

# Unfolding Conformal Geometry

**Euihun Joung** (Kyung Hee University)

in collaboration with **Mingi Kim** and **Yujin Kim** [2106.XXXX]



# Weyl Invariant Densities

- Type-B Anomaly: Weyl invariant densities [Bonora et al, Deser&Schwimmer, ... , Boulanger]
- 8d Classification [Boulanger&Erdmenger]
  - Basis: Weyl-covariant derivatives of Weyl tensors
  - Weyl variation of each basis:  $\sim \partial\sigma$
  - Make an ansatz in this basis / Ask the Weyl invariance
- Revisit the problem by unfolding conformal geometry [Vasiliev,...]

# SO(2,d) Gauge Formulation

[Kaku&Townsend&Nieuwenhuizen, ... , Fradkin&Tseytlin, ... , Kuzenko&Ponds]

- Conformal Geometry, Q-curvature, Tractor calculus

[Thomas, Fefferman, Graham, Gover, ...]

- Cartan Geometry (Parabolic Geometry) [Cartan, ... , Sharpe, ...]

**Gauge Field**  $\hat{A} = e^a \hat{P}_a + \frac{1}{2} \omega^{ab} \hat{J}_{ab} + f^a \hat{K}_a + b \hat{D}$

**Curvature**

$$\begin{aligned} F_{\hat{P}}^a &= (D^L + b) e^a, & F_{\hat{J}}^{ab} &= R^{ab} - 2 f^{[a} \wedge e^{b]}, \\ F_{\hat{K}}^a &= (D^L - b) f^a, & F_{\hat{D}} &= db + f^a \wedge e_a. \end{aligned}$$

**Constraints**  $F_{\hat{P}}^a \stackrel{!}{=} 0, \quad i_a F_{\hat{J}}^{ab} \stackrel{!}{=} 0, \quad (F_{\hat{D}} \stackrel{!}{=} 0)$

**SOLVE**

$$\omega_{ab,c} = E_{[b}^{\mu} E_{c]}^{\nu} \partial_{\mu} e_{a\nu} + E_{[c}^{\mu} E_{a]}^{\nu} \partial_{\mu} e_{b\nu} + E_{[b}^{\mu} E_{a]}^{\nu} \partial_{\mu} e_{c\nu} + 2 b_{[a} \eta_{b]c}$$

$$f_{[a,b]} = \partial_{[a} b_{b]} \quad f_{(a,b)} = \frac{1}{d-2} \left( R_{ab} - \frac{\eta_{ab} R}{2(d-1)} \right) \text{Schouten tensor}$$

**Gauge symmetry**  $\delta \hat{A} = d\hat{\Lambda} + [\hat{A}, \hat{\Lambda}], \quad \hat{\Lambda} = \epsilon^a \hat{P}_a + \frac{1}{2} \lambda^{ab} \hat{J}_{ab} + \kappa^a \hat{K}_a + \sigma \hat{D}$

**FIX**

$$\delta_{\kappa} b_a = \kappa_a \quad \rightarrow \quad b_a = 0$$

$$\delta_{\lambda} e_{\mu}^a = \lambda^{ab} e_{b\mu} \quad \rightarrow \quad g_{\mu\nu} = \eta_{ab} e_{\mu}^a e_{\nu}^b$$

Under dilatation  
 $\kappa_a = \partial_a \sigma$

**We recover Conformal Geometry based on metric tensor**

# What we have

$$D^K e^a = 0,$$

$$D^K \omega^{ab} - 2 e^{[a} \wedge f^{b]} = \frac{1}{2} e_c \wedge e_d C^{ab,cd},$$

$$D^K b + e^a \wedge f_a = 0,$$

$$D^K f^a = \frac{1}{2} e_b \wedge e_c C^{a,bc},$$

$$C_{ab,cd} \sim \begin{array}{|c|c|} \hline a & c \\ \hline b & d \\ \hline \end{array},$$

$$C_{c,ab} \sim \begin{array}{|c|c|} \hline a & c \\ \hline b & \\ \hline \end{array}.$$

$$\eta^{ab} C_{ab,cd} = 0,$$

$$\eta^{ab} C_{a,bc} = 0.$$

**Weyl tensor**

**Cotton tensor**

$K = SO(1,1) \times SO(1,d-1)$  covariant derivatives

$$D^K W^{[\Delta]ab\dots} = D^L W^{[\Delta]ab\dots} + (|W| - \Delta) b W^{[\Delta]ab\dots}$$

$$\Delta_e = 0, \quad \Delta_\omega = 1, \quad \Delta_b = 1, \quad \Delta_f = 2$$

$|W|$ : differential form degree

# Unfolding

[Vasiliev, ...,  
Shaynkman&Tipunin&Vasiliev, ...]

- Consider  $C_{ab,cd}, C_{a,bc}$  as new fields (zero forms)
- Introduce “evolution” equation for  $C_{ab,cd}, C_{a,bc}$

$$D^K C^{ab,cd} = (D^L - 2b)C^{ab,cd} = e_f \boxed{C^{ab,cd,e}} + (\text{pre-existing fields}),$$

$$D^K C^{a,bc} = (D^L - 3b)C^{a,bc} = e_d \boxed{C^{a,bc,d}} + (\text{pre-existing fields}).$$

**New zero form fields**

## Rule of the game

- New fields are completely determined by pre-existing fields
- No constraints on pre-existing fields

- **Bianchi identity**  $(D^L - 2b)_{[k} C^{ab, cd)} - 2 \delta_{[k}^{[a} C^{b]},_{cd)} = 0,$   
 $(D^L - 3b)_{[k} C^{a, cd)} - f_{b,[k} C^{ab, cd)} = 0.$

- Infinitely many new zero forms

$$C^{[\Delta]}a(m),b(n) = C^{[\Delta]}a_1 \cdots a_m, b_1 \cdots b_n$$

$$C^{[2]}a(2),b(2) = C^{(a_1|b_1,|a_2)}b_2, \quad C^{[3]}a(2),b = C^{(a_1,a_2)}b$$

- General form of the equations

$$D^K C^{[\Delta]}a(m),b(n) = e_c \mathcal{E}^{[\Delta+1]}a(m),b(n),c(C) + f_c \mathcal{F}^{[\Delta-1]}a(m),b(n),c(C)$$

Total degree  $\Delta + 1$ 
Total degree  $\Delta - 1$

## Polynomials of zero forms

$$\mathcal{E}^{[\Delta+1]}a(m),b(n),c(C) = \mathcal{E}_{d(p),e(q)}^{[\Delta+1]}a(m),b(n),c C^{[\Delta+1]}d(p),e(q)$$

$$+ \sum_{\substack{\Delta_1, \Delta_2 \\ \Delta_1 + \Delta_2 = \Delta + 1}} \mathcal{E}_{d(p),e(q)|f(s),g(t)}^{[\Delta_1, \Delta_2]}a(m),b(n),c C^{[\Delta_1]}d(p),e(q) C^{[\Delta_2]}f(s),g(t) + \dots$$

# First order

$$(\hat{P}^c C)^{[\Delta]a(m),b(n)} = -\mathcal{E}_{d(p),e(q)}^{[\Delta+1]a(m),b(n),c} C^{[\Delta+1]d(p),e(q)}$$

$$D^K C^{[\Delta]a(m),b(n)} + e^c (\hat{P}_c C)^{[\Delta]a(m),b(n)} + f^c (\hat{K}_c C)^{[\Delta]a(m),b(n)} = \mathcal{O}(C^2)$$

- $\hat{P}_a$  and  $\hat{K}_a$  map  $C^{[\Delta+1]}$  and  $C^{[\Delta-1]}$  to  $C^{[\Delta]}$
- Bianchi identity identifies  $\hat{P}_a$  and  $\hat{K}_a$  with  $SO(2,d)$  generators

## From Bianchi identity

$$\begin{aligned} (\hat{P}_{[c} \hat{P}_{d]} C)^{[\Delta]a(m),b(n)} &= 0, & (\hat{K}_{[c} \hat{K}_{d]} C)^{[\Delta]a(m),b(n)} &= 0, \\ (([\hat{K}_a, \hat{P}_b] + \hat{J}_{ab} - \eta_{ab} \hat{D}) C)^{[\Delta]a(m),b(n)} &= 0, \end{aligned}$$



$$\hat{P}^a C^{[\Delta]}(m,n) = \left( p_{1+}^{\Delta,m,n} \mathcal{Y}_{1+}^a + p_{1-}^{\Delta,m,n} \mathcal{Y}_{1-}^a + p_{2+}^{\Delta,m,n} \mathcal{Y}_{2+}^a + p_{2-}^{\Delta,m,n} \mathcal{Y}_{2-}^a \right) C^{[\Delta]}(m,n)$$

$$\hat{K}^a C^{[\Delta]}(m,n) = \left( k_{1+}^{\Delta,m,n} \mathcal{Y}_{1+}^a + k_{1-}^{\Delta,m,n} \mathcal{Y}_{1-}^a + k_{2+}^{\Delta,m,n} \mathcal{Y}_{2+}^a + k_{2-}^{\Delta,m,n} \mathcal{Y}_{2-}^a \right) C^{[\Delta]}(m,n)$$

**Coefficients to determine from Bianchi**

## Cell Operators

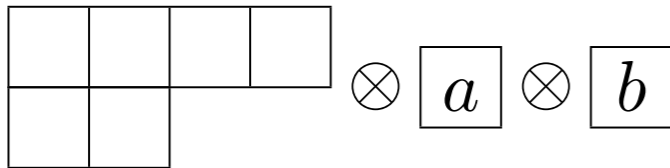
[Ponomarev&Vasiliev]

$$\mathcal{Y}_{1+}^a = \Pi_{\mathbb{Y}} u^a, \quad \mathcal{Y}_{1-}^a = \Pi_{\mathbb{Y}} \partial_{u_a}, \quad \mathcal{Y}_{2+}^a = \Pi_{\mathbb{Y}} v^a, \quad \mathcal{Y}_{2-}^a = \Pi_{\mathbb{Y}} \partial_{v_a},$$

$$\mathcal{Y}_{1+1+}^{a,b} = \Pi_{\mathbb{Y}} u^a u^b, \quad \mathcal{Y}_{1+2+}^{a,b} = \Pi_{\mathbb{Y}} u^a v^b, \quad \mathcal{Y}_{2+2+}^{a,b} = \Pi_{\mathbb{Y}} v^a v^b,$$

$$\mathcal{Y}_{1-1-}^{a,b} = \Pi_{\mathbb{Y}} \partial_{u_a} \partial_{u_b}, \quad \mathcal{Y}_{1-2-}^{a,b} = \Pi_{\mathbb{Y}} \partial_{u_a} \partial_{v_b}, \quad \mathcal{Y}_{2-2-}^{a,b} = \Pi_{\mathbb{Y}} \partial_{v_a} \partial_{v_b},$$

## Algebra of Cell Operators



$$\mathcal{Y}_{1\pm}^a \mathcal{Y}_{1\pm}^b = \mathcal{Y}_{1\pm}^b \mathcal{Y}_{1\pm}^a = \mathcal{Y}_{1\pm 1\pm}^{a,b}, \quad \mathcal{Y}_{2\pm}^a \mathcal{Y}_{2\pm}^b = \mathcal{Y}_{2\pm}^b \mathcal{Y}_{2\pm}^a = \mathcal{Y}_{2\pm 2\pm}^{a,b},$$

$$\mathcal{Y}_{1\pm}^a \mathcal{Y}_{2\pm}^b = \mathcal{Y}_{1\pm 2\pm}^{a,b}, \quad \mathcal{Y}_{2\pm}^b \mathcal{Y}_{1\pm}^a = \mathcal{Y}_{1\pm 2\pm}^{a,b} \mp \frac{1}{m-n+1} \mathcal{Y}_{1\pm 2\pm}^{b,a},$$

$$\mathcal{Y}_{1+}^a \mathcal{Y}_{2-}^b = \mathcal{Y}_{1+2-}^{a,b}, \quad \mathcal{Y}_{2-}^b \mathcal{Y}_{1+}^a = \mathcal{Y}_{1+2-}^{a,b} - \frac{1}{d+m+n-3} \mathcal{Y}_{1+2-}^{b,a},$$

$$\mathcal{Y}_{2+}^a \mathcal{Y}_{1-}^b = \mathcal{Y}_{2+1-}^{a,b}, \quad \mathcal{Y}_{1-}^b \mathcal{Y}_{2+}^a = \frac{(m-n-1)(m-n+1)}{(m-n)^2} \left( -\mathcal{Y}_{2+1-}^{a,b} + \frac{1}{d+m+n-3} \mathcal{Y}_{2+1-}^{b,a} \right)$$

$$\mathcal{Y}_{1+}^a \mathcal{Y}_{1-}^b = \mathcal{Y}_{1+1-}^{a,b}, \quad \mathcal{Y}_{2+}^a \mathcal{Y}_{2-}^b = \mathcal{Y}_{2+2-}^{a,b},$$

$$\mathcal{Y}_{1-}^a \mathcal{Y}_{1+}^b = \eta^{ab} + \mathcal{Y}_{1+1-}^{b,a} - \frac{2}{d+2m-2} \mathcal{Y}_{1+1-}^{a,b} - \frac{m-n+3}{(m-n+2)(d+m+n-3)} \mathcal{Y}_{2+2-}^{a,b} + \frac{1}{m-n+2} \mathcal{Y}_{2+2-}^{b,a},$$

$$\mathcal{Y}_{2-}^a \mathcal{Y}_{2+}^b = \eta^{ab} + \mathcal{Y}_{2+2-}^{b,a} - \frac{2}{d+2n-4} \mathcal{Y}_{2+2-}^{a,b} - \frac{m-n-1}{(m-n)(d+m+n-3)} \mathcal{Y}_{1+1-}^{a,b} - \frac{1}{m-n} \mathcal{Y}_{1+1-}^{b,a},$$

$$\hat{j}^{ab} = \mathcal{Y}_{1+1-}^{a,b} - \mathcal{Y}_{1+1-}^{b,a} + \mathcal{Y}_{2+2-}^{a,b} - \mathcal{Y}_{2+2-}^{b,a}$$

$$\hat{P}^a C^{[\Delta]}(m,n) = \left( p_{1+}^{\Delta,m,n} \mathcal{Y}_{1+}^a + p_{1-}^{\Delta,m,n} \mathcal{Y}_{1-}^a + p_{2+}^{\Delta,m,n} \mathcal{Y}_{2+}^a + p_{2-}^{\Delta,m,n} \mathcal{Y}_{2-}^a \right) C^{[\Delta]}(m,n)$$

$$\hat{K}^a C^{[\Delta]}(m,n) = \left( k_{1+}^{\Delta,m,n} \mathcal{Y}_{1+}^a + k_{1-}^{\Delta,m,n} \mathcal{Y}_{1-}^a + k_{2+}^{\Delta,m,n} \mathcal{Y}_{2+}^a + k_{2-}^{\Delta,m,n} \mathcal{Y}_{2-}^a \right) C^{[\Delta]}(m,n)$$

$$[\hat{P}_a, \hat{P}_b] = 0 \quad \rightarrow \quad p p + p p = 0$$

$$[\hat{K}_a, \hat{K}_b] = 0 \quad \rightarrow \quad k k + k k = 0$$

$$[\hat{K}_a, \hat{P}_b] = \eta_{ab} \hat{D} - \hat{J}_{ab} \quad \rightarrow \quad p k + k p = \#$$

- Unique off-shell system up to field redefinition ambiguity
- Various on-shell systems
  - Conformal gravity (Bach flat geometry)
  - Einstein gravity
  - Higher-depth analogues

$\Delta = 2$

$\Delta = 3$

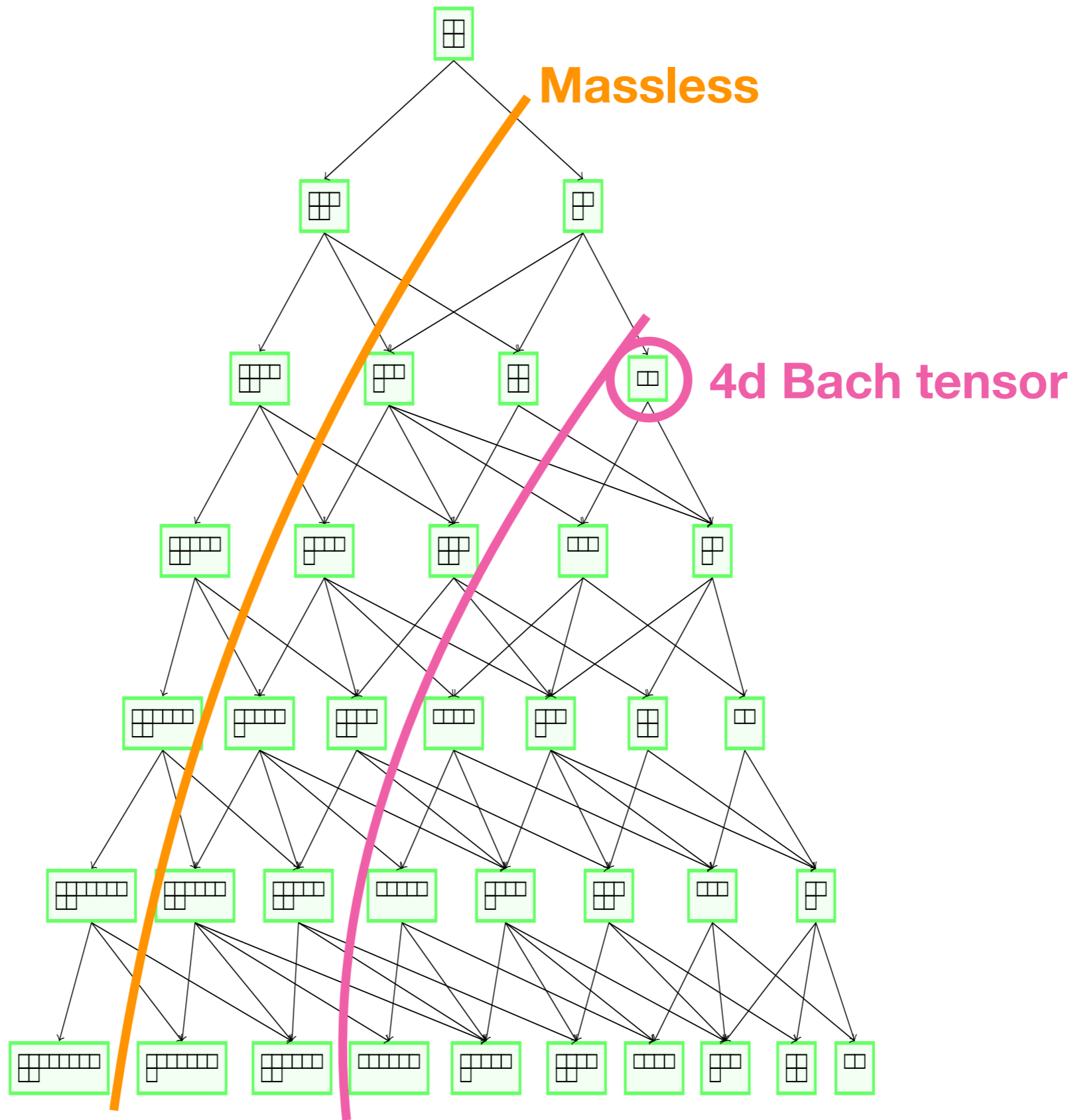
$\Delta = 4$

$\Delta = 5$

$\Delta = 6$

$\Delta = 7$

$\Delta = 8$



# Representation

- On-shell Fradkin-Tseytlin module [Shaynkman&Tipunin&Vasiliev, Beccaria&Tseytlin&Bekaert]

$$\mathcal{D}(2, (s, s)) = \mathcal{S}(2 - s, (s)) \ominus \mathcal{D}(s + d - 2, (s))$$

Bach flat equation

- Off-shell Fradkin-Tseytlin module (shadow module)

$$\mathcal{S}(0, (2)) = \mathcal{V}(0, (2)) \ominus \mathcal{V}(-1, (1)) \oplus \mathcal{D}(-1, (1))$$

Metric

Gauge

Conformal Killing

$$= \bigoplus_{m,n=0}^{\infty} [(2 + n + 2m, (n + 2, 2)) \oplus (3 + n + 2m, (n + 2, 1)) \oplus (4 + n + 2m, (n + 2))]$$

Match what we found!

# Higher order (sketch)

## Nonlinear equation

$$D^K C^I = e_a \mathcal{E}^{I,a}(C) + f_a \mathcal{F}^{I,a}(C)$$

## Bianchi identity

$$\begin{aligned} 0 = & e_a \wedge e_b \left( \frac{1}{4} C^{[2]ac,bd} (\hat{J}_{cd} C)^I - \frac{1}{2} C^{[3]ca,b} \mathcal{F}^I{}_c(C) + \mathcal{E}^{J,b}(C) \frac{\partial \mathcal{E}^{I,a}}{\partial C^J} \right) \\ & + e_a \wedge f_b \left( (\hat{J}^{ab} C)^I - \Delta_I \eta^{ab} C^I + \mathcal{F}^{J,b}(C) \frac{\partial \mathcal{E}^{I,a}}{\partial C^J} - \mathcal{E}^{J,a}(C) \frac{\partial \mathcal{F}^{I,b}}{\partial C^J} \right) \\ & + f_a \wedge f_b \mathcal{F}^{J,b}(C) \frac{\partial \mathcal{F}^{I,a}}{\partial C^J} . \end{aligned}$$

## Polynomial Expansions

$$\mathcal{E}^{[\Delta],a}(C) = \sum_{k=1}^{\lfloor \frac{\Delta+1}{2} \rfloor} \mathcal{E}_k^{[\Delta],a}(C), \quad \mathcal{F}^{[\Delta],a}(C) = \sum_{k=1}^{\lfloor \frac{\Delta-1}{2} \rfloor} \mathcal{F}_k^{[\Delta],a}(C)$$

$$\frac{1}{4} C^{[2]ac,bd} (\hat{J}_{cd} C)^{[2]} + \mathcal{E}_2^{[3],[a}(C^{[2]}, C^{[2]}) \frac{\partial \mathcal{E}_1^{[2],b]}(C^{[3]})}{\partial C^{[3]}} = 0$$

$$\frac{1}{4} C^{[2]ac,bd} (\hat{J}_{cd} C)^{[3]} - \frac{1}{2} C^{[3]}_c [a,b] \mathcal{F}_1^{[3],c}(C^{[2]}) + \mathcal{E}_1^{[2],[a}(C^{[3]}) \frac{\partial \mathcal{E}_2^{[3],b]}(C^{[2]}, C^{[2]})}{\partial C^{[2]}} + \mathcal{E}_2^{[4],[a}(C^{[2]}, C^{[3]}) \frac{\partial \mathcal{E}_1^{[3],b]}(C^{[4]})}{\partial C^{[4]}} = 0$$

$$\frac{1}{4} C^{[2]ac,bd} (\hat{J}_{cd} C)^{[4]} + \mathcal{E}_1^{[3],[a}(C^{[4]}) \frac{\partial \mathcal{E}_2^{[4],b]}(C^{[2]}, C^{[3]})}{\partial C^{[3]}} + \mathcal{E}_2^{[5],[a}(C^{[2]}, C^{[4]}) \frac{\partial \mathcal{E}_1^{[4],b]}(C^{[5]})}{\partial C^{[5]}} = 0$$

$$-\frac{1}{2} C^{[3]}_c [a,b] \mathcal{F}_1^{[4],c}(C^{[3]}) + \mathcal{E}_1^{[2],[a}(C^{[3]}) \frac{\partial \mathcal{E}_2^{[4],b]}(C^{[2]}, C^{[3]})}{\partial C^{[2]}} + \mathcal{E}_2^{[5],[a}(C^{[3]}, C^{[3]}) \frac{\partial \mathcal{E}_1^{[4],b]}(C^{[5]})}{\partial C^{[5]}} = 0$$

$$\mathcal{F}_1^{[3],b}(C^{[2]}) \frac{\partial \mathcal{E}_2^{[4],a]}(C^{[2]}, C^{[3]})}{\partial C^{[3]}} - \mathcal{E}_2^{[3],b}(C^{[2]}, C^{[2]}) \frac{\partial \mathcal{F}_1^{[4],a]}(C^{[3]})}{\partial C^{[3]}} + \mathcal{F}_2^{[5],b}(C^{[2]}, C^{[2]}) \frac{\partial \mathcal{E}_1^{[4],a]}(C^{[5]})}{\partial C^{[5]}} = 0$$

**At each order, finite dimensional linear equations**

# Reduction

**Impose algebraic constraints**  $\Phi(e, \omega, b, f, C) = 0$

- Einstein gravity  $\Phi^a = f^a - \Lambda e_b$
- Other gravitational theories  $\Phi^a = f^a - \ell^2 C^{[4]ab} e_b$   
 $\Phi^a = f^a - F(C) e_b$
- Conformal gravity  $\Phi^{[d](2,0)} = C^{[d](2,0)} + \mathcal{O}(C^2)$

## **K-invariance of constraint**

$$\delta_\kappa \Phi^{[d](2,0)}(C) = \kappa^a \mathcal{F}^{I,a}(C) \frac{\partial \Phi^{[d](2,0)}(C)}{\partial C^I} = 0$$

# Weyl invariants

- Ansatz for strictly Weyl invariant d-forms

$$I_d = \epsilon_{a_1 \dots a_d} e^{a_1} \wedge \dots \wedge e^{a_d} \mathcal{I}_d(C)$$

- Gauge variation factorizes in even d

$$\delta I_d = \epsilon_{a_1 \dots a_d} (\varepsilon^{a_1} e^{a_2} \wedge \dots \wedge e^{a_d} \wedge f_c + \kappa_c e^{a_1} \wedge \dots \wedge e^{a_d}) \mathcal{F}^{I,c}(C) \frac{\partial \mathcal{I}_d(C)}{\partial C^I}$$

**K-invariance of ansatz**  $\mathcal{I}_d(C) = \mathcal{I}_d(C^{[2]}, C^{[3]}, \dots, C^{[d-2]})$

$$\delta_\kappa \mathcal{I}_d(C) = \kappa^a \mathcal{F}^{I,a}(C) \frac{\partial \mathcal{I}_d(C)}{\partial C^I} = 0$$

❖ Essential same as [Boulanger&Erdmenger]



**4d**  $\mathcal{I}_4(C) = c_1 C^{[2]a(2),b(2)} C^{[2]}_{a(2),b(2)}$

**$\Delta=4$  scalar : 1**

**6d**  $\mathcal{I}_6(C) = c_1 C^{[4]a(2),b(2)} C^{[2]}_{a(2),b(2)} + c_2 C^{[3]a(3),b(2)} C^{[3]}_{a(3),b(2)} + c_3 C^{[3]a(2),b} C^{[3]}_{a(2),b}$

**(non-trivial)  $\Delta=6$  scalars : 3**

$$\begin{aligned} \delta_\kappa \mathcal{I}_6(C) &= c_1 (\kappa_c C^{[3]a(2)c,b(2)} + \kappa^b C^{[3]a(2),b}) C^{[2]}_{a(2),b(2)} \\ &\quad + 2 c_2 \kappa^a C^{[2]a(2),b(2)} C^{[3]}_{a(3),b(2)} + 2 c_3 \kappa_b C^{[2]a(2),b(2)} C^{[3]}_{a(2),b} \\ &= (c_1 + 2 c_2) \kappa^a \boxed{C^{[2]a(2),b(2)} C^{[3]}_{a(3),b(2)}} + (c_1 + 2 c_3) \kappa^a \boxed{C^{[2]a(2),b(2)} C^{[3]}_{b(2),a}} \end{aligned}$$

**$\Delta=5$  vector : 2**

**In 6d, there is  $3-2=1$  non-trivial Weyl invariant**

8d

	CC	CCC
$\Delta=8$ scalars	7	11
$\Delta=7$ vectors	8 (6)	7

❖ Boulanger, Erdmenger found  $5=1(CC+CCC)+4(CCC)$

10d

	CC	CCC	CCCC
$\Delta=10$ scalars	12	62	83
$\Delta=9$ vectors	19 (11)	85	46

# Nonlinear Action of SO(2,d)

- Nonlinear action  $\hat{P}^a C^I = \mathcal{E}^{I,a}(C)$   $\hat{K}^a C^I = \mathcal{F}^{I,a}(C)$

LIE ALGEBROID

- SO(2,d) naturally acts on **Space of functions of C**
  - Space of C: Hilbert space
  - Space of functions of C: Fock space?
- Lowest states → **Lowest functions**
  - Weyl invariant: Lowest scalar function
  - On-shell conformal gravity: Lowest tensor function

# Future Plan

- Weyl invariants
- Add scalar field : Q-curvature
- Add conformal spin 3 field in 4d [Beccaria, Tseytlin, Grigoriev, Kuzenko, Ponds, ...]
- Conformal higher spin gravity [Segal, Bekaert&EJ&Mourad, ...]
- Nonlinear representation theory?!

Thank you for your attention!