

Title: Bulk Physics from CFT

Date: Jun 23, 2011 09:00 AM

URL: <http://pirsa.org/11060066>

Abstract: Gauge/gravity duality is our most complete construction of quantum gravity, but it gives in a simple way only the observations of an observer at the AdS boundary. I discuss various issues regarding the representation of the bulk physics.

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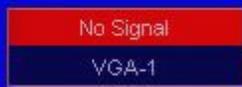
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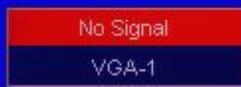
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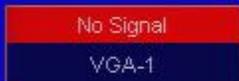
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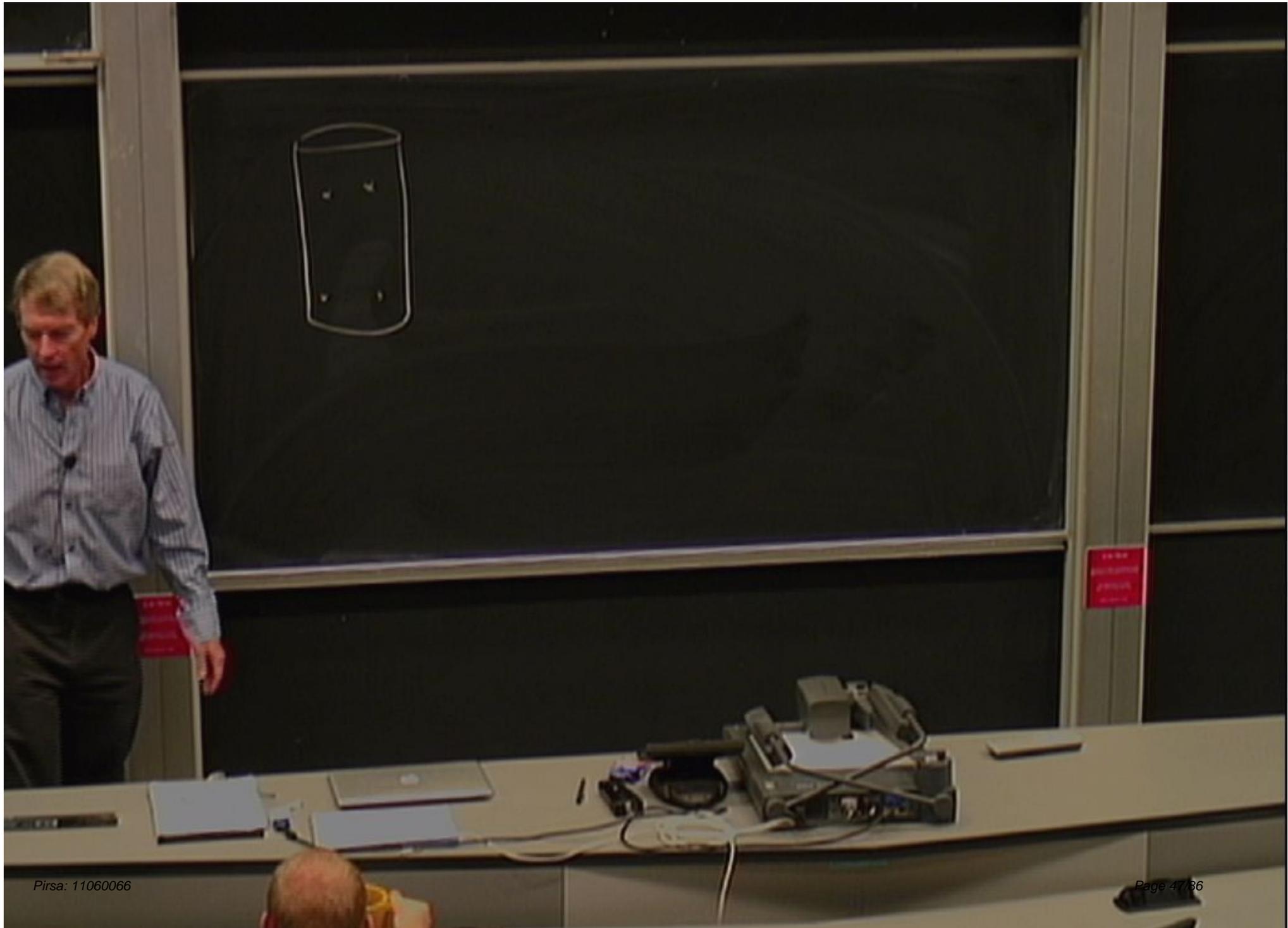
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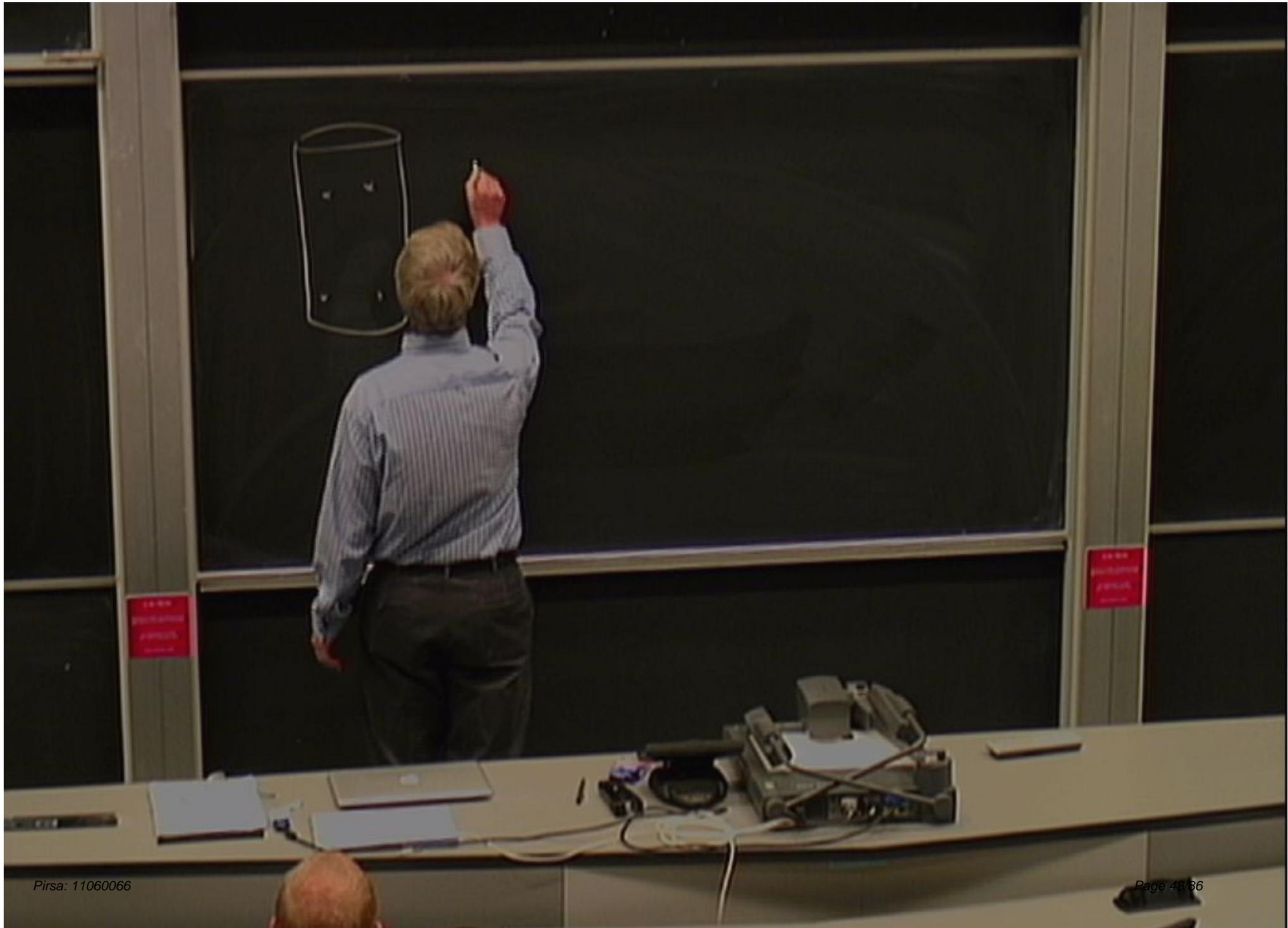
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BH evolution unitary



BH evolution unitary
Lorentz cov



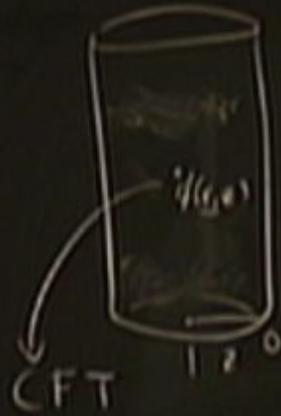
BH evolution unitary
Lorentz covariant
~~Euclidean unitary~~



BH evolution unitary
Lorentz covariant
~~Euclidean signature~~
S-matrix at $E \gg M_p$



BH evolution unitary
Lorentz exist
~~Euclidean unitarity~~
S-matrix at $E \gg M_p$



BH evolution unitary
Lorentz exact
~~Euclidean unitarity~~
S-matrix at $E \gg M_p$



BH evolution unitary
Lorentz covariant
~~Euclidean unitary~~
S-matrix at $E \gg M_p$

BDHM
BKLT
B



BH evolution unitary
 Lorentz exact
~~Euclidean unitary~~
 S-matrix at $E \gg M_p$

BDHM
 BKLT
 B

$$\lim_{z \rightarrow 0} \phi(x, z) z^{-\Delta} \rightarrow \mathcal{O}(x)$$



BH evolution unitary
 Lorentz cov
~~Euclidean unitary~~
 S-matrix at $E \gg M_p$

BDHM
 BKLT
 B
 KLL

$$\lim_{z \rightarrow 0} \phi(x, t) z^{-\Delta} \rightarrow \mathcal{O}(x)$$

$$(\square - m^2)\phi = g\phi^2$$

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$$(\square - m^2)G(x, z, x', z') = \frac{1}{i} \delta(x - x')$$

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$$(\square - m^2)G(x, z, x', z') = \delta(x - x')$$

$$(\square - m^2)\phi = g\phi^2$$

$$(\square - m^2)G(x, z, x', z') = \frac{1}{\Omega} \delta(x - x', z - z')$$

$$\phi(x, z) = \int d^d x' d^d z' \delta(x - x', z - z') \phi(x', z') G(x, z; x', z')$$

$$(\square - m^2)\phi = g\phi^2$$

$$(\square - m^2)G(x, z; x', z') = \frac{1}{\sqrt{g}}\delta(x-x', z-z')$$

$$\phi(x, z) = \int \phi(x', z') (\square - m^2)G(x, z; x', z')$$

$$+ \int \phi(x', z') (\vec{\partial}_2 - \vec{\partial}'_2)G(x, z; x', z') + O(g)$$

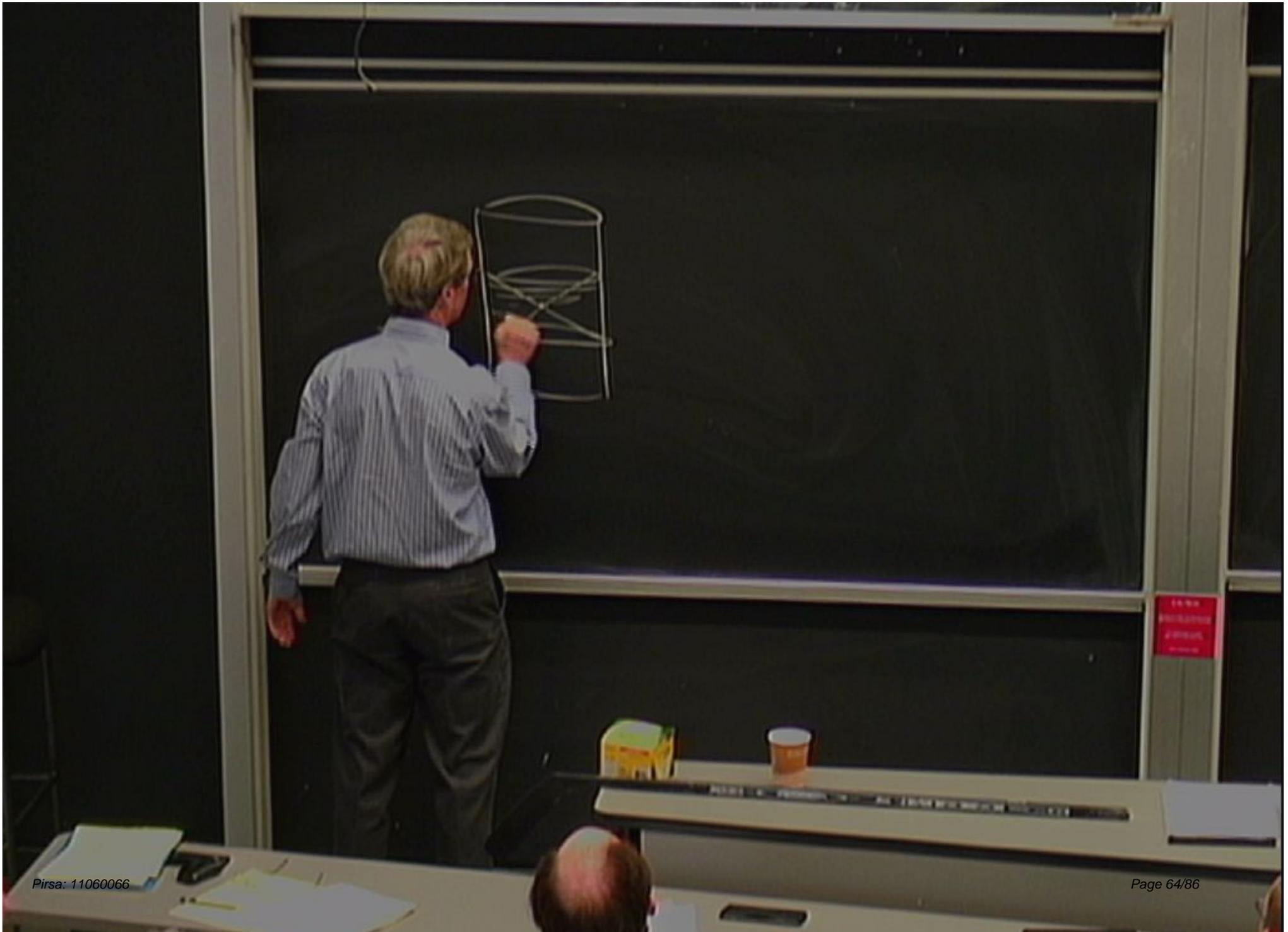


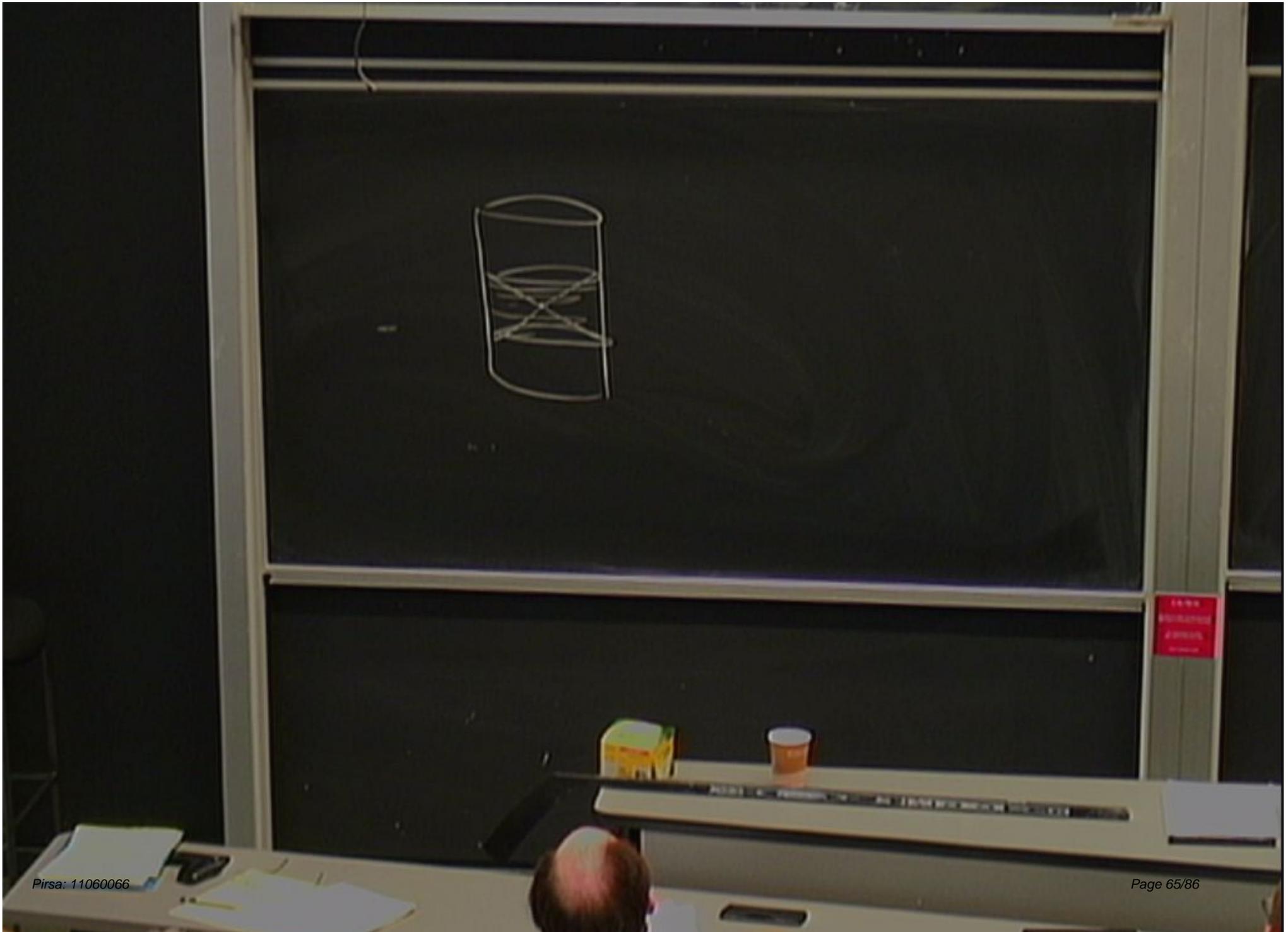
$$(\mathbb{D} - m^2) G(x, z; x', z') = \frac{1}{\sqrt{g}} \delta(x - x', z - z')$$

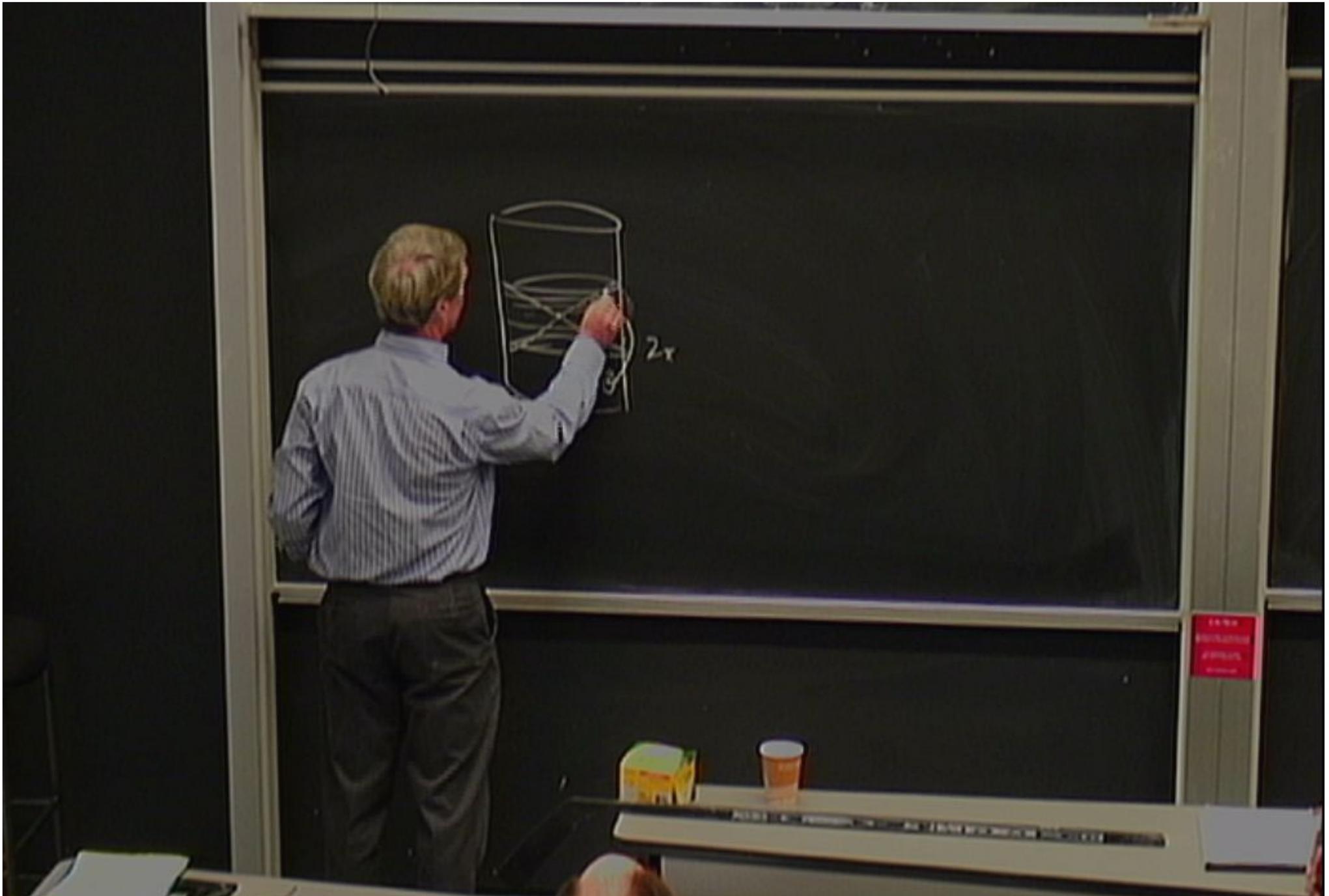
$$\phi(x, z) = \int d^d x' d^d z' \sqrt{g'} \phi(x', z') (\mathbb{D} - m^2) G(x, z; x', z')$$

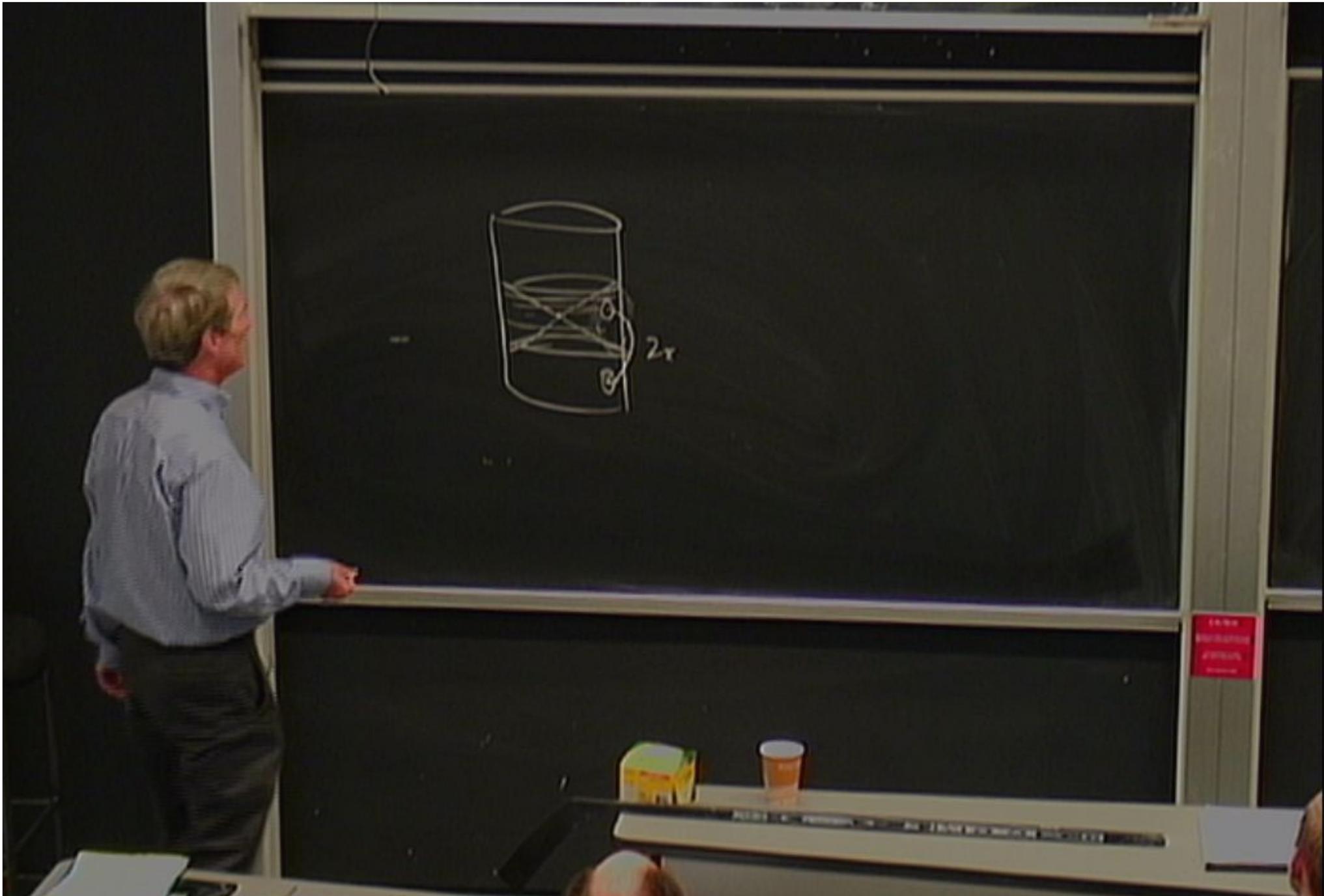
$$= \int_{z=0} d^d x' \sqrt{g'} \phi(x', z') (\vec{\partial}_z - \vec{\partial}'_z) G(x, z; x', z') + \mathcal{O}(\eta)$$

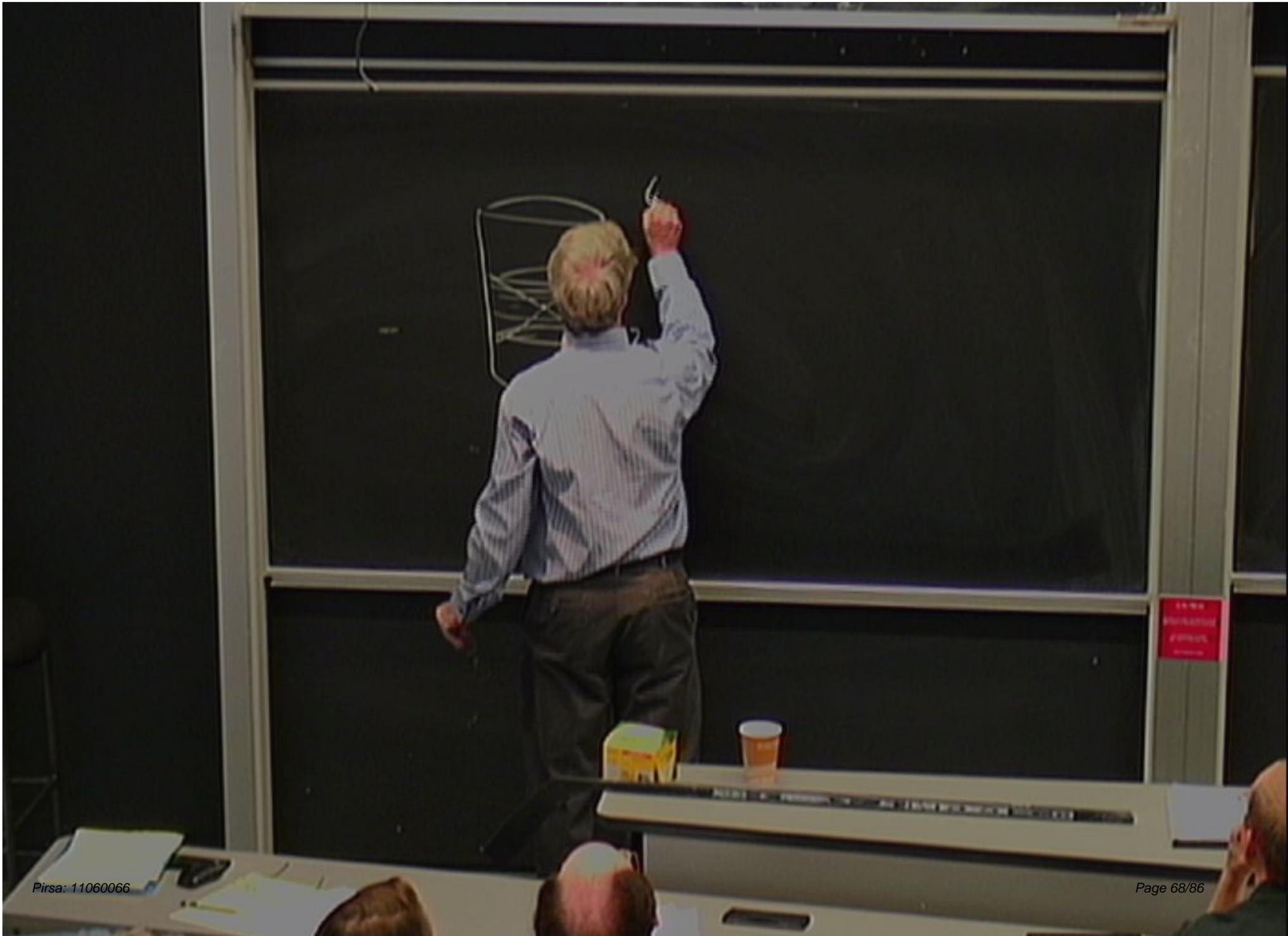
$$= \int d^d x' T(x, z; x') \mathcal{O}(x') + \mathcal{O}(\eta)$$

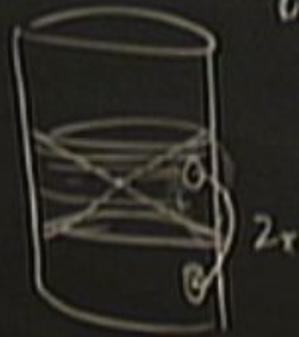












$$G(x, z) = \dots + g \int d^4x' dz' \phi^2(x', z')$$
$$G(x, z; x', z')$$

$$\phi(x, z) = \int d^d v' d^d z' \sqrt{\eta'} \phi(v', z') (\mathbb{D} - m') G(x, z; x', z')$$

$$= \int_{z=0} d^d x' \sqrt{\eta'} \phi(v', z') (\vec{\partial}_2 - \vec{\partial}'_2) G(x, z; x', z') + O(\eta)$$

$$= \int d^d v' T(x, z; x') \phi(v') + g \int d^d v' d^d v'' T(x, z; v', v'') \phi(v') \phi(v'')$$



$$\text{tr } F_{uv}(x) F^{uv}(y)$$



$$\text{tr } F_{\mu\nu}(x) F^{\mu\nu}(x)$$
$$\rightarrow \text{tr } \underbrace{F_{\mu\nu}(x)}_W \underbrace{F^{\mu\nu}(x)}_W$$



$$\text{tr } F_{\mu\nu}(x) F^{\mu\nu}(x)$$
$$\rightarrow \text{tr } \underbrace{F_{\mu\nu}(x')}^W \underbrace{F^{\mu\nu}(x'')}_{}$$

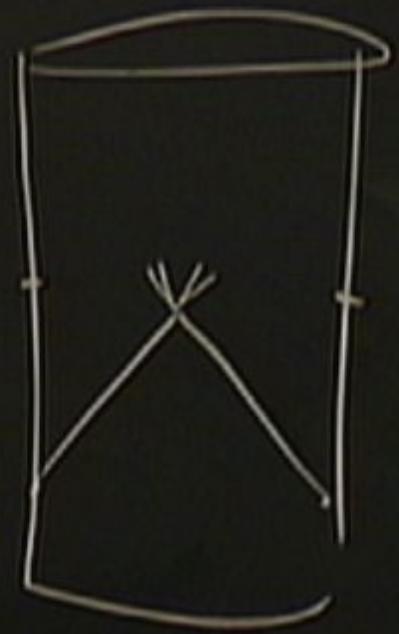


$$\text{tr } F_{uv}(x) F^{uv}(y)$$
$$\rightarrow \text{tr } \underbrace{F_{uv}(x')}_{W} \underbrace{F^{uv}(y'')}_{W}$$



$$\text{tr } F_{\text{cov}}(x) F^{\text{cov}}(y)$$

$$\rightarrow \text{tr } \underbrace{F_{\text{cov}}(x')}_{\text{W}} \underbrace{F^{\text{cov}}(y'')}_{\text{W}}$$

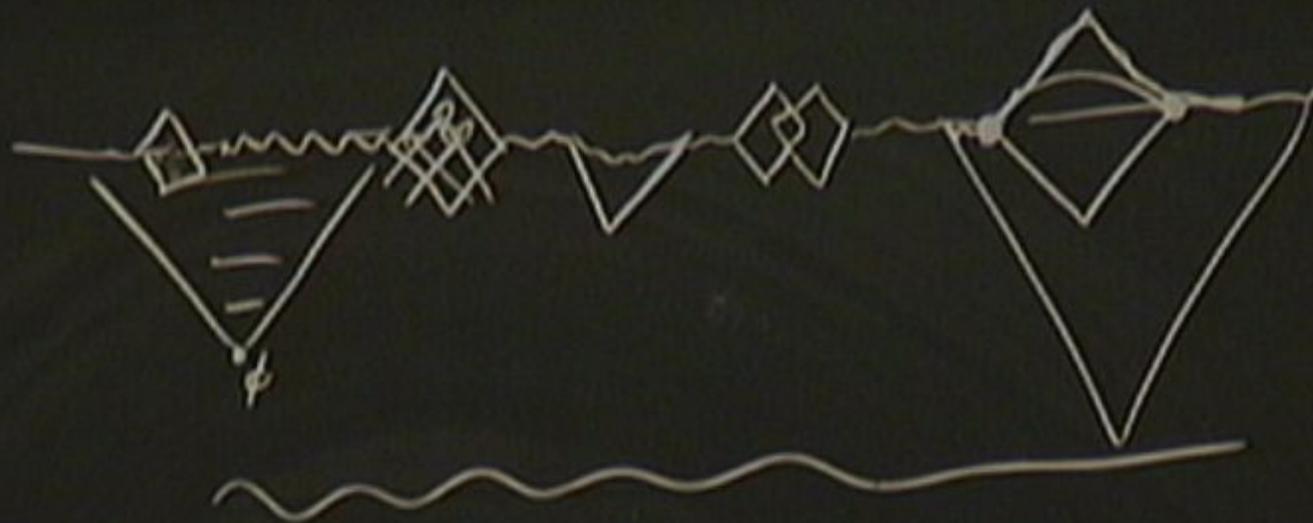




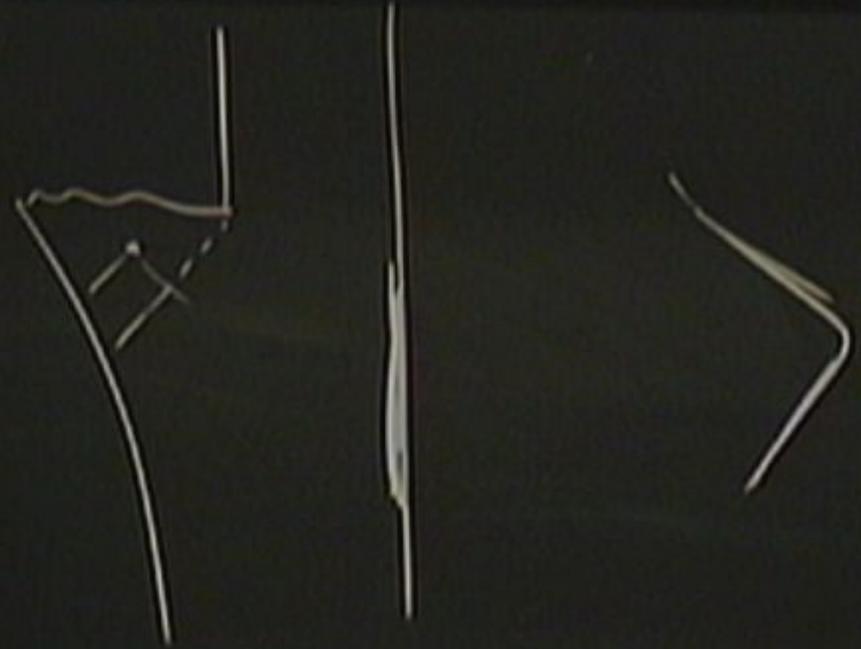
$$\text{tr } F_{\mu\nu}(x) F^{\mu\nu}(y)$$
$$\rightarrow \text{tr } F_{\mu\nu}(x) \underbrace{\quad}_W \underbrace{\quad}_{(y)}$$



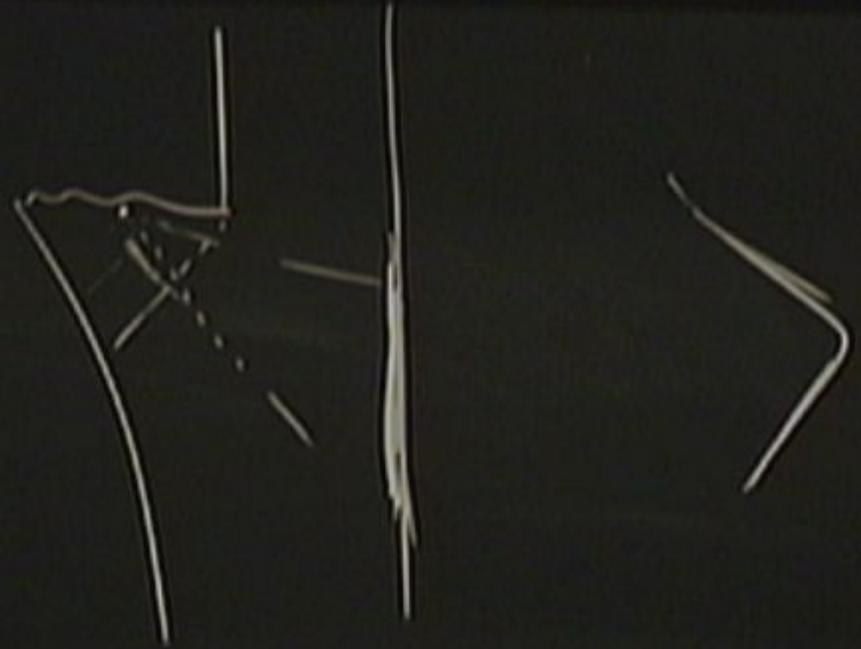




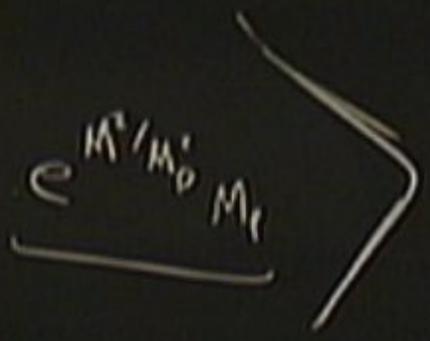
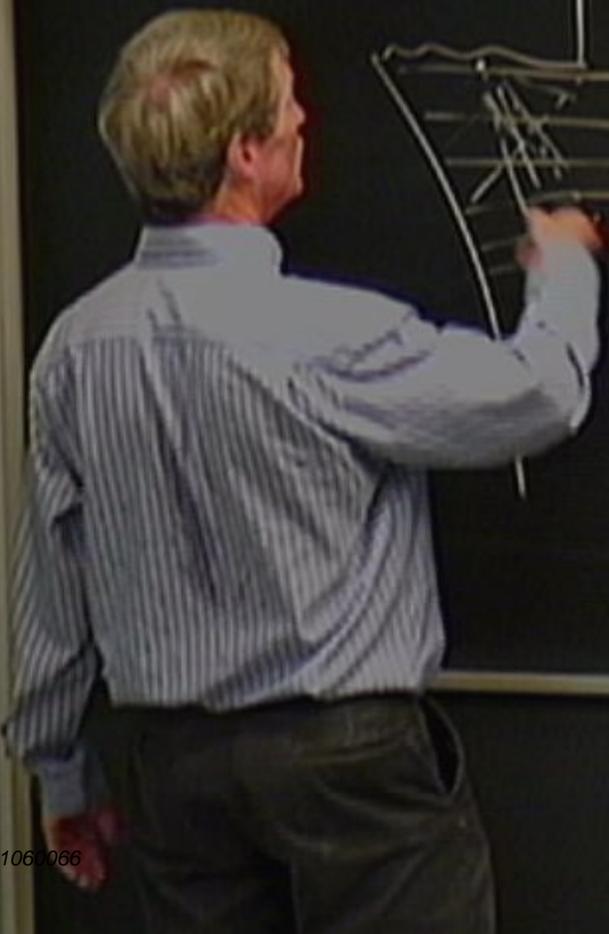
$$= \int d^d x' T(x, z; x') \mathcal{O}(x') + g \int d^d x' d^d y' T(x, z; x', y') \mathcal{O}(x') \mathcal{O}(y')$$

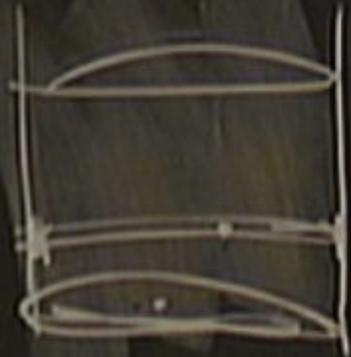


$$= \int d^d x' T(x, z; x') \mathcal{O}(x') + g \int d^d x' d^d y' T(x, z; x', y') \mathcal{O}(x') \mathcal{O}(y')$$



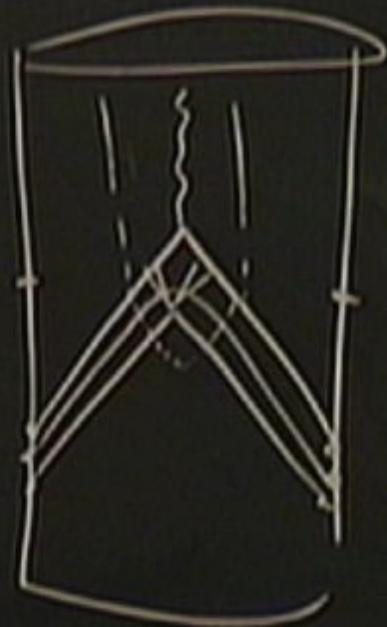
$$= \int d^d x' T(x, z; x') \mathcal{O}(x') + g \int d^d x' d^d y' T(x, z; x', y') \mathcal{O}(x') \mathcal{O}(y')$$



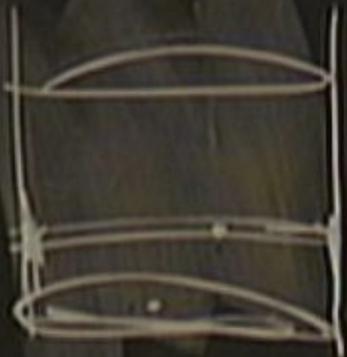


$$\text{tr } F_{uv}(x) F^{uv}(y)$$

$$\rightarrow \text{tr } F_{uv}(x') \overset{W}{F^{uv}(y'')} \text{ (with } W \text{ between } F_{uv}(x') \text{ and } F^{uv}(y'') \text{)}$$

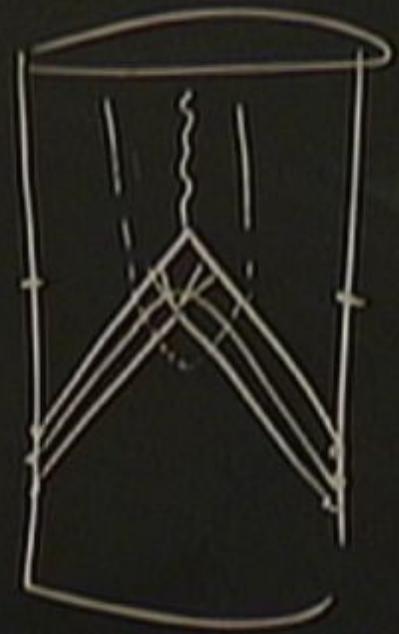


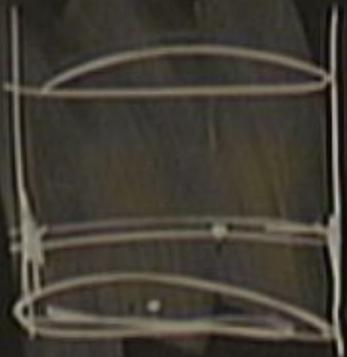
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$$\text{tr } F_{uv}(x) F^{uv}(y)$$

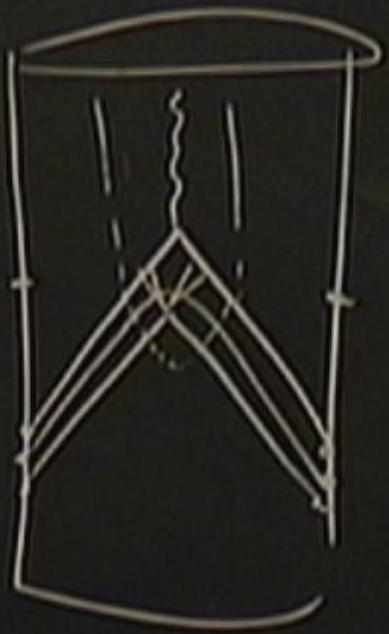
$$\rightarrow \text{tr } F_{uv}(x') F^{uv}(y'')$$

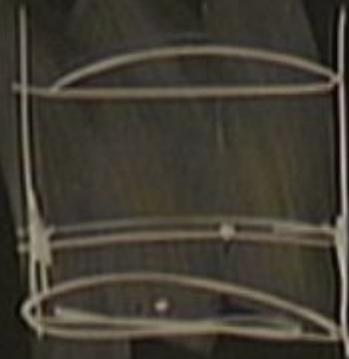




$$\text{tr } F_{uv}(x) F^{uv}(y)$$

$$\rightarrow \text{tr } F_{uv}(x') \overset{W}{F^{uv}(x'')} \quad \leftarrow$$





$$\text{tr } F_{uv}(x) F^{uv}(y)$$

$$\rightarrow \text{tr } F_{uv}(x') F^{uv}(x'')$$

