Title: Bubbling wormholes and matrix models

Speakers: Ji Hoon Lee

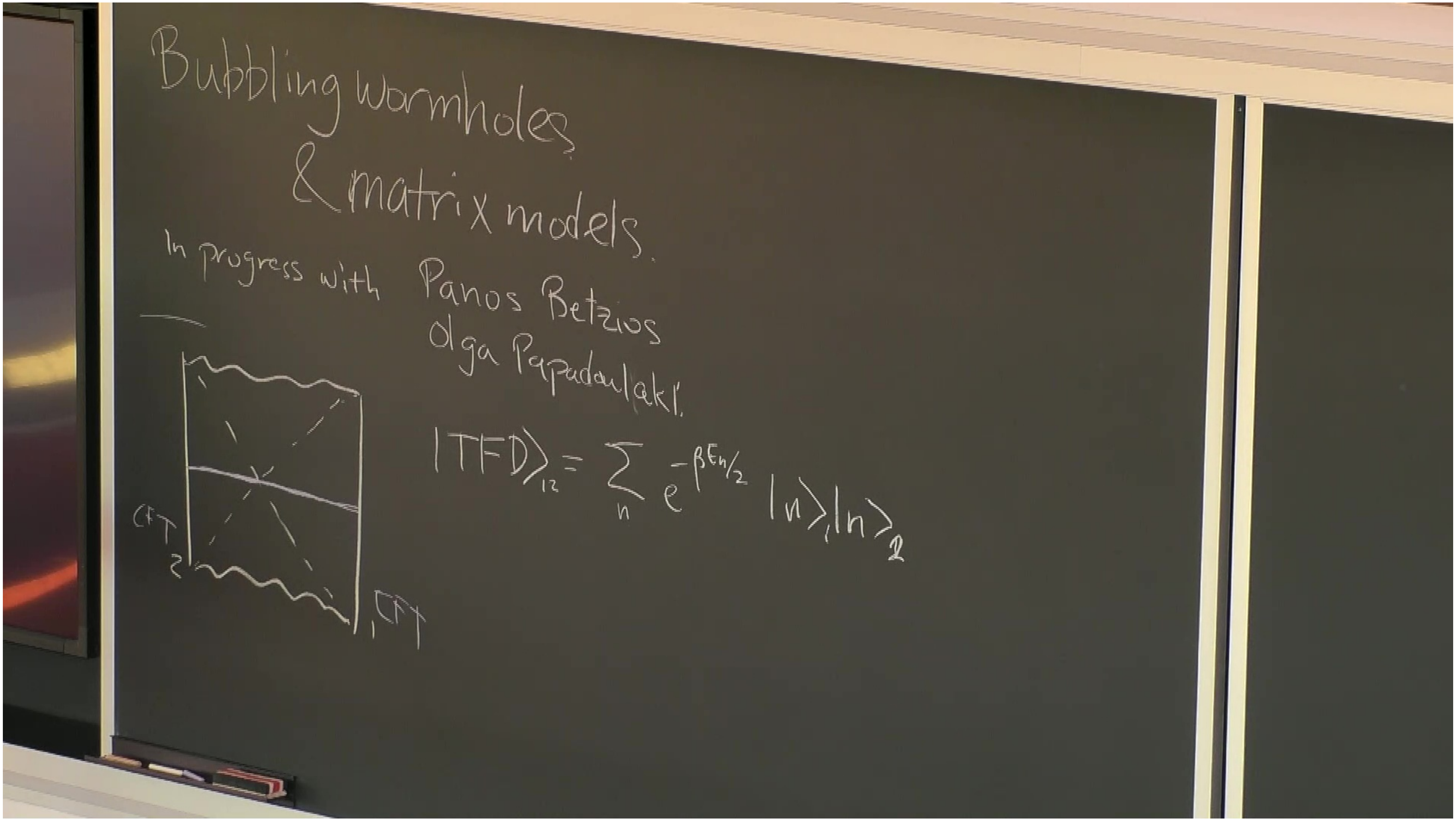
Series: Quantum Fields and Strings

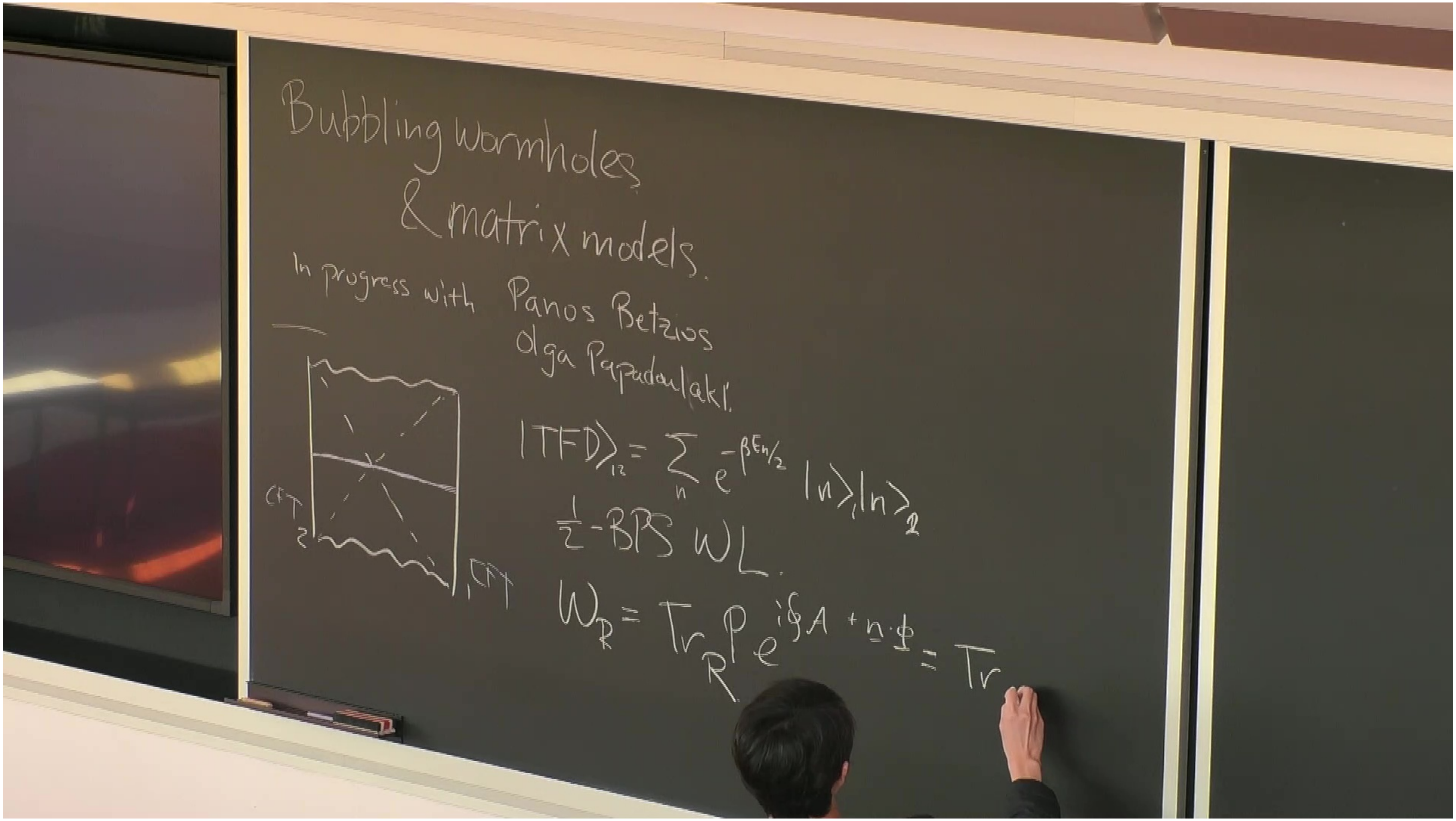
Date: April 21, 2023 - 11:00 AM

URL: https://pirsa.org/23040153

Abstract: Abstract: TBA

Zoom link: https://pitp.zoom.us/j/92398762552?pwd=OXdkemQvbGltdWs3eW1GVWNRbGhldz09


Bubbling wormholes
& matrix models.
In progress with Panos Betzios
Olga Papadoulaki.
$|TFD\rangle_{12} = \sum_n e^{-\beta E_n/2} |n\rangle_1 |n\rangle_2$
CFT_2
CFT_1



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CFT$_2$
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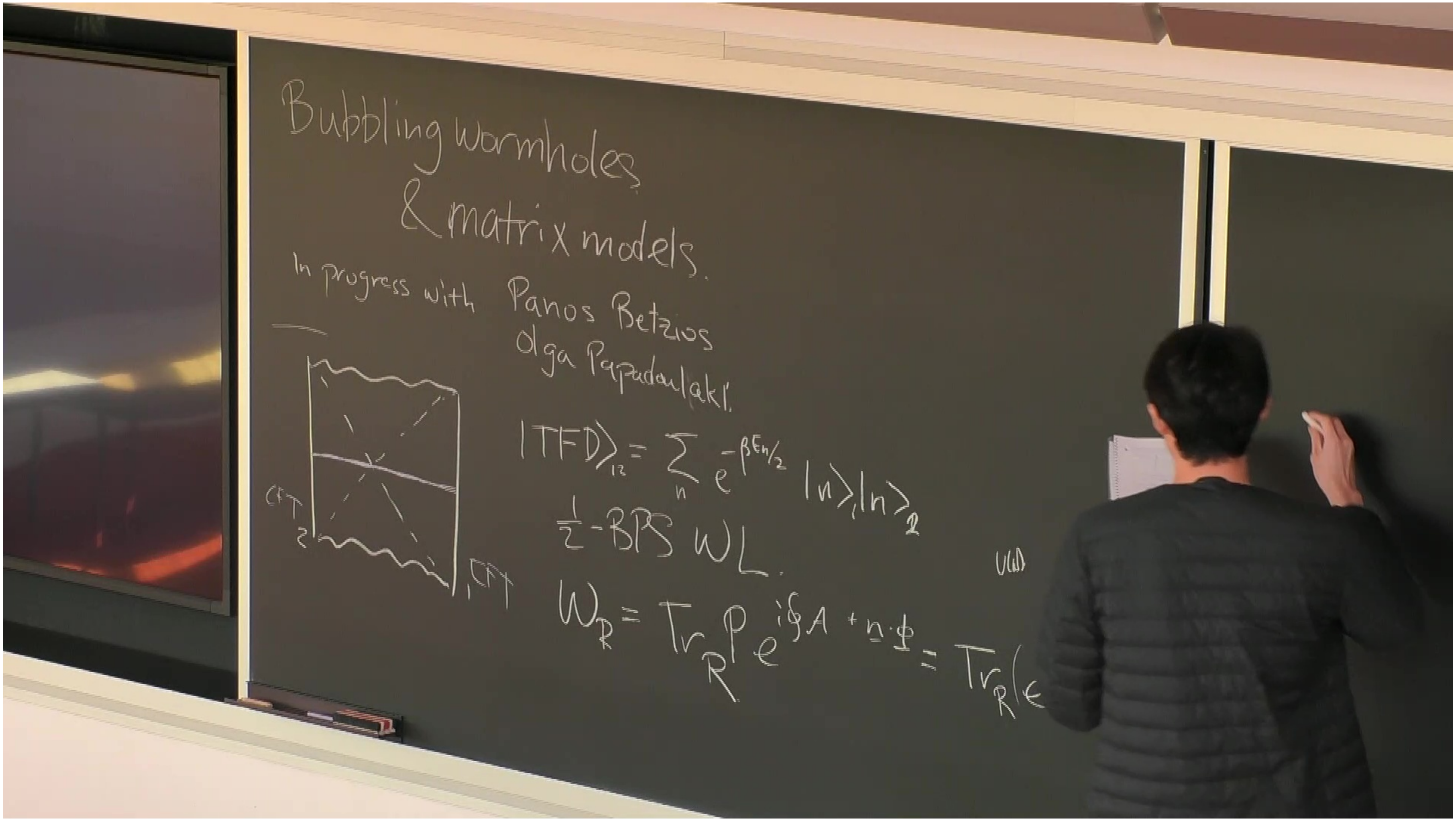
$|TFD\rangle_{12} = \sum_n e^{-\beta E_n/2} |n\rangle_1 |n\rangle_2$
$\frac{1}{2}$-BPS WL.
$W_R = \mathrm{Tr}_R P e^{i\oint A + n\cdot\Phi} = \mathrm{Tr}$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$\frac{1}{2}$-BPS WL.
U(N)
$W_R = \mathrm{Tr}_R P e^{i\oint A + n\cdot\Phi} = \mathrm{Tr}_R(e$

$$\langle W_R \rangle = \int dM \, e^{-\frac{2N}{\lambda}\mathrm{Tr}\, M^2} \, \mathrm{Tr}_R \, e^{M}$$

$S^1 \subset S^4$

lot can be hidden here!

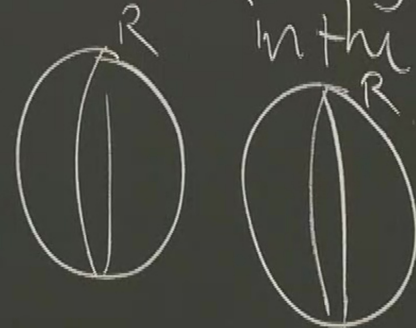
$$\sum_R \langle \mathrm{Tr}_R \, e^{M_1} \rangle_1 \langle \mathrm{Tr}_R \, e^{M_2} \rangle_2$$

glues BPS geometries in the bulk.

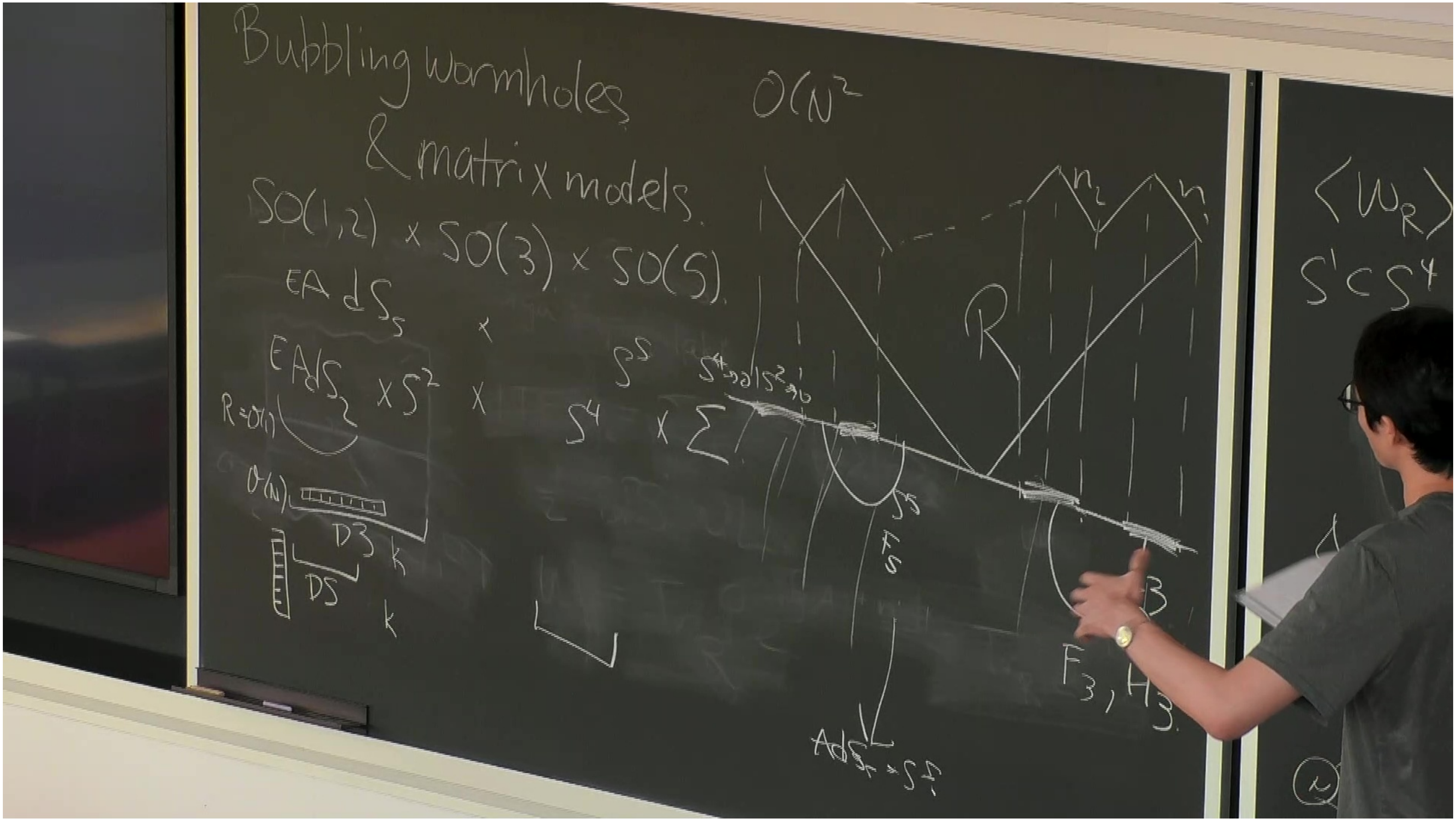
$$\Delta_{12} = \sum_R \mathrm{Tr}_R \, e^{M_1} \, \mathrm{Tr}_R \, e^{M_2}$$

$$= \int d\bar{X} dX \, e^{-\int \bar{X}(d - A_1 - A_2) X}$$

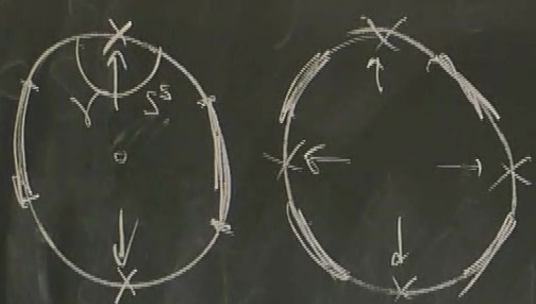
$\sum_R$



$$\langle \Delta_{12} \Delta_{23} \Delta_{34} \Delta_{41} \rangle$$


Bubbling wormholes
& matrix models
O(N^2
SO(1,2) x SO(3) x SO(5)
EAdS5 x S5
EAdS2 x S2 x S4 x Σ
O(N)
D3
D5
k
R
n2
n1
F5
F3, H3
⟨W_R⟩
S1 ⊂ S4

h_1, h_2 $\qquad a, b \sim \sqrt{\lambda}$

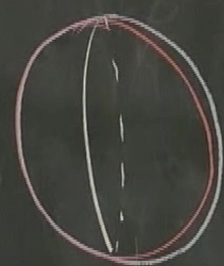


$$Q_{D3} = \int_{S^5_i} dC_4 = \int_{\gamma} f(h_1, h_2)$$

$$= 24\pi (b-a)^2 \widehat{\mathrm{Vol}}(S_4)$$

$$N_i = \frac{4}{\pi}(b-a)^2$$

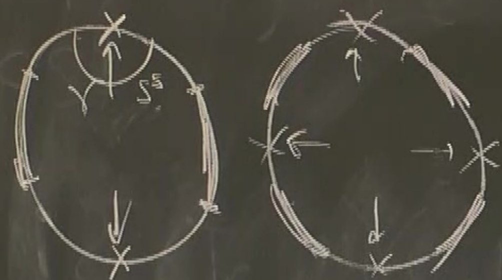
$S^4 \supset S^1 \subset S^4$



$U(N)$

$$\sum_R \mathrm{Tr}_R(U)\,\mathrm{Tr}_R(V^\dagger) = \delta(U, V)$$

$h_1, h_2 \qquad a, b \sim \sqrt{\lambda}$



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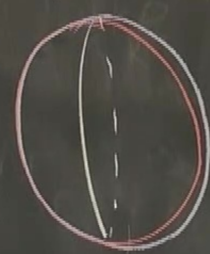
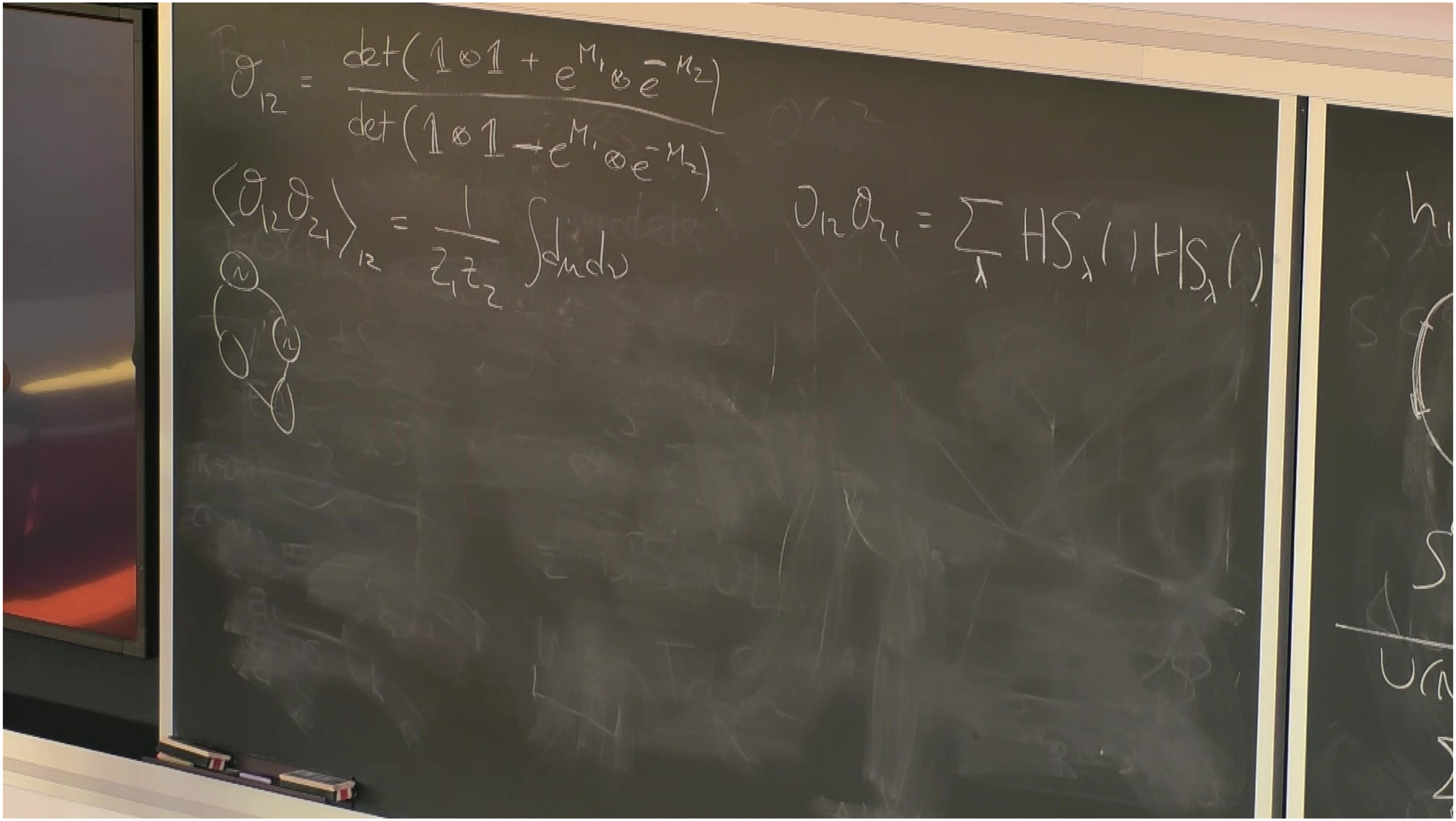
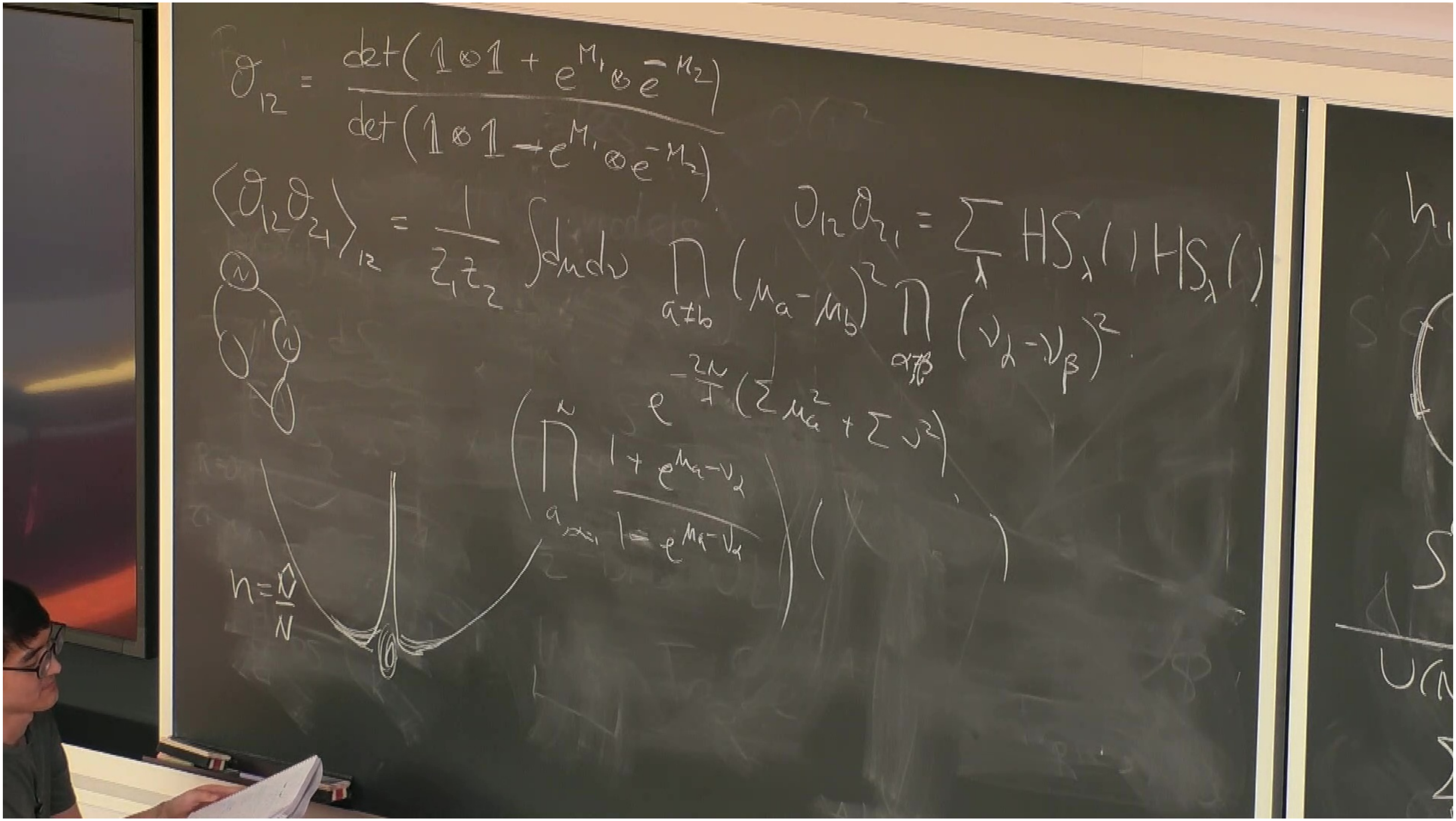


$U(N)$

$$\sum_R Tr_R(U)\, Tr_R(V^\dagger) = \delta(U, V)$$

$$\sum_R e^{-L|R|}\, Tr_R U \, Tr_R V$$


$\vartheta_{12} = \frac{\det(1 \otimes 1 + e^{M_1} \otimes e^{-M_2})}{\det(1 \otimes 1 - e^{M_1} \otimes e^{-M_2})}$
$\langle \vartheta_{12} \vartheta_{21} \rangle_{12} = \frac{1}{Z_1 Z_2} \int d\mu\, d\nu$
$\vartheta_{12} \vartheta_{21} = \sum_\lambda HS_\lambda(\ ) HS_\lambda(\ )$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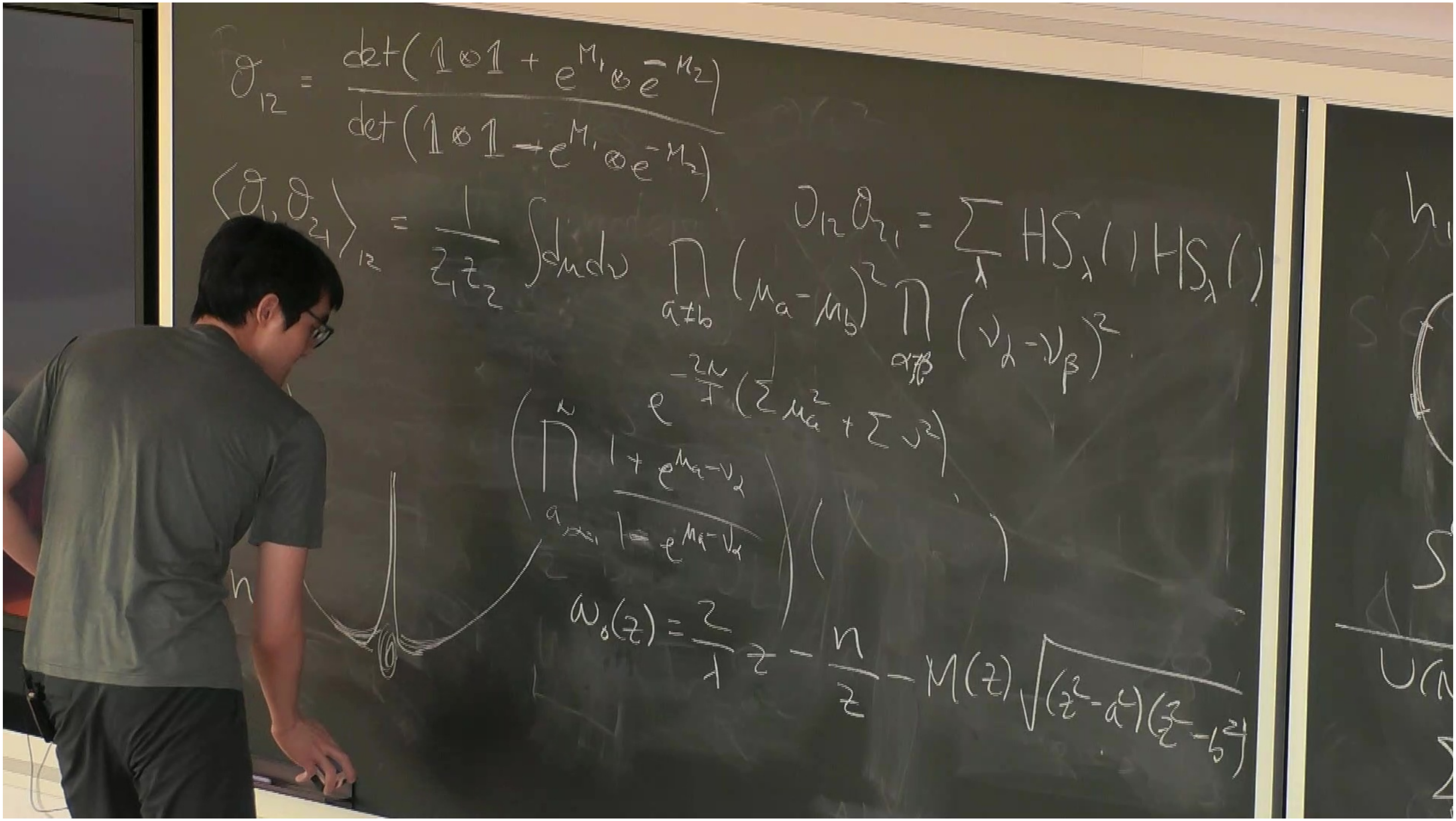
$\langle \vartheta_{12}\vartheta_{21}\rangle_{12} = \frac{1}{Z_1 Z_2}\int d\mu\, d\nu \prod_{a\neq b}(\mu_a-\mu_b)^2 \prod_{\alpha\neq\beta}(\nu_\alpha-\nu_\beta)^2$
$e^{-\frac{2N}{t}(\sum \mu_a^2 + \sum \nu^2)}$
$\left(\prod_{a,\alpha=1}^{N} \frac{1+e^{\mu_a-\nu_\alpha}}{1-e^{\mu_a-\nu_\alpha}}\right)\left(\ \right)$
$\vartheta_{12}\vartheta_{21} = \sum_\lambda HS_\lambda(\ )HS_\lambda(\ )$
N
N
$n=\frac{N}{N}$
U(N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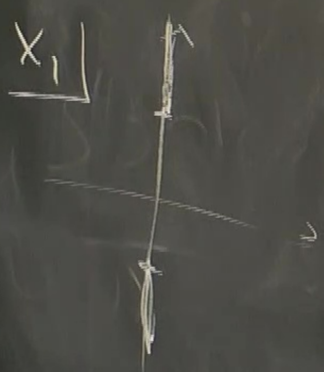
$e^{-\frac{2N}{\lambda}(\sum \mu_a^2 + \sum \nu^2)}$
$\left(\prod_{a,\alpha}^{N} \frac{1+e^{\mu_a-\nu_\alpha}}{1-e^{\mu_a-\nu_\alpha}}\right)(\ )$
$\vartheta_{12}\vartheta_{21} = \sum_\lambda HS_\lambda(\ )HS_\lambda(\ )$
$\omega_0(z) = \frac{2}{\lambda} z - \frac{n}{z} - M(z)\sqrt{(z^2-a^2)(z^2-b^2)}$

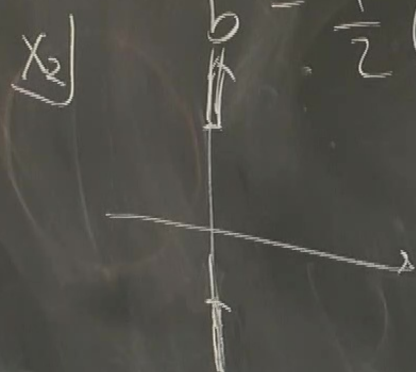
$$\omega_0(z) = \frac{2}{\lambda} z - \frac{2ab}{\lambda z} - \frac{2}{\lambda z}\sqrt{(z^2-a^2)(z^2-b^2)}$$

$a \sim b \sim \sqrt{\lambda}$

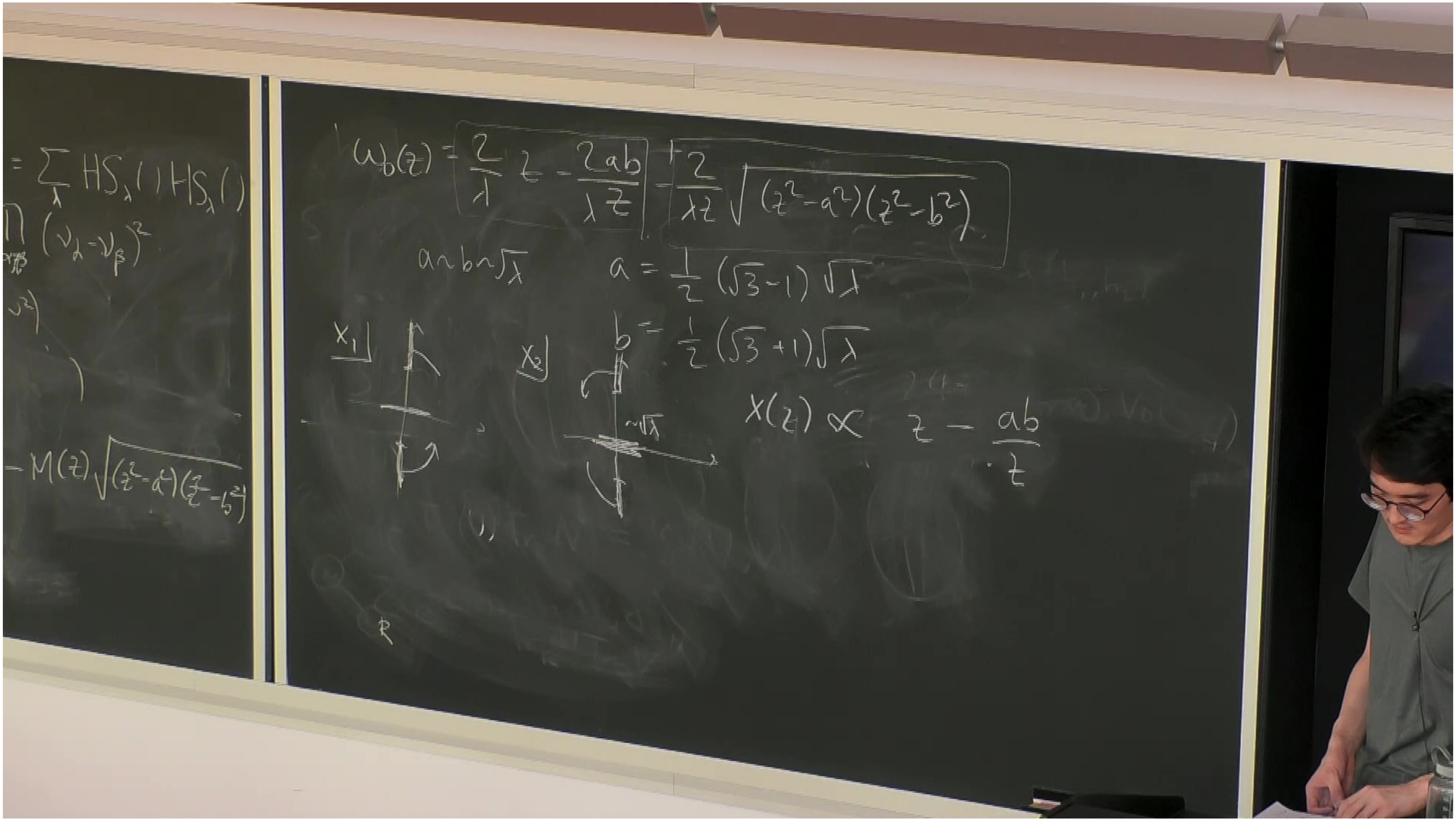
$$a = \frac{1}{2}(\sqrt{3}-1)\sqrt{\lambda}$$

$$b = \frac{1}{2}(\sqrt{3}+1)\sqrt{\lambda}$$





$$X(z) \propto z - \frac{ab}{z}$$



$\omega_0(z) = \frac{2}{\lambda} z - \frac{2ab}{\lambda z} + \frac{2}{\lambda z}\sqrt{(z^2-a^2)(z^2-b^2)}$
$a \sim b \sim \sqrt{\lambda}$
$a = \frac{1}{2}(\sqrt{3}-1)\sqrt{\lambda}$
$b = \frac{1}{2}(\sqrt{3}+1)\sqrt{\lambda}$
X_1
X_2
$\sim\sqrt{\lambda}$
$X(z) \propto z - \frac{ab}{z}$
$- M(z)\sqrt{(z^2-a^2)(z^2-b^2)}$