Title: Shape dependence of superconformal defects

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Collection: Boundaries and Defects in Quantum Field Theory

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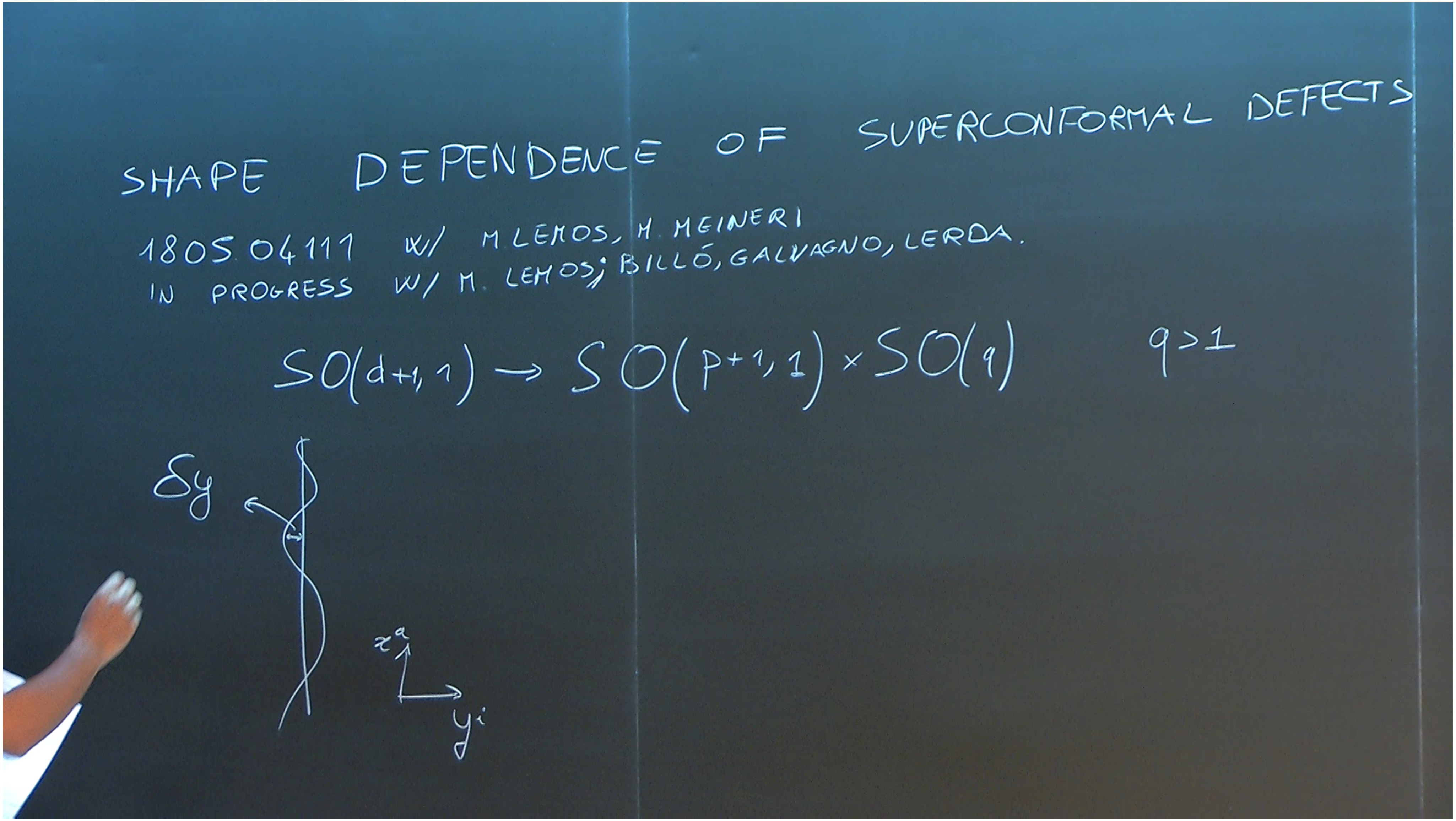
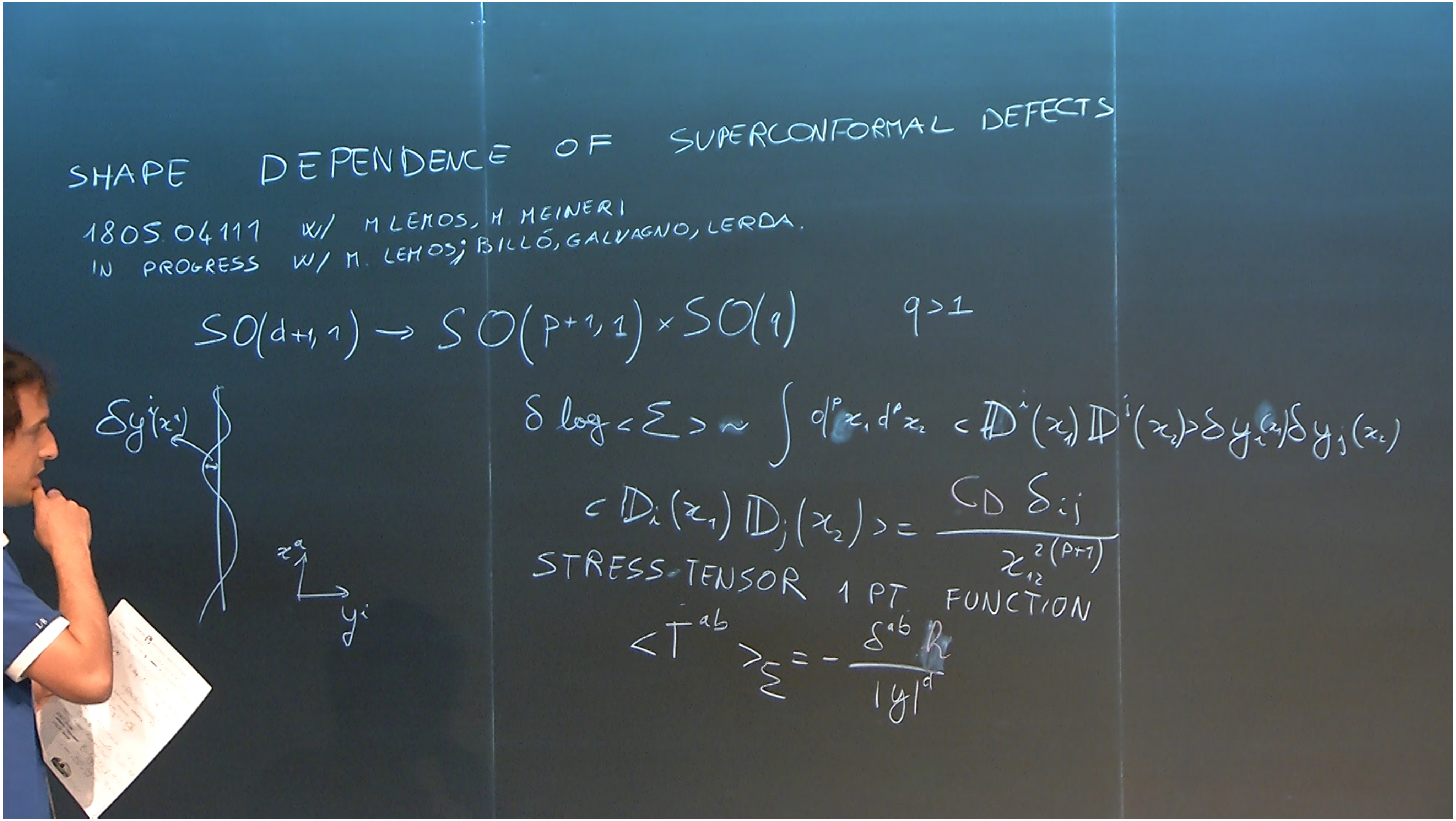
Abstract: The shape deformation of conformal defects is implemented by the displacement operator. In this talk we consider superconformal defects and we provide evidence of a general relation between the two-point function of the displacement and the one-point function of the stress tensor operator. We then discuss the available techniques for the computation of this one-point function. First, we show how it can be related to a deformation of the background geometry. Then we conclude with a discussion of surface defects in four-dimensional N=2 theories, where the chiral algebra provides an additional powerful tool.

SHAPE DEPENDENCE OF SUPERCONFORMAL DEFECTS

1805.04111 W/ M LEMOS, M. MEINERI

IN PROGRESS W/ M. LEMOS; BILLÓ, GALVAGNO, LERDA.


SHAPE DEPENDENCE OF SUPERCONFORMAL DEFECTS
1805.04111 W/ M LEMOS, M. MEINERI
IN PROGRESS W/ M. LEMOS; BILLÓ, GALVAGNO, LERDA.
$SO(d+1,1) \to SO(p+1,1) \times SO(q)$
$q>1$
δy
x^a
y^i


SHAPE DEPENDENCE OF SUPERCONFORMAL DEFECTS
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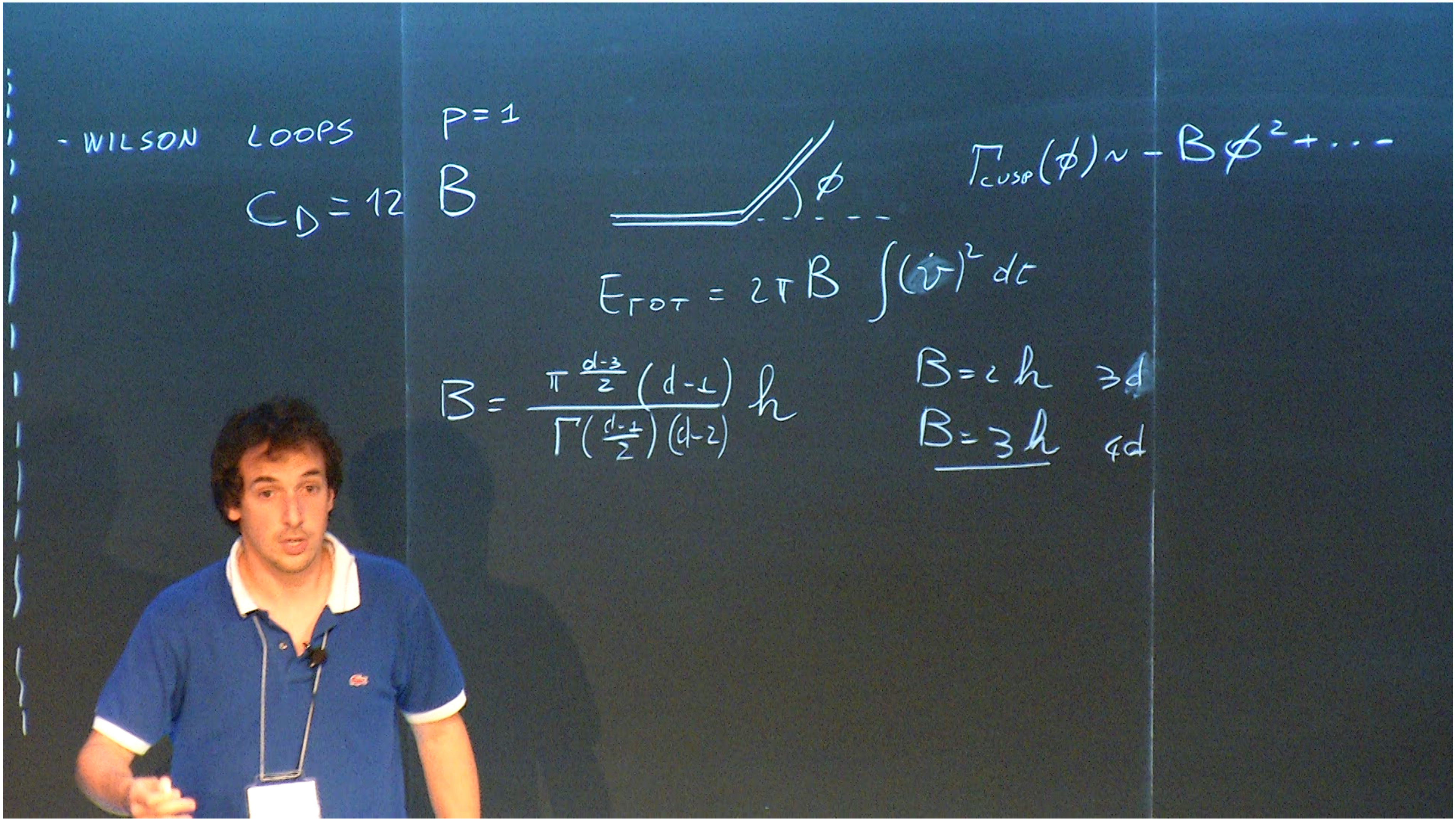
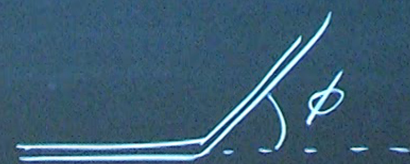
IN PROGRESS W/ M. LEMOS; BILLÓ, GALVAGNO, LERDA.
$SO(d+1,1) \to SO(p+1,1) \times SO(q)$
$q > 1$
$\delta y^i(x^a)$
x^a
y^i
$\delta \log \langle \Sigma \rangle \sim \int d^p x_1\, d^p x_2 \, \langle \mathbb{D}^i(x_1)\, \mathbb{D}^j(x_2) \rangle \delta y_i(x_1) \delta y_j(x_2)$
$\langle \mathbb{D}_i(x_1)\, \mathbb{D}_j(x_2) \rangle = \frac{C_D\, \delta_{ij}}{x_{12}^{2(p+1)}}$
STRESS TENSOR 1 PT FUNCTION
$\langle T^{ab} \rangle_\Sigma = - \frac{\delta^{ab}\, h}{|y|^d}$


- WILSON LOOPS
$p = 1$
$C_D = 12\, B$
ϕ
$\Gamma_{cusp}(\phi) \sim -B\phi^2 + \dots$
$E_{TOT} = 2\pi B \int (\dot{v})^2 \, dt$
$B = \frac{\pi^{\frac{d-3}{2}}(d-1)}{\Gamma\left(\frac{d-1}{2}\right)(d-2)} h$
$B = 2h$ 3d
$B = 3h$ 4d

- WILSON LOOPS $\quad p=1$

$$C_D = 12\, B$$



$$\Gamma_{cusp}(\phi) \sim -B\phi^2 + \dots$$

$$E_{ROT} = 2\pi B \int (\dot{v})^2\, dt$$

$$B = \frac{\pi^{\frac{d-3}{2}}\,(d-1)}{\Gamma\left(\frac{d-1}{2}\right)(d-2)}\, h$$

$B = 2h \quad 3d$

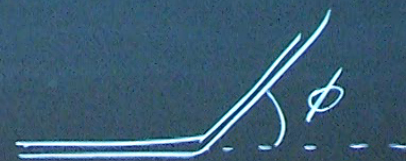
$\underline{B = 3h} \quad 4d$

- SURFACE DEFECTS $\quad p=2,\ q=2$

$$\log\langle\Sigma\rangle = \Big[\, c_1 \int_\Sigma R + c_2 \int_\Sigma \tilde{K}^i_{ab}\tilde{K}_i^{ab} + c_3 \int_\Sigma \gamma^{ab}\gamma^{cd}\, C_{abcd}$$

- WILSON LOOPS $p=1$

$$C_D = 12\, B$$



$$\Gamma_{cusp}(\phi) \sim -B\phi^2 + \dots$$

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$B = 2h$ 3d

$\underline{B = 3h}$ 4d

- SURFACE DEFECTS $p=2,\ q=2$

$$\log\langle\Sigma\rangle = \left[c_1 \int_\Sigma R + c_2 \int_\Sigma \tilde{K}^i_{ab}\tilde{K}^{ab}_i + c_3 \int_\Sigma \gamma^{ab}\gamma^{cd} C_{abcd} \right] \log\frac{1}{\varepsilon}$$

$$c_2 = \frac{\pi^2}{16} C_D \qquad c_3 = 3\pi^2 h$$

...ROGRESS W/ M. LEMOS; BILLÓ, GALVAGNO, ...

$\mathcal{N}=1 \longleftrightarrow \mathcal{N}=(2,0)$ IN 2d

IN 4d

$\mathcal{N}=2 \longrightarrow \mathcal{N}=(2,2)$

$\searrow \mathcal{N}=(4,0)$

$\boxed{q=2}$

$$C_D = d\,\Gamma\left(\frac{d+1}{2}\right)\left(\frac{2}{\sqrt{\pi}}\right)^{d-1} h$$

$\boxed{q=2}$

$$C_D = d\,\Gamma\!\left(\frac{d+1}{2}\right)\left(\frac{2}{\sqrt{\pi}}\right)^{d-1} h$$

<u>CLAIM</u>: FOR ANY SUPERCONFORMAL DEFECT

$$C_D = K(p,q)\, h$$

$\boxed{q=2}$

$$C_D = d\,\Gamma\left(\frac{d+1}{2}\right)\left(\frac{2}{\sqrt{\pi}}\right)^{d-1} h$$

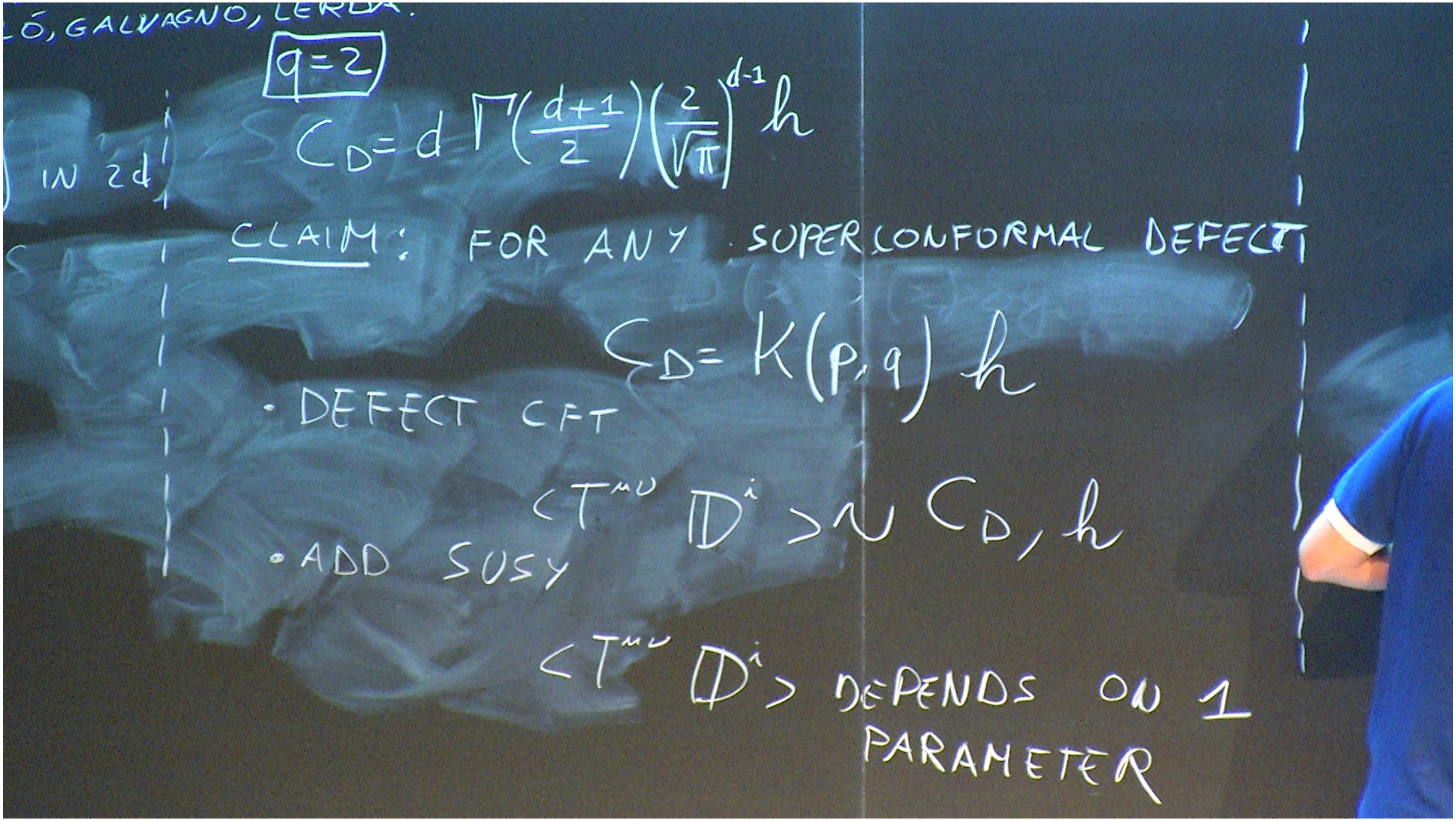
<u>CLAIM</u>: FOR ANY SUPERCONFORMAL DEFECT

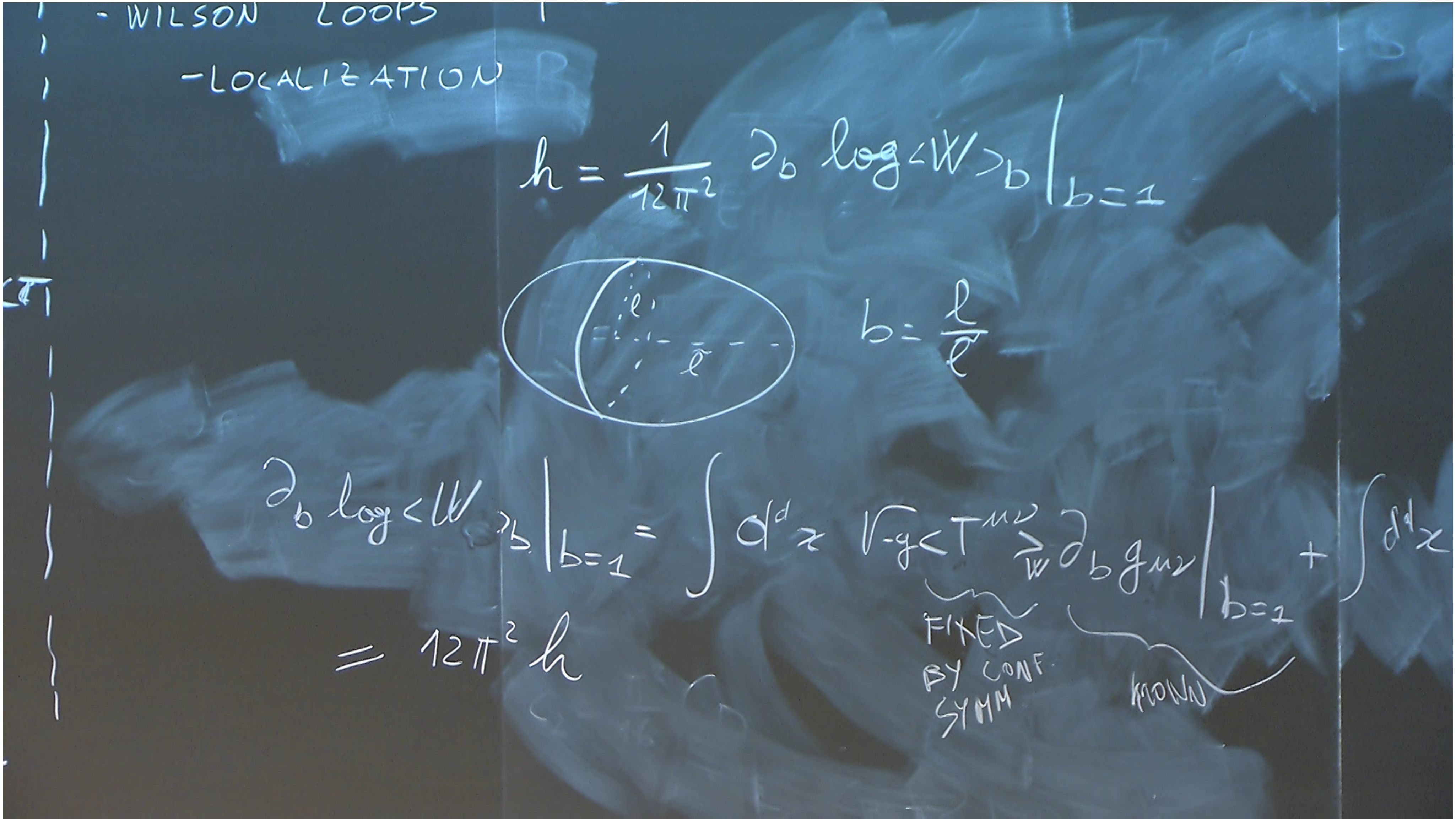
$$C_D = K(p,q)\, h$$

- DEFECT CFT

$$\langle T^{\mu\nu}\, \mathbb{D}^i \rangle \sim C_D,\ h$$

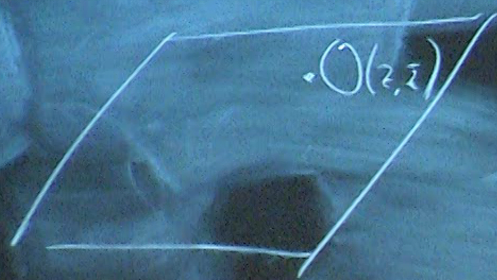
- ADD SUSY


GALVAGNO,
$\boxed{q=2}$
$C_D = d\,\Gamma\left(\frac{d+1}{2}\right)\left(\frac{2}{\sqrt{\pi}}\right)^{d-1} h$
IN 2d
CLAIM: FOR ANY SUPERCONFORMAL DEFECT
$C_D = K(p,q)\, h$
• DEFECT CFT
$\langle T^{\mu\nu} \mathbb{D}^i \rangle \sim C_D, h$
• ADD SUSY
$\langle T^{\mu\nu} \mathbb{D}^i \rangle$ DEPENDS ON 1 PARAMETER


- WILSON LOOPS
- LOCALIZATION
$h = \frac{1}{12\pi^2} \partial_b \log \langle W \rangle_b \Big|_{b=1}$
$b = \frac{\ell}{\tilde{\ell}}$
$\partial_b \log \langle W \rangle_b \Big|_{b=1} = \int d^d x \sqrt{-g} \langle T^{\mu\nu} \rangle_W \partial_b g_{\mu\nu} \Big|_{b=1} + \int d^d x$
$= 12\pi^2 h$
FIXED BY CONF SYMM
KNOWN

IN PROGRESS W/ M. LEMOS; BILLÓ, GALVAGNO, LEREDA.

- CHIRAL ALGEBRA



$$\mathbb{Q} = Q^{1}_{-} + \tilde{S}^{2\dot{-}}$$

E.G. $T(z) = j^{+}_{1\dot 1} + \bar z\, j^{0}_{1\dot 1} + \bar z^{2}\, j^{-}_{1\dot 1}$

$SU(2)_R \quad j^{I}_{\alpha\dot\alpha}$

$$\langle T(z)\, T(0)\rangle = \frac{c_{2d}}{2 z^4}$$

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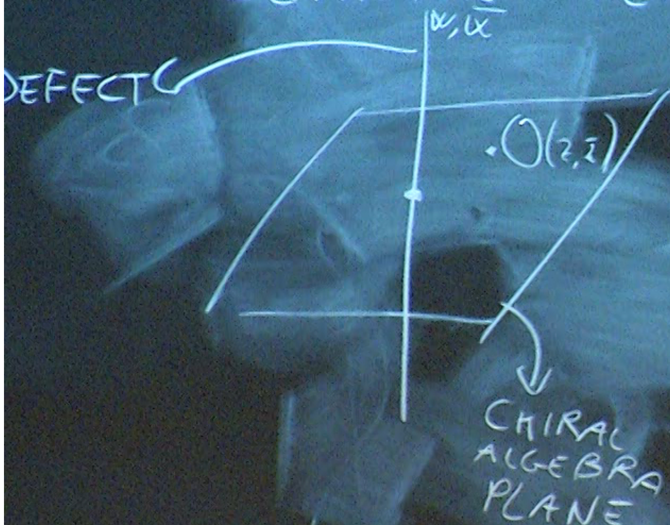
IN PROGRESS W/ M. LEMOS; BILLÓ, GALVAGNO, LERDA.

- CHIRAL ALGEBRA



$$\mathbb{Q} = Q^1_- + \tilde{S}^{2\dot{-}}$$

- E.G. $T(z) = j^+_{1\dot 1} + \bar z\, j^0_{1\dot 1} + \bar z^2\, j^-_{1\dot 1}$

$SU(2)_R$ $\quad j^I_{\alpha\dot\alpha}$

$$\langle T(z)\, T(0)\rangle = \frac{c_{2d}}{2 z^4}$$

$\mathcal{N}=(2,2)$ DEFECTS

$$SU(2,2|2) \longrightarrow SU(1,1|1) \times SU(1,1|1) \times U(1)_c$$

$$[h, q; \bar{h}, \bar{q}; c] \qquad c = R + m_\perp$$

$$h = q \quad \bar{h} = +\bar{q} \Rightarrow (a,c)$$

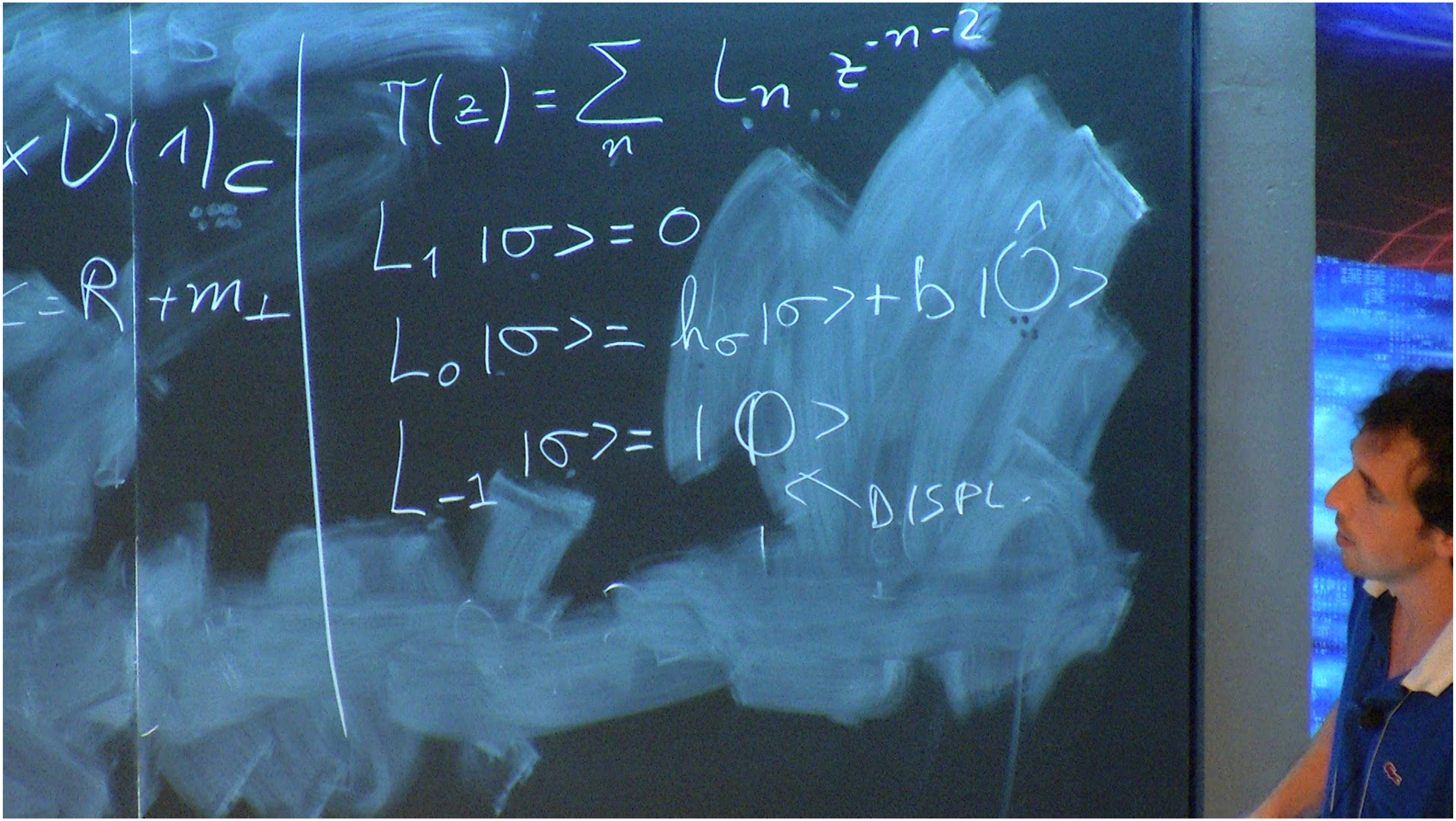
DEFECT OPE

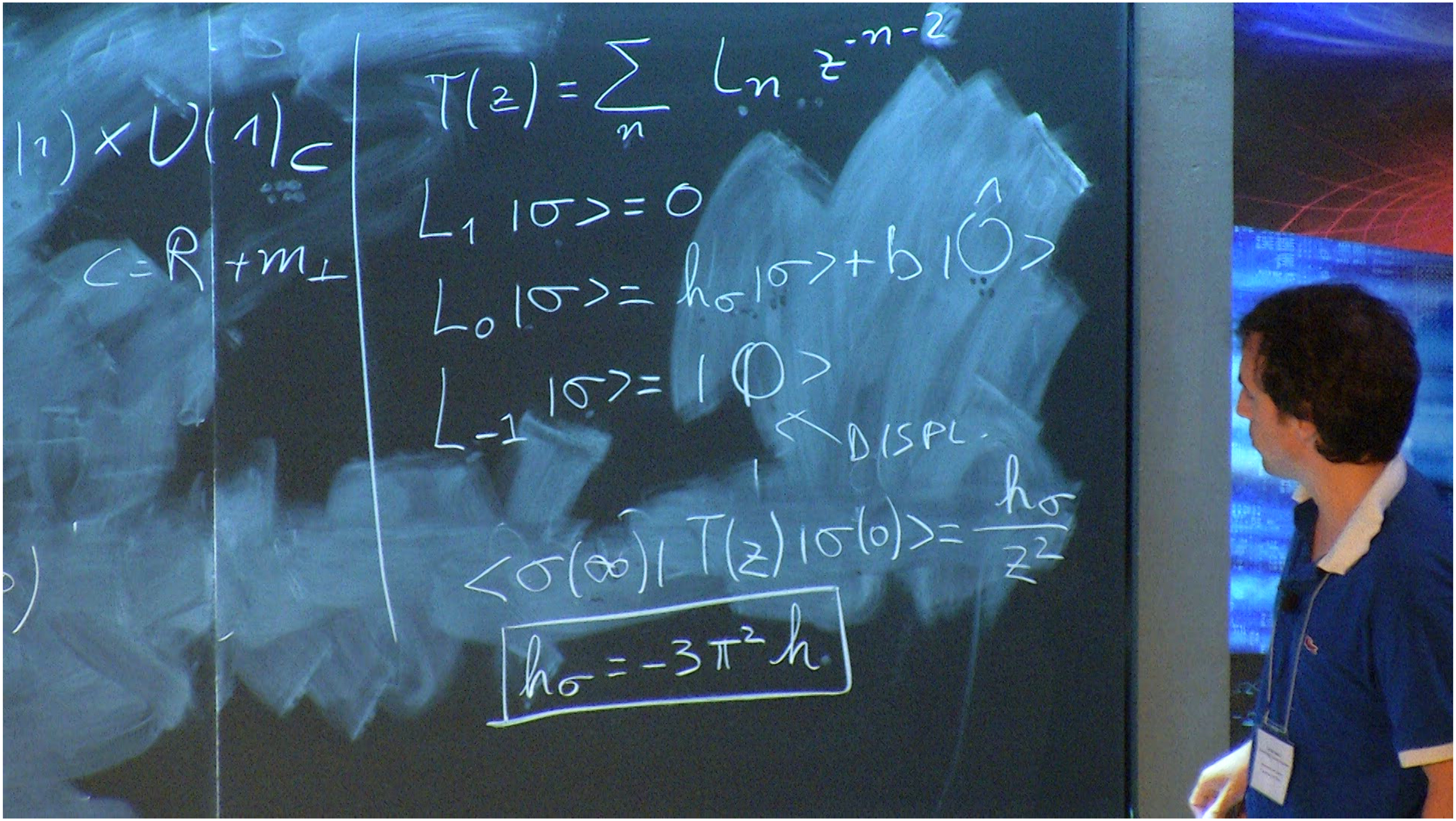
$$\mathcal{O}(z,\bar{z}) = \sum_{\hat{\mathcal{O}}} z^{h} \bar{z}^{\bar{h}} \hat{\mathcal{O}}(0,0)$$

SCHUR

(a,c)

$$\mathcal{O}(z) = \sum_{c} z^{c-h_{\mathcal{O}}} \hat{\mathcal{O}}_c$$


× U(1)_c
= R + m_⊥
T(z) = Σ_n L_n z^(-n-2)
L_1 |σ> = 0
L_0 |σ> = h_σ |σ> + b |Ô>
L_-1 |σ> = |Φ>
DISPL.


$T(z) = \sum_n L_n z^{-n-2}$
$L_1 |\sigma\rangle = 0$
$L_0 |\sigma\rangle = h_\sigma |\sigma\rangle + b |\hat{O}\rangle$
$L_{-1} |\sigma\rangle = |\Phi\rangle$
DISPL.
$\langle \sigma(\infty) | T(z) | \sigma(0) \rangle = \frac{h_\sigma}{z^2}$
$h_\sigma = -3\pi^2 h$
$c = R + m_\perp$