot{y}_r y_r'\right]^2$$

set $J = \sqrt{\lambda}\mathcal{J}$

$$I = -J \int d\tau \int \tfrac{d\sigma}{2\pi} \sqrt{\left[1 - F(y)\dot{y}_r^2\right]\left[G^{-1}(y) + \tfrac{\lambda}{J^2} F(y) y_s'^2\right] + \tfrac{\lambda}{J^2}\left[F(y)\dot{y}_r y_r'\right]^2}$$

• zero tension limit: $\lambda \to 0$ for fixed J, i.e. $\mathcal{J} = \frac{J}{\sqrt{\lambda}} \to \infty$ removes all σ-derivative terms

$$I_0 = -J \int d\tau \int \frac{d\sigma}{2\pi} \sqrt{G^{-1}(y)\left[1 - F(y)\dot{y}_r^2\right]}$$

$$= -J \int d\tau \int \frac{d\sigma}{2\pi} \sqrt{\frac{(1 + \frac{1}{4}y_r^2)^2 - \dot{y}_r^2}{(1 - \frac{1}{4}y_r^2)^2}}$$

• $J \gg 1$ corresponds to semiclassical expansion
expanding in powers of $\widetilde{y} = J^{1/2} y$:

$$I_0 = \tfrac{1}{2} \int d\tau \int \frac{d\sigma}{2\pi} \; [\dot{\widetilde{y}}_r^2 - \widetilde{y}_r^2 + O(J^{-1} \widetilde{y}^4)]$$

8+8 massive modes in $AdS_5 \times S^5$ case

• same in flat space: $F = G = 1$

$$I_0 = -J \int d\tau \int \frac{d\sigma}{2\pi} \; \sqrt{1 - \dot{y}_r^2}$$

collection of free particles
[tensionless limit in flat space is not defined unless
one fixes one momentum]

Conformal symmetry in zero-tension limit?

• flat space: $\alpha' \to \infty$, no scale, massless higher spins

– conformal invariance? Why?

• previous suggestion [Lindstrom, Sundborg, Theodoris 91]

$\mathrm{T}\sqrt{g}g^{ab}$ degenerate in the limit: can be replaced by V^aV^b

$$I = \int d^2z \, V^a V^b \partial_a X^m \partial_b X^n G_{mn}(X)$$

$V^a(z)$ auxiliary vector density –

target space Weyl invariance?

sp-time conformal group in flat case?

• apparently not: $V^a(z)$ is not same as $V^a(x(z))$

that is required to compensate for conformal transformations

indeed: standard massless HS fields are not conformal for $s > 1$

Galilean conformal symmetry?

$$S = \mathrm{T}\int d^2\xi\sqrt{-\det\gamma_{ab}}\,, \qquad\qquad \gamma_{ab} = \partial_a X^m \partial_b X^n \eta_{mn}$$

generalised momenta satisfy

$$P^2 + \mathrm{T}^2\gamma\gamma^{00} = 0, \qquad\qquad P_m \partial_\sigma X^m = 0$$

add with Lagrange multipliers and integrate out momenta

$$S = \int d^2\xi\, \tfrac{1}{2\lambda}\left[\dot{X}^2 - 2\rho\dot{X}^m\partial_\sigma X_m + \rho^2\partial_\sigma X^m\partial_\sigma X_m - 4\lambda^2\mathrm{T}^2\gamma\gamma^{00}\right]$$

$$S = -\tfrac{1}{2}\mathrm{T}\int d^2\xi\sqrt{-g}\,g^{ab}\partial_a X^m\partial_b X^n\eta_{mn}$$

$$g^{ab} = \begin{pmatrix} -1 & \rho \\ \rho & -\rho^2 + 4\lambda^2\mathrm{T}^2 \end{pmatrix}$$

tensionless limit: replace degenerate metric g^{ab} by V^aV^b

$$V^a = \frac{1}{\sqrt{2}\lambda}(1,\rho)$$

$$S_{\mathrm{T}\to 0} = \int d^2\xi \;\, V^aV^b\partial_a X^m \partial_b X^n \eta_{mn}$$

Residual symmetries:

under $\xi^a \to \xi^a + \epsilon^a$ vector density V^a transforms as:

$$\delta V^a = -V^\beta \partial_b \epsilon^a + \epsilon^b \partial_b V^a + \tfrac{1}{2} V^a \partial_b \epsilon^b$$

gauge:

$$V^a = (v,0) \quad \to \quad S_{\mathrm{T}\to 0} = \int d^2\xi \;\, v\,\dot{X}^m \dot{X}^n \eta_{mn}$$

residual symmetry (analog of Virasoro): [Bagchi 14]

$$\epsilon^a = \big(f'(\sigma)\tau + g(\sigma), f(\sigma)\big)$$

$$\delta F = [f'(\sigma)\tau\partial_\tau + f(\sigma)\partial_\sigma + g(\sigma)\partial_\tau]F = [L(f) + M(g)]F$$

• generators:

$$L(f) = f'(\sigma)\tau\partial_\tau + f(\sigma)\partial_\sigma, \qquad M(g) = g(\sigma)\partial_\tau$$

$$[L(f_1), L(f_2)] = L(f_1 f_2' - f_1' f_2), \quad [L(f), M(g)] = M(fg' - f'g)$$

$$[M(g_1), M(g_2)] = 0$$

$$[L_m, L_n] = (m-n)L_{m+n}, \quad [L_m, M_n] = (m-n)M_{m+n}, \quad [M_m, M_n] = 0$$

same as 2d Galilean Conformal Algebra

• Virasoro symmetry is replaced in "conformal gauge" by 2d Galilean conformal symmetry

$$L_n = ie^{in\sigma}(\partial_\sigma + in\tau\partial_\tau), \qquad M_n = ie^{in\sigma}\partial_\tau$$

• GCA in any d: conjectured symmetry of Galilean CFT: non-relativistic analog conformal symmetry (but ∞-dimensional)

• infinite dim symmetry in any flat d $\quad (i = 1, , ...d-1)$

$$L_n = t^{n+1}\phi_t + (n-1)t^n x_i \partial_i, \quad M_n^i = t^{n+1}\partial_i, \quad J_{ij}^n = t^n\left(x_i\partial_j - x_j\partial_i\right)$$

$$[L_n, L_m] = (n-m)L_{n+m}, \quad [L_n, M_m^i] = (n-m)M_{n+m}^i, \quad [M_n^i, M_m^j] = 0$$

• finite dim subgroup is contraction of relativistic conf algebra

$$L_{-1,0,+1} = H, D, K^0 \qquad M_{-1,0,+1}^i = P^i, B^i, K^i$$

K^0, K^i special conformal and B^i Galilean boosts

• quantum version of the GCA in $d = 2$

$$[L_n, L_m] = (n-m)L_{n+m} + \tfrac{1}{12}c_L(n^3-n)\delta_{n+m,0}\,,$$
$$[L_n, M_m] = (n-m)M_{n+m} + \tfrac{1}{12}c_M(n^3-n)\delta_{n+m,0}\,, \quad [M_n, M_m] = 0.$$

contraction of two copies of the Virasoro algebra $\mathcal{L}_n, \bar{\mathcal{L}}_n$

$$\mathcal{L}_n + \bar{\mathcal{L}}_n = L_n, \quad \mathcal{L}_n - \bar{\mathcal{L}}_n = \tfrac{1}{\epsilon}M_n\,, \quad c + \bar{c} = c_L, \quad c - \bar{c} = \tfrac{1}{\epsilon}c_M$$

if $c = \bar{c}$ then in the limit $c_L = c_M = 0$
no anomalies in Virasoro $\rightarrow$ no anomalies in GCA
cf. no critical dimension for tensionless string [Lizzi et al 86]

• is this symmetry really fundamental for $\mathrm{T} = 0$ string?...
Virasoro is residual gauge symmetry of tensile string;
same should be for this symmetry
• but unlikely it is actually responsible for
degeneracy of spectrum in $\mathrm{T} \rightarrow 0$ limit
in non-trivial curved space case

Superstring in pp-wave limit of $AdS_5 \times S^5$ [Metsaev 02]

$$ds^2 = dx^+dx^- - \mathrm{f}^2 x_I^2 dx^+dx^+ + dx^I dx^I$$

$$F_{+1234} = F_{+5678} = \mathrm{f} = \mathrm{curv.\,scale}\,, \qquad I = 1, ..., 8$$

- l.c. gauge: $x^+ = p^+\tau, \quad \Gamma^+\theta^{\mathcal{I}I} = 0$

$$L = \partial^a x^I \partial_a x^I - \mathrm{m}^2 x^I x^I + \text{fermions}$$

- eqs of motion: 8 massive bosons + 8 massive fermions

$$\omega_n = \sqrt{k_n^2 + \mathrm{m}^2}, \quad k_n = 2\pi n, \quad \mathrm{m} = 2\pi\alpha' p^+ \mathrm{f} = 2\pi\mu$$

- Hamiltonian $H = P^-$

$$H = \mathrm{f}(a_0^I \bar{a}_0^I + 2\bar{\theta}_0 \bar{\gamma}^- \Pi \theta_0 + 4)$$
$$+ \frac{1}{\alpha' p^+} \sum_{\mathcal{I}=1,2} \sum_{n=1}^{\infty} \sqrt{n^2 + (\alpha' p^+ \mathrm{f})^2}\, (a_n^{\mathcal{I}I} \bar{a}_n^{\mathcal{I}I} + \eta_n^{\mathcal{I}} \bar{\gamma}^- \bar{\eta}_n^{\mathcal{I}})$$

Connection to BMN limit of $AdS_5 \times S^5$ $(R = 1)$

$$P^+ = J = \sqrt{\lambda} p^+$$

$$(E - J)J = \sum_n \sqrt{J^2 + \lambda n^2}, \qquad E - J = \sum_n \sqrt{1 + \frac{\lambda}{J^2} n^2}$$

$$\mathcal{J} = p^+ = \frac{J}{\sqrt{\lambda}} \to \infty$$

- flat space limit is f $\to 0$: $P^- p^+ =$(mass)^2
- dimensionless parameters: $\mathrm{m} = 2\pi\alpha' p^+ \mathrm{f} \equiv 2\pi\mu$ and $\alpha'(p^+)^2$
- zero-tension limit: $\alpha' p^+ \mathrm{f} \to \infty$ [Metsaev, AT 02]

$$H_0 = \mathrm{f}\Big[(a_0^I \bar{a}_0^I + 2\bar{\theta}_0 \bar{\gamma}^- \Pi \theta_0 + 4) + \sum_{\mathcal{I}=1,2} \sum_{n=1}^{\infty} (a_n^{\mathcal{I}I} \bar{a}_n^{\mathcal{I}I} + \eta_n^{\mathcal{I}} \bar{\gamma}^- \bar{\eta}_n^{\mathcal{I}})\Big]$$

- vacuum = product of zero-mode vac and Fock oscillator vac

$\bar{a}_0^I|0\rangle = 0\,,\ \bar{\theta}_0^\alpha|0\rangle = 0\,,\ \bar{a}_n^{\mathcal{I}I}|0\rangle = 0\,,\ \bar{\eta}_n^{\mathcal{I}\alpha}|0\rangle = 0\,,\ n = 1, 2, ...$

- generic state: $|\Phi\rangle = \Phi(a_0\,, a_n\,, \theta_0\,, \eta_n)|0\rangle$

subspace of physical states $N^1|\Phi_{phys}\rangle = N^2|\Phi_{phys}\rangle$

$N^{\mathcal{I}} = \sum_{n=1}^{\infty} k_n (a_n^{\mathcal{I}I} \bar{a}_n^{\mathcal{I}I} + \eta_n^{\mathcal{I}} \bar{\gamma}^- \bar{\eta}_n^{\mathcal{I}})$

- large degeneracy of states in energy

Degeneracy of states in 0-tension limit leads to divergences:

• flat space: $M^2 = \frac{1}{\alpha'} N \to 0$ – appearance of massless fields

• partition function becomes divergent:

integral over longitudinal directions is no longer suppressed producing volume of the gauge group that appears in the limit

• analogy: massive $\to$ massless vector

$Z = \int [dA] \exp[-\int d^4x (F_{ab}F^{ab} + m^2 A_a A^a)]$

$A_a = A_a^{\perp} + \partial_a \phi$

$F_{ab}F^{ab} + m^2 A_a A^a = A_a^{\perp}(-\partial^2 + m^2) A_a^{\perp} + m^2 \partial_a \phi \partial^a \phi$

if $m \to 0$ integral over ϕ is no longer suppressed: jump in d.o.f.

$\int [d\phi]$ is volume of gauge group that appears in the limit $m \to 0$

one needs to divide over $\int [d\phi]$ to get finite partition function

still *ratios* of *certain* correlation functions have smooth limit

e.g. $\frac{\langle F_{mn} F_{kl} .... F_{pq} \rangle}{\langle F_{mn} F_{kl} \rangle}$

Partition function in pp-wave background

8b+8f: free energy on $R_L \times S^1_\beta \times R^8$ [Grignani et al 03]

$$F_{\rm b} = \frac{1}{\beta}{\rm Tr}\ln(1 - e^{-\beta p^0}) = -\sum_{k=1}^{\infty} \frac{1}{k\beta}{\rm Tr}\, e^{-\frac{k\beta}{2}(p^+ - p^-)}$$

$$F = F_{\rm b} + F_{\rm f} = -\sum_{k=1}^{\infty} \frac{1-(-1)^k}{2k\beta}{\rm Tr}\, e^{-\frac{k\beta}{2}(p^+ - p^-)}$$

$$F = -\frac{L}{4\pi^2\alpha'}\int_0^\infty \frac{d\tau_2}{\tau_2^2}\int_{-\frac{1}{2}}^{\frac{1}{2}} d\tau_1 \sum_{k=1,3,5,\ldots}^{\infty} e^{-\frac{k^2\beta^2}{4\pi\alpha'\tau_2}}\, G(\tau_1,\tau_2) - \frac{\pi L}{24\beta^2}$$

$$G(\tau_1,\tau_2) \equiv \prod_{n=-\infty}^{\infty}\left[\frac{1+\exp(-2\pi\tau_2\sqrt{n^2+\mu^2}+2\pi i\tau_1 n)}{1-\exp(-2\pi\tau_2\sqrt{n^2+\mu^2}+2\pi i\tau_1 n)}\right]^8$$

$L \to \infty$ = length in longitudinal 9-th direction, $\mu = \alpha' p^+ {\rm f}$

- flat-space limit: $\mu = 0$
- naive $\mu \to \infty$ limit: $G \to 1, \quad F = -\frac{\pi L}{6\beta^2}$:

free energy density of gas of massless particles in 2d

• zero-tension limit: $\mu \to \infty$ with scale f fixed:
$\alpha' p^+ \to \infty$ while $\beta^2 p^+$=fixed, Lp^+=fixed

$$G = \prod_{n=-\infty}^{\infty} \Big(\frac{1 + e^{-2\pi\tau_2' + 2\pi i \tau_1 n}}{1 - e^{-2\pi\tau_2' + 2\pi i \tau_1 n}}\Big)^8 , \qquad \tau_2' = \mu\tau_2$$

product is diverent: reflects degeneracy in the 0-tension limit

• interpretation: new gauge symmetry appearing in $\mathrm{T} = 0$ limit
• divide over its volume to define partition function?
consider ratios of correlation functions?

Interactions: 3-point function [Klebanov,Spradlin,Volovich 02]

$$|V\rangle = \exp\left[\tfrac{1}{2}\sum_{r,s=1}^{3}\sum_{m,n=-\infty}^{\infty} a^{I\dagger}_{m(r)}\overline{N}^{(rs)}_{mn}a^{J\dagger}_{n(s)}\delta_{IJ}\right]|0\rangle$$

Neumann matrices for $m,n>0$

$$\overline{N}^{(rs)}_{mn} = \delta^{rs}\delta_{mn} - \left[C^{1/2}_{(r)}C^{-1/2}A^{(r)\mathrm{T}}\Gamma_{+}^{-1}A^{(s)}C^{-1/2}C^{1/2}_{(s)}\right]_{mn}$$

$$A^{(1)}_{mn} = (-1)^{m+n+1}\frac{\sqrt{mn}}{\pi}\frac{y\sin(\pi m y)}{n^2-m^2y^2}$$

$$A^{(2)}_{mn} = (-1)^{m}\frac{\sqrt{mn}}{\pi}\frac{(1-y)\sin(\pi m y)}{n^2-m^2(1-y)^2}$$

$$A^{(3)}_{mn} = \delta_{mn}, \qquad C_{mn} = m\delta_{mn}, \qquad C^{(1)}_{mn} = \delta_{mn}\sqrt{m^2+\mu^2y^2}$$

$$C^{(2)}_{mn} = \delta_{mn}\sqrt{m^2+\mu^2(1-y)^2}, \qquad C^{(3)}_{mn} = \delta_{mn}\sqrt{m^2+\mu^2}$$

$$B_m = \frac{}{\pi y(1-y)\alpha' p^+}\frac{(-1)^{m+1}\sin(\pi m y)}{m^{3/2}}$$

- $\mu\to\infty$: simplifications

and divergences due to degeneracy

Open questions

- which is efficient description of $\mathrm{T}=0$ limit?

is there a constructive definition of (string ?) theory

directly in the limit?

or only makes sense as limit of exact quantum spectrum ?

- new gauge symmetries of string theory in $\mathrm{T}=0$ limit?
- quantum bosonic $\mathrm{T}=0$ string theory well-defined in AdS_{d+1}?

dual to free scalar adjoint CFT_d ?

- precise connection to massless HS theory in AdS ?
- how to reproduce e.g. spectrum and simplets correlators

of primary operators in $g_{\mathrm{YM}}=0$ YM $SU(N)$ theory

from tensionless string in AdS ?

- generalization to superstring in AdS dual to SYM case