

Title: Non AdS/nonCFT correspondence

Date: Jul 05, 2005 09:30 AM

URL: <http://pirsa.org/05070071>

Abstract:

Deformations

* Field theory: $(\lambda = g_{YM}^2 N)$

$$W = \frac{2\sqrt{2}}{g_{YM}^2} \text{tr}(\phi_1 [\phi_2, \phi_3]) + \frac{m}{g_{YM}^2} (\text{tr}(\phi_1^2) + \text{tr}(\phi_2^2) + \text{tr}(\phi_3^2))$$

Classical vacua: $[\phi_i, \phi_j] = -\frac{m}{\sqrt{2}} \epsilon_{ijk} \phi_k$

Vacua with a mass gap:

Higgs - N dim'l rep. $SU(N)$

Confining - $\phi=0 \rightarrow N$ vacua

Intermediate $N=pq$ $SU(N) \rightarrow SU(p) \rightarrow p$ vacua

Deformations

* Field theory: $(n=1^x)$ $(\lambda = g_{YM}^2 N)$

$$W = \frac{2\sqrt{2}}{g_{YM}^2} \text{tr}(\phi_1 [\phi_2, \phi_3]) + \frac{m}{g_{YM}^2} (\text{tr}(\phi_1^2) + \text{tr}(\phi_2^2) + \text{tr}(\phi_3^2))$$

Classical vacua: $[\phi_i, \phi_j] = -\frac{m}{\sqrt{2}} \epsilon_{ijk} \phi_k$

Vacua with a mass gap:

Higgs - N dim'l rep. $SU(N)$

Confining - $\phi=0 \rightarrow N$ vacua

Intermediatic $N \gg pq$ $SU(N) \rightarrow SU(p) \rightarrow p$ vacua

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{\text{AdS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} $\text{SUGRA solutions are singular!}$

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{\text{AdS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} $\text{SUGRA solutions are singular!}$

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{\text{AdS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1)

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{\text{AdS}}^2 = \frac{dx_n^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m: z$ $ds_{\text{NLS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m: z$ $ds_{\text{AdS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} Δ SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m: z$ $ds_{\text{AdS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m: z$ $ds_{\text{NS}}^2 = \frac{dx_n^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$
 B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source D5, NS5

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{NS}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$
 B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source D5, NS5

2)

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m: z$ $ds_{\text{NS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source $D5, NS5$

2) Higgs

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m: z$ $ds_{NS}^2 = \frac{dx_n^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source $D5, NS5$

2) Higgs

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{\text{NS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source D5, NS5

2) Higgs

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{\text{AdS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$
 B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in z direction
 Need source $D5, D7$
 2) Higgs $\phi \neq 0$

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{\text{NS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source D5, NS5
 2) Higgs $\phi \neq 0 \rightarrow$

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m; z$ $ds_{\text{AdS}}^2 = \frac{dx_n^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$
 B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source D5, NS5
 2) Higgs $\phi \neq 0 \rightarrow$ p3-brane in bulk

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m: z$ $ds_{\text{AdS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior

Need source D5, NS5

2) Higgs $\phi \neq 0 \rightarrow p3\text{-brane in bulk}$
 $\sum |\phi_i|^2 \simeq m^2 N^2$

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m_i z$ $ds_{\text{AdS}}^2 = \frac{dx^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior
 Need source $\rightarrow$ NS5

2) Higgs $\phi \neq 0 \rightarrow$ D3-brane

$\sum |\phi_i|^2 \simeq m^2 N^2$
 $\hookrightarrow$ eigenvalues sit on a 2-sphere

* String theory: need solutions with
 $\leftrightarrow \chi_i(x, z) \xrightarrow{z \rightarrow 0} m: z$ $ds_{\text{NS}}^2 = \frac{dx_n^2 + dz^2}{z^2}$
 $t(\lambda\lambda) \uparrow$ B_{ab}, C_{ab} SUGRA solutions are singular!

Hints: 1) H_3, F_3 grow in interior

Need source D5, NS5

2) Higgs $\phi \neq 0 \rightarrow$ D3-brane in bulk

$\sum_{i=1}^3 |\phi_i|^2 \simeq m^2 N^2$
 $\hookrightarrow$ eigenvalues sit on a 2-sphere



$$\gamma_5^2 \in SS, z_0 \sim \frac{1}{\alpha' M^2}$$

$$\gamma_5^2 \in SS, \quad z_0 \sim \frac{1}{\alpha' m N}$$

$$\gamma_5^2 \in SS, z_0 \sim \frac{1}{\alpha' m N}$$

fuzzy sphere
 $s^2 \subset SS, z_0 = \frac{1}{\alpha' MN}$


 fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

N
 $Dp \rightarrow D(p+2)$ -
 brane
 on S^2


 fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

N
 $Dp \rightarrow D(p+2)$ -
 brane
 on S^2


 fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

N
 $Dp \rightarrow D(p+1)$ -
 brane
 on S^2

$\int_{S^2} F$


 fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

N
 $Dp \rightarrow D(p+1)$ -
 brane
 on S^2
 $\int_{S^2} F = N$



fuzzy sphere

$S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

$AAS_3 \times S^5$

$\int F_5 = N$



z

N

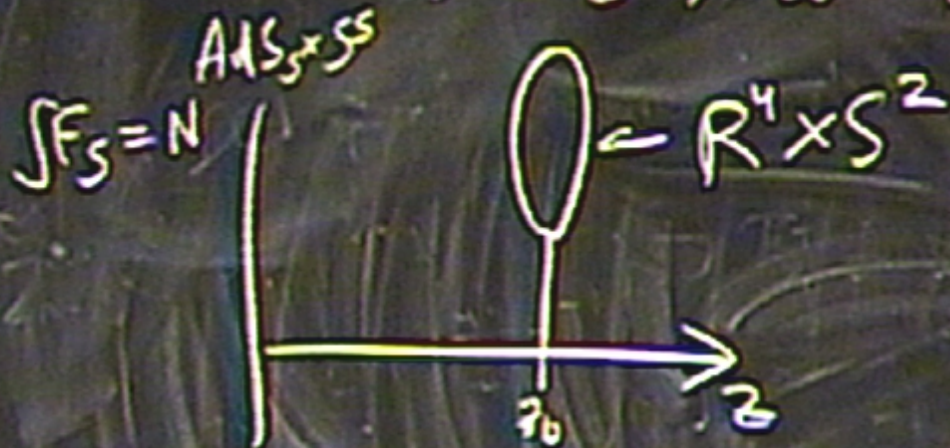
$D\varphi \rightarrow D(\varphi + \alpha) - \text{brane}$

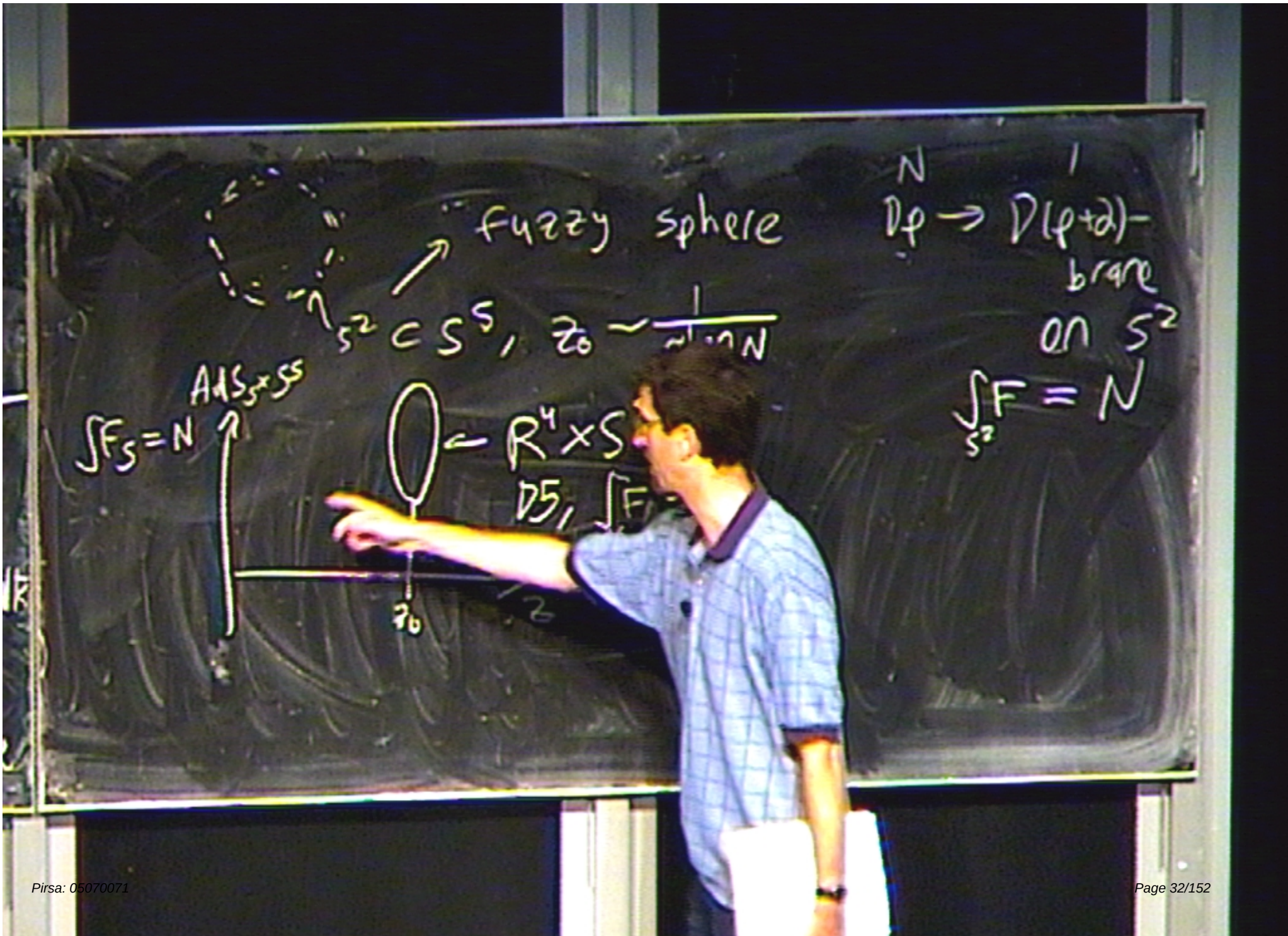
on S^2

$\int_{S^2} F = N$

fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

N
 $Dp \rightarrow D(p+2)$ -
 brane
 on S^2
 $\int_{S^2} F = N$





fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha \cdot n \cdot N}$

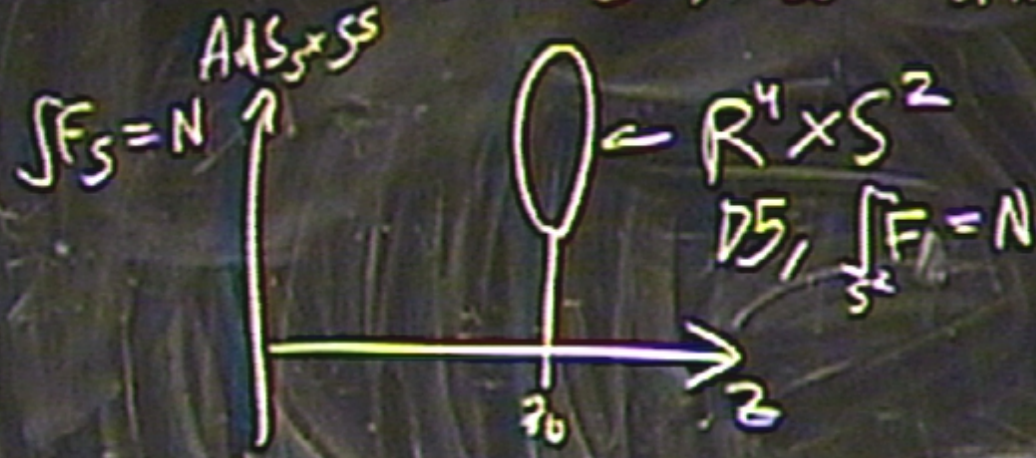
N
 $Dp \rightarrow D(p+2)$ -
 brane
 on S^2
 $\int_{S^2} F = N$

$\int F_5 = N$ $\uparrow$
 $AS_3 \times S^5$

$\bigcirc \leftarrow R^4 \times S^1$
 $D5, \int F = \frac{1}{2}$
 z_0

fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

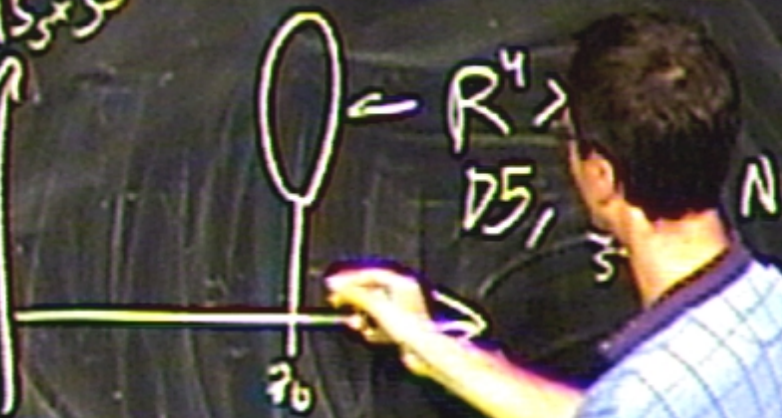
N
 $Dp \rightarrow D(p+2)$ -brane
 on S^2
 $\int_{S^2} F = N$



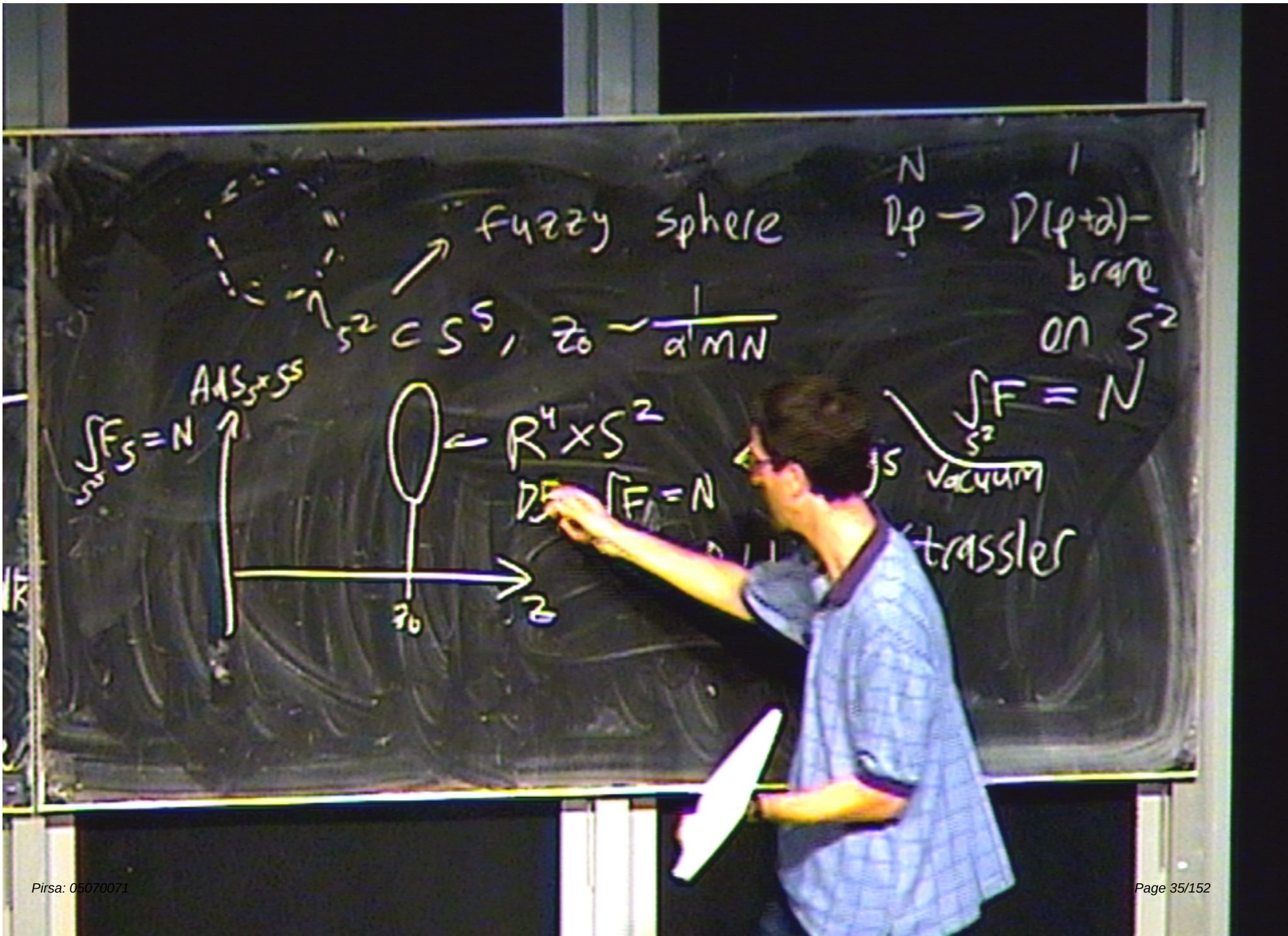
fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

N
 $Dp \rightarrow D(p+2)$ -brane
 on S^2
 $\int_{S^2} F = N$

$\int_{S^5} F_5 = N$
 $AdS_5 \times S^5$



Ichinski-Strassler



fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m N}$

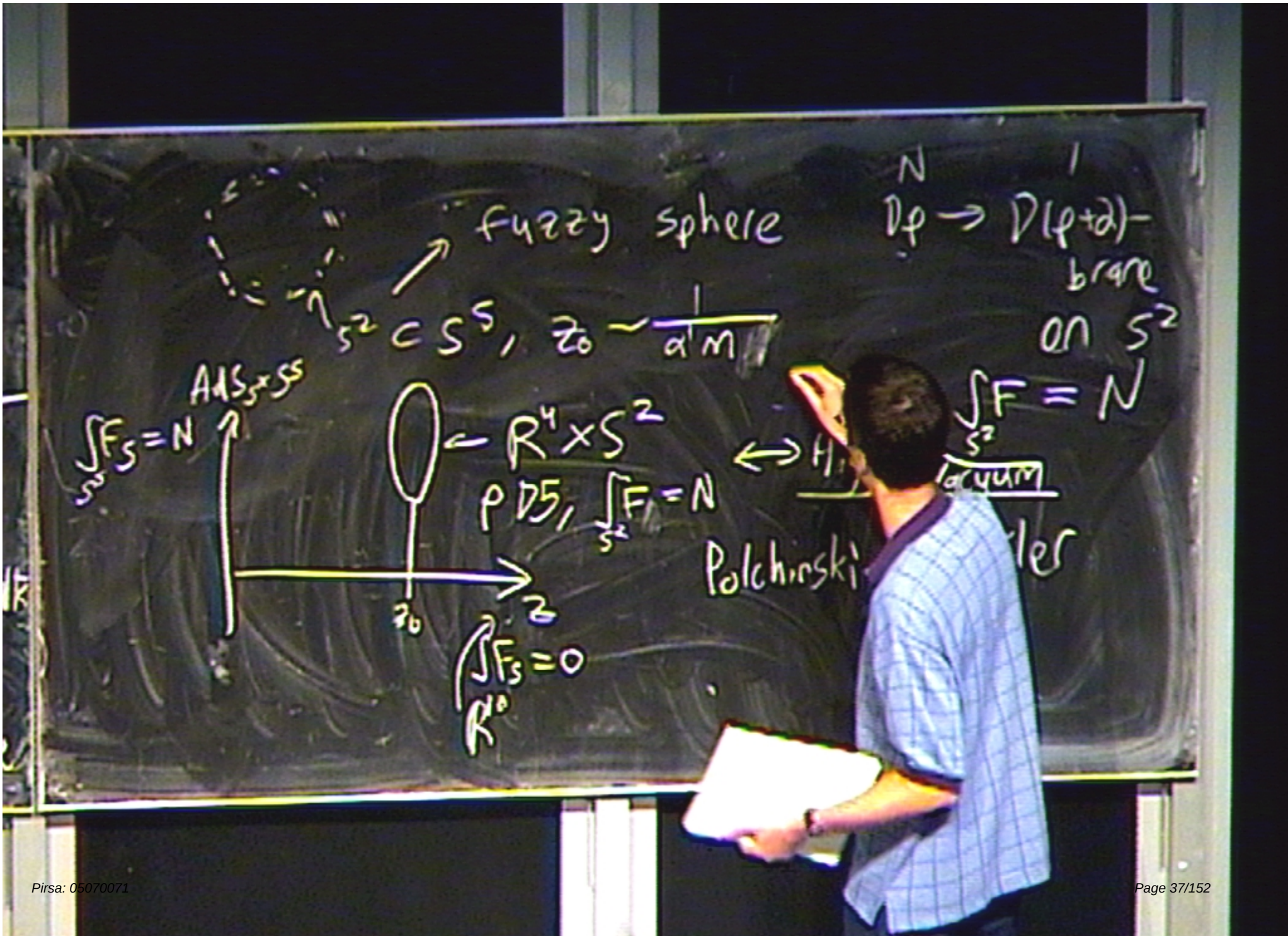
N
 $Dp \rightarrow D(p+2)$ -brane
 on S^2

$\int_{S^5} F_5 = N$
 $AdS_5 \times S^5$

$R^4 \times S^2$
 $D5, \int_{S^2} F_2 = N$

$\int_{S^2} F = N$
 Higgs vacuum
 Polchinski-Strassler

$\int_{R^{1,0}} F_3 = 0$



fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m q}$

N
 $Dp \rightarrow D(p+2)$ -brane
 on S^2

$\int_{S^5} F_5 = N$
 $AdS_5 \times S^5$

$R^4 \times S^2$
 $PD5, \int_{S^2} F_1 = N$

$\int_{S^2} F = N$
Higgs vacuum

Polchinski-Strassler

$\int_{R^{1,3}} F_3 = 0$

Deformations

* Field theory: $(n=1^x)$ $(\lambda = g_{YM}^2 N)$

$$W = \frac{2\sqrt{2}}{g_{YM}^2} \text{tr}(\phi_1 [\phi_2, \phi_3]) + \frac{m}{g_{YM}^2} (\text{tr}(\phi_1^2) + \text{tr}(\phi_2^2) + \text{tr}(\phi_3^2))$$

Classical vacua: $[\phi_i, \phi_j] = -\frac{m}{\sqrt{2}} \epsilon_{ijk} \phi_k$

Vacua with a mass gap:

Higgs - N dim'l rep. ~~$SU(N)$~~

Confining - $\phi=0 \rightarrow N$ vacua

Intermediatic $N=pq$ $SU(N) \rightarrow SU(p) \rightarrow p$ vacua.

fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m q}$

N
 $Dp \rightarrow D(p+2)$ -
 brane
 on S^2

$\int_{S^5} F_5 = N$
 $AdS_5 \times S^5$

$R^4 \times S^2$
 $PD5, \int_{S^2} F_2 = N$

$\int F = N$
 Higgs vacuum

Polchinski-Strassler

$\int_{R^{10}} F_5 = 0$

fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m q}$

N
 $Dp \rightarrow D(p+2)$ -
 brane
 on S^2

$\int_{S^5} F_5 = N$
 $AdS_5 \times S^5$

$R^4 \times S^2$
 $P D5, \int_{S^2} F_2 = N$

$\int_{S^2} F = N$
 Higgs vacuum

Polchinski-Strassler

$\int_{R^{10}} F_5 = 0$

$$\begin{cases} g_s P \ll 1 \\ g_s N \gg 1 \end{cases}$$

fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m q}$

N
 $Dp \rightarrow D(p+d)$ -
 brane
 on S^2

$\int_{S^5} F_5 = N$
 $AdS_5 \times S^5$

$R^4 \times S^2$
 $PD5, \int_{S^2} F_1 = N$

$\int_{S^2} F = N$
 Higgs vacuum

Polchinski-Strassler

$\int_{R^{10}} F_5 = 0$
 R^{10}
 Can trust $\begin{cases} g_s P \ll 1 \\ g_s N \gg 1 \end{cases}$
 SUGRA sources

Deformations

* Field theory = $(n=1^x)$ $(\lambda = g_{YM}^2 N)$

$$W = \frac{2\sqrt{2}}{g_{YM}^2} \text{tr}(\phi_i [\phi_j, \phi_k]) + \frac{m}{g_{YM}^2} (\text{tr}(\phi_1^2) + \text{tr}(\phi_2^2) + \text{tr}(\phi_3^2))$$

Classical vacua: $[\phi_i, \phi_j] = -\frac{m}{\sqrt{2}} \phi_k$

Vacua with a mass gap:

Higgs - N dim'l rep. ~~$SU(N)$~~

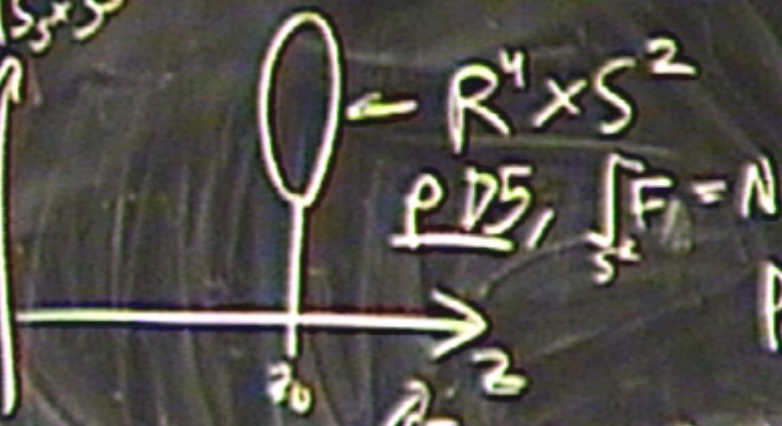
Confining - $\phi=0 \rightarrow N$

Intermediatic $N \rightarrow pq$ $SU(N) \rightarrow SU(p)$

fuzzy sphere
 $S^2 \subset S^5, z_0 \sim \frac{1}{\alpha' m q}$

N
 $Dp \rightarrow D(p+2)$ -brane
 on S^2

$\int_{S^5} F_5 = N$
 $AdS_5 \times S^5$



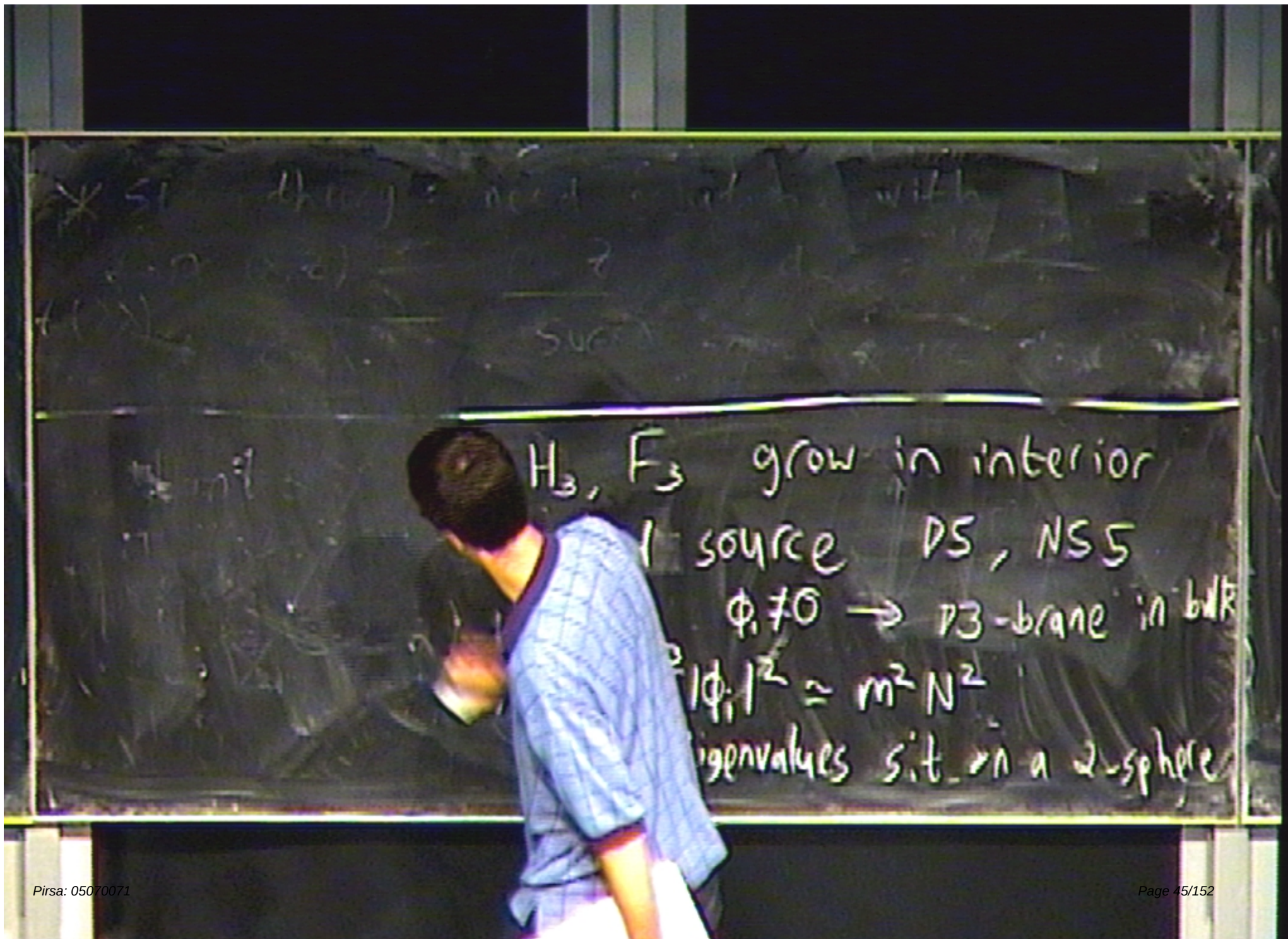
$P D5, \int_{S^2} F_3 = N$

$\int_{S^2} F = N$
Higgs vacuum

Polchinski-Strassler

$\int_{R^3} F_3 = 0$

Can trust $\begin{cases} g_s P \ll 1 \\ g_s N \gg 1 \end{cases}$
 SUGRA sources



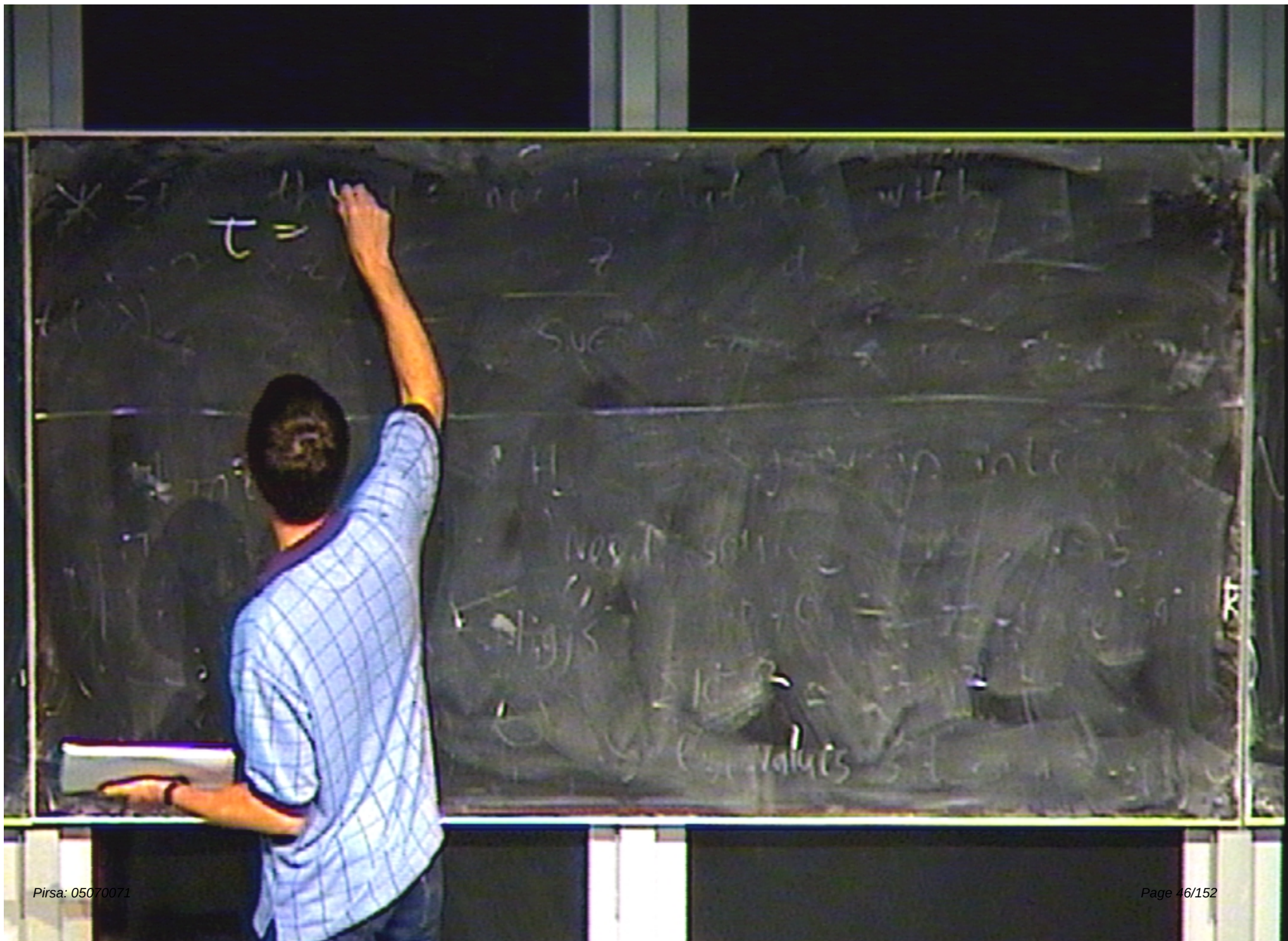
H_3, F_3 grow in interior

1 source D5, NS5

$\phi \neq 0 \rightarrow$ p3-brane in bulk

$$|\phi_i|^2 \simeq m^2 N^2$$

eigenvalues sit on a 2-sphere



$$\tau = \frac{4\pi i}{g_{YM}^2} + \frac{\theta}{2\pi}$$

$$\tau \rightarrow -\frac{1}{\tau}$$

Higgs vacuum: electric condensate

↳ electric screened
magnetic confined

$$\tau = \frac{4\pi i}{g_{YM}^2} + \frac{\theta}{2\pi}$$

$$\tau \rightarrow -\frac{1}{\tau}$$

Higgs vacuum: electric condensate

↳ electric screened
magnetic confined

$$\tau \rightarrow -\frac{1}{\tau} \updownarrow$$

magnetic screened
electric confined

$$\tau = \frac{4\pi i}{g_{YM}^2} + \frac{\theta}{2\pi}$$

$$\tau \rightarrow -\frac{1}{\tau}$$

Higgs vacuum: electric condensate

↳ electric screened
magnetic confined

$$\tau \rightarrow -\frac{1}{\tau} \updownarrow$$

magnetic screened
electric confined

$$\tau = \frac{4\pi i}{g_{YM}^2} + \frac{\theta}{2\pi}$$

$$\tau \rightarrow -\frac{1}{\tau}$$

Higgs vacuum: electric condensate

↳ electric screened
magnetic confined

$$\tau \rightarrow -\frac{1}{\tau} \updownarrow$$

Confined vacuum: magnetic screened
electric confined

$$\tau = \frac{4\pi i}{g_{YM}^2} + \frac{\theta}{2\pi}$$

$$\tau \rightarrow -\frac{1}{\tau}$$

Higgs vacuum: electric condensate
 ↳ electric screened
 magnetic conf.

$$\tau \rightarrow -\frac{1}{\tau} \updownarrow$$

Confined vacuum: magnetic screened
 electric confined

$$\tau = \frac{4\pi i}{g_{YM}^2} + \frac{\theta}{2\pi}$$

$$\tau \rightarrow -\frac{1}{\tau}$$

Higgs vacuum: electric condensate
 ↳ electric screened
 magnetic confined

$$\tau \rightarrow -\frac{1}{\tau} \updownarrow$$

Confined vacuum: magnetic screened
 electric confined

$$\tau = \frac{4\pi i}{g_{YM}^2} + \frac{\theta}{2\pi}$$

$$\tau \rightarrow -\frac{1}{\tau}$$

Higgs vacuum: electric condensate

↳ electric screened
magnetic confined

$$\tau \rightarrow -\frac{1}{\tau}$$

Confined vacuum: magnetic screened
electric confined

$$\tau = \frac{4\pi i}{g_{YM}^2} + \frac{\theta}{2\pi}$$

$$\tau \rightarrow -\frac{1}{\tau}$$

Higgs vacuum: electric condensate

↳ electric screened
magnetic confined

$$\tau \rightarrow -\frac{1}{\tau}$$

Confined vacuum: magnetic screened
electric confined

Energy sphere

$D(p=0)$

$\int F_5 = N$ $\uparrow$ $AdS_5 \times S^5$

$\leftarrow R^4 \times S^2$

$\leftarrow N S^2, \int F = N$

vacuum

Polchinski-Strassler

$\int_{R^{10}} F_5 = 0$

Can trust $\begin{cases} g_s P \ll 1 \\ g_s N \gg 1 \end{cases}$
SUGRA sources

Fuzzy sphere

$$\int F_5 = N \quad \text{AdS}_5 \times S^5$$

$$\leftarrow R^4 \times S^2$$

$$N S^2, \int F = N$$

confining vacuum

Polchinski-Strassler

$$\int_{R^{10}} F_5 = 0$$

Can trust $\left\{ \begin{array}{l} g_s P \ll 1 \\ g_s N \gg 1 \end{array} \right.$
SUGRA sources

hazy sphere

$\rho \rightarrow \rho(p=0)$

$\int F_5 = N$ $\uparrow$ $AdS_5 \times S^5$



$R^4 \times S^2$

$N S^5, \int F_5 = N$

$\longleftrightarrow$ confining vacuum

Polchinski-Strassler

$\int_{R^{10}} F_5 = 0$

can trust $\begin{cases} g_s P \ll 1 \\ g_s N \gg 1 \end{cases}$
SUGRA sources

* 1) Mass gap ?

$$\tau \rightarrow \frac{1}{\tau}$$



Electromagnetic interaction
 by exchange of photons
 massless particles
 long range interaction
 weak interaction
 by exchange of W and Z
 massive particles
 short range interaction
 strong interaction
 by exchange of gluons
 massless particles
 long range interaction

* 1) Mass gap ? $\checkmark$ Spectrum



* 1) Mass gap ? ✓ Spectrum



* 1) Mass gap ? $\checkmark$ Spectrum



Est. values

* 1) Mass gap ? $\checkmark$ Spectrum



* 1) Mass gap ? $\checkmark$ Spectrum



* 1) Mass gap ?

✓ Spectrum

$\lambda \rightarrow \infty$

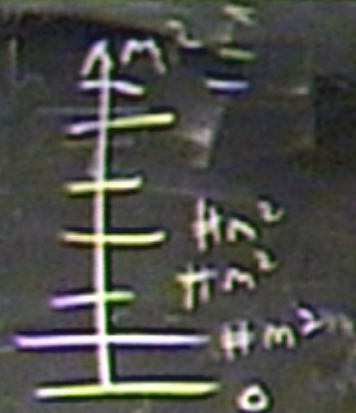


1) Mass gap ? ✓

Spectrum

$\lambda \rightarrow \infty$

2) Confinement ?
Screening ?

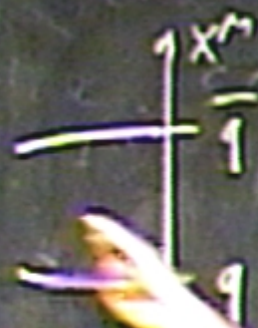
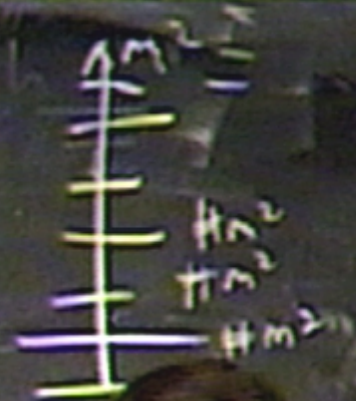


1) Mass gap ? ✓

Spectrum

$\lambda \rightarrow \infty$

2) Confinement ?
Screening ?



1) Mass gap ? $\checkmark$

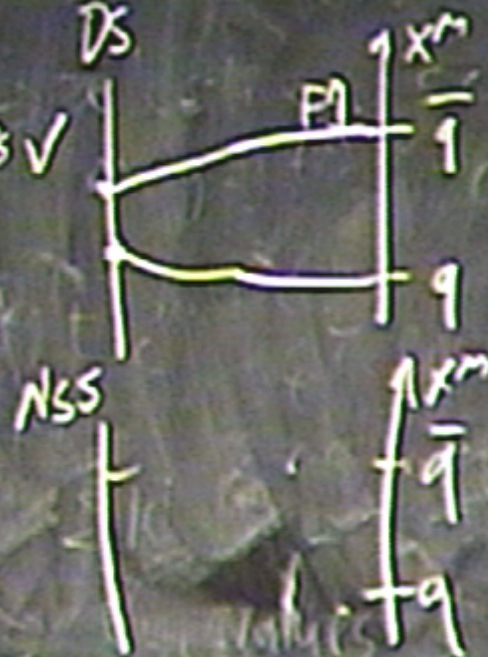
Spectrum

$\lambda \rightarrow \infty$



2) Confinement ?

Screening ? Higgs $\checkmark$



1) Mass gap ? $\checkmark$

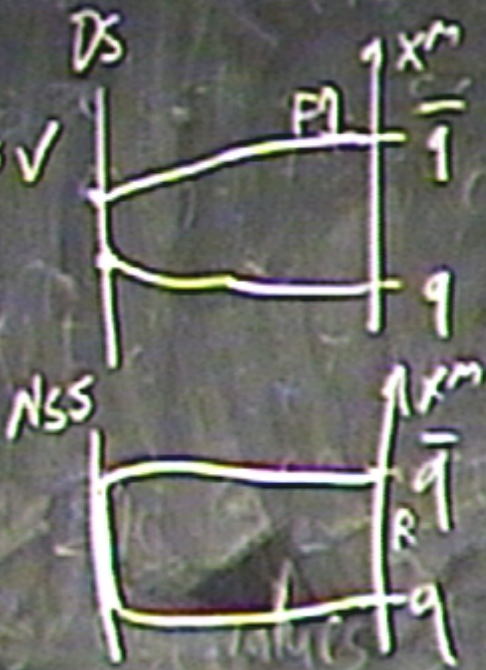
Spectrum

$\lambda \rightarrow \infty$



2) Confinement ?

Screening ? Higgs $\checkmark$



$$V \propto \underline{T_S R}$$

1) Mass gap ? $\checkmark$

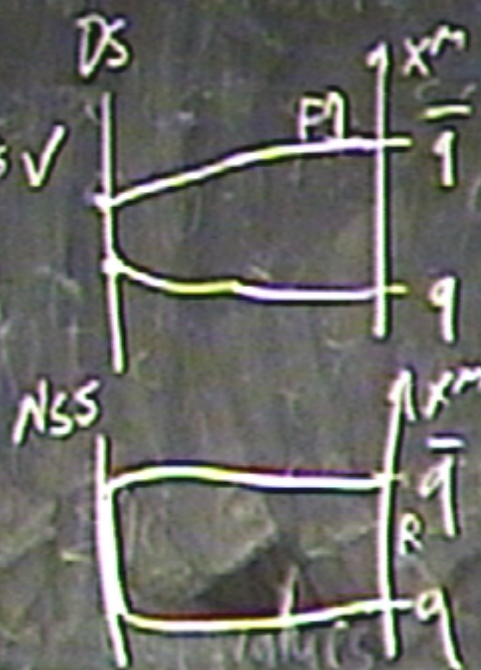
Spectrum

$\lambda \rightarrow \infty$

2) Confinement ?

Screening ? Higgs $\checkmark$

$\lambda \rightarrow \infty$ $T_s \gg \Lambda_{QCD}^2$



$V \propto T_s$

1) Mass gap ? $\checkmark$

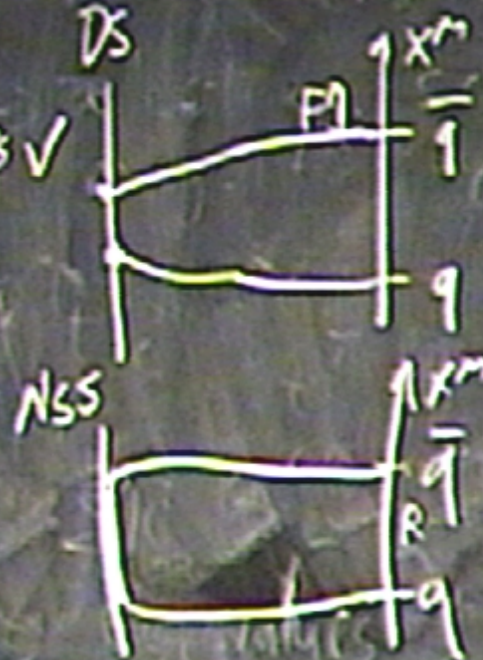
Spectrum

$\lambda \rightarrow \infty$



2) Confinement ?

Screening ? Higgs $\checkmark$

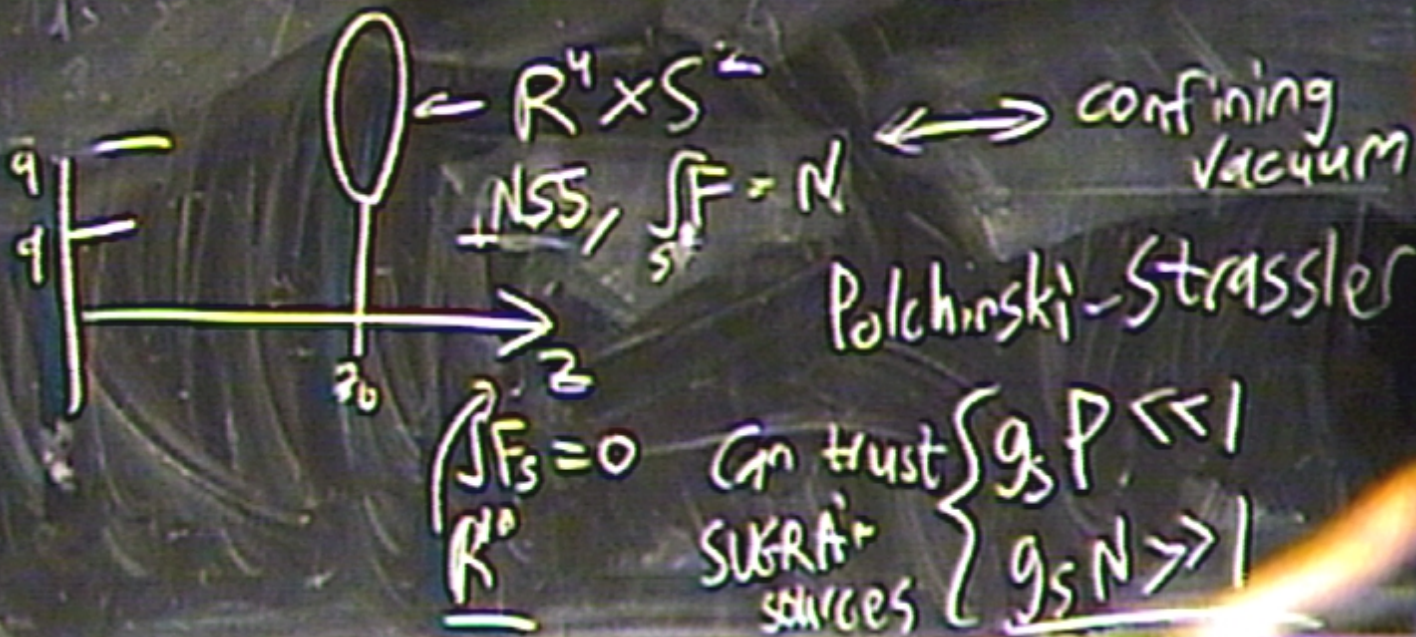


$\lambda \rightarrow \infty$ $T_S \gg \Lambda_{QCD}^2$

$$V \propto T_S R$$

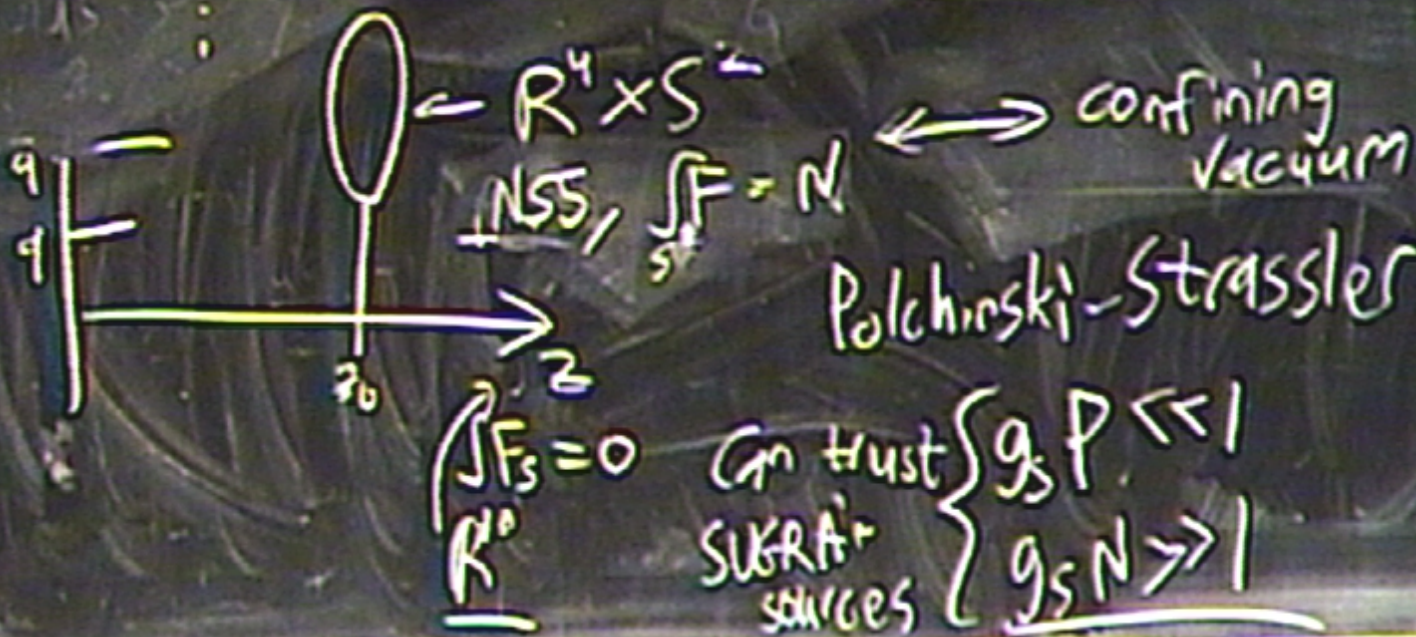
Instanton
Baryons
Condensates

$$\langle \text{tr}(\lambda\lambda) \rangle$$



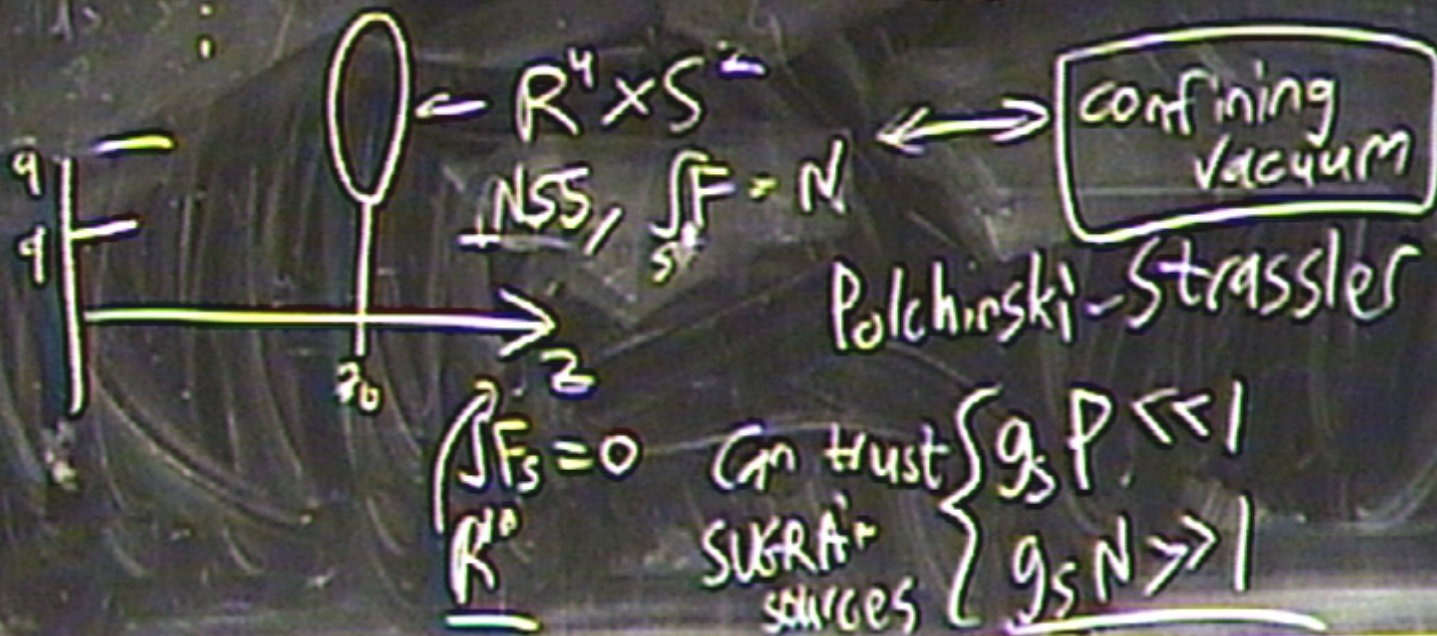
Instanton
Baryons
Condensates

$$\langle \text{tr}(\lambda\lambda) \rangle$$



Instanton
Baryons
Condensates

$$\frac{\langle \text{tr}(\lambda) \rangle}{N S^2} \rightarrow (1,1) \text{ S-brane}$$



Instanton
Baryons
Condensates

Advantages: 1) Simple field theory interpretation
2) Simple non-SUSY backgrounds

Instanton
Baryons
Condensates

Advantages:

- 1) Simple field theory
- 2) Simple non-SUSY vacua

Disadvantage:

Instanton
Baryons
Condensates

Advantages: 1) Simple field, the interpretation
2) Simple non-SUS backgrounds

Disadvantage:

Instanton
Baryons
Condensates

Advantages: 1) Simple field theory interpretation
2) Simple non-SUSY backgrounds

Disadvantage: At large λ , Needed to add branes
NS5-branes $\rightarrow$ no pert. string description

Compactifications

* Field (K, γ) $(\gamma = 1^v)$ $(\gamma = \gamma^v)$

$$W = \frac{2\sqrt{2}}{g} \left((v, \frac{1}{2}, \frac{1}{2}) \right) = \frac{1}{g} \left((v, \frac{1}{2}, \frac{1}{2}) + (v, \frac{1}{2}, \frac{1}{2}) \right)$$

Class. vacuum $\left[\phi, d \right] = \frac{m}{\pi} \epsilon \cdot \phi$

Vacuum with a gap:

Higgs mechanism $\phi \rightarrow 0$ $\rightarrow$ $\phi \rightarrow 0$

Example: $\phi \rightarrow 0$ $\rightarrow$ $\phi \rightarrow 0$

Intermediate $N = pq$ $SU(N) \rightarrow SU(p) \times p$ vacuum

Compactifications

N D4's on S^1 , anti-periodic fermions

$$W = \frac{2\sqrt{2}}{g} \ln \left(\frac{1}{2} \left(1 + \sqrt{1 + \frac{m^2}{g^2}} \right) \right)$$

Classical vacuum $\langle \phi \rangle = \frac{m}{\sqrt{2}g}$

Vacuum with a gap:

Higgs $\phi = \frac{m}{\sqrt{2}g}$

For $m \ll g$, $\phi \approx \frac{m}{\sqrt{2}g}$

Interpolates $N \times U(1) \rightarrow SU(N) \rightarrow SU(p) \rightarrow p$ vacua

Compactifications

N D4's on S^1 , anti-periodic fermions

* N^2 NSS on $S^2 \rightarrow n=1$ SYM

Compactifications

N D4's on S^1 , anti-periodic fermions

* $N^{\frac{1}{2}}$ NSS on $S^2 \rightarrow n=1$ SYM

Classical vacuum $\langle \phi \rangle = \frac{m}{\sqrt{2}} \epsilon$

Vacuum with a gap:

Higgs mechanism $\phi = 0$

Conformal $\phi = 0$ $\rightarrow$ $U(1)$ $\rightarrow$ $U(1)$

Integrable $N(p,q)$ $SU(N) \rightarrow SU(p) \times p$ vacua

Compactifications

N D4's on S^1 , anti-periodic fermions

* $N^{\frac{1}{2}}$ NSS on $S^2 \rightarrow n=1$ SYM

$\hookrightarrow$ weakly coupled + curved

Vacua with gaps:

$\mathbb{R}^4 \rightarrow \mathbb{R}^3 \times \mathbb{R}$

$\phi = 0 \rightarrow n=1$

Interpolated: $N(p,q)$ $SU(N) \rightarrow SU(p) \rightarrow p$ vacua

Compactifications

N D4's on S^1 , anti-periodic fermions

* $N^{\frac{1}{2}}$ NSS on $S^2 \rightarrow \mathfrak{su}(2)$ SYM

$\hookrightarrow$ weakly coupled + curved

$\nearrow$ NSS in flat space? In IIB

$\searrow$ DS

D_p

Example: $q=0 \rightarrow \mathfrak{su}(2) \rightarrow \mathfrak{su}(1|1)$
Integrable: N PQ $\rightarrow$ $\mathfrak{su}(N) \rightarrow \mathfrak{su}(p) \rightarrow p$ Vichu

Compactifications

N D4's on S^1 , anti-periodic fermions

* $N^{\frac{1}{2}}$ NSS on $S^2 \rightarrow n=1$ SYM

↳ weakly + coupled + curved

↳ NSS in flat space? In IIB

↳ DS D_p $0 \leftarrow l_p^8 \propto g_s^2 \alpha'^4$

fixed $\leftarrow g_{\text{YM}}^2 \propto g_s(\alpha')^{\frac{p-3}{2}}$

Compactifications

N D4's on S^1 , anti-periodic fermions

* $N^{\frac{1}{2}}$ NSS on $S^2 \rightarrow \mathcal{N}=1$ SYM

$\hookrightarrow$ weakly coupled + curved

$\nearrow$ NSS in flat space? In IIB

$\rightarrow$ DS

D_p

$$0 \ll l_p^8 \propto g_s^2 \alpha'^4$$

$$\text{fixed} \leftarrow g_{\text{YM}}^2 \propto g_s (\alpha')^{\frac{p-3}{2}} = \alpha' g_s$$

$\frac{p=5}{\quad}$

$$g_s \rightarrow \infty$$

$$\alpha' \rightarrow 0$$

N NS S , $g_s \rightarrow 0$, α' fixed
 $\downarrow$
 $SU(N)$, $g_{YM}^2 = \alpha'$

$\begin{matrix} & N \\ \nearrow & \\ S & \end{matrix}$
 $NS5$, $g_s \rightarrow 0$, α' fixed
 $\downarrow$
 $SU(N)$, $g_{YM}^2 = \alpha'$ "little string theory"

N NS5, $g_s \rightarrow 0$, α' fixed
 $d=6$ $SU(N)$, $g_{YM}^2 = \alpha'$

"little string theory"

$$\rho(E) \propto e^{E\sqrt{N\alpha'}}$$

Continuous spectrum above

Holographic dual of LST

$$ds_{\text{str}}^2 = dx_m^2 + dp^2 + N d\Omega_3^2$$

$$= e^{-\rho/\sqrt{N}}$$

$$\int_{S^3} H_3 = N$$

Holographic dual of LST

$$ds_{\text{str}}^2 = dx_\mu^2 + dp^2 + N d\Omega_3^2$$

$$g_s = e^{-\rho/\sqrt{N}}$$

$$\int_{S^3} H_3 = N$$

Holographic dual of LST

$$ds_{\text{str}}^2 = dx_\mu^2 + dp^2 + N d\Omega_3^2$$

$$g_s = e^{-\rho/\sqrt{N}}$$

$$\int_{S^3} H_3 = N$$

Holographic dual of LST

$$ds_{\text{str}}^2 = dx_\mu^2 + dp^2 + N d\Omega_3^2$$

$$g_s = e^{-\rho/\sqrt{N}}$$

$$\int_{S^3} H_3 = N$$

LST on $T^2 \rightarrow \mathcal{N}=4$ SYM

on $S^2 \rightarrow$ choose spin structure

$$n=1$$

Compactifications

N.D.'s on S^1 and $\mathbb{R}^n$ (formal)

* N^3 with $\partial N^3 = S^2 \rightarrow S^1$ (formal)

(...)

(...)

Compactifications

Λ_{SYM}

$\ll$

$\frac{1}{R_{S^2}}$

$\frac{1}{\sqrt{N \alpha'}}$

Compactifications

Decouple: Λ_{SYM}

$$\ll \frac{1}{R_{S^2}}, \frac{1}{\sqrt{N\alpha'}}$$

Compactifications

Decouple: $\Lambda_{\text{SYM}} \ll \frac{1}{R_{S^2}}, \frac{1}{\sqrt{N\alpha'}}$

$$g_{\text{YM, Ad}}^2 = \frac{\alpha'}{R^2}$$

Compactifications

Decouple: $\Lambda_{\text{SYM}} \ll \frac{1}{R_{S^2}}, \sqrt{N\alpha'}$

$$g_{\text{YM}, \text{Ad}}^2 \left(\frac{1}{R} \right) = \frac{\alpha'}{R^2}$$

$$\hookrightarrow \Lambda_{\text{SYM}} \approx \frac{1}{R}$$

Compactifications

Decouple: $\Lambda_{\text{SYM}} \ll \frac{1}{R_{S^2}}, \sqrt{N\alpha'}$

$$g_{\text{YM}, \text{Ad}}^2 \left(\frac{1}{R} \right) = \frac{\alpha'}{R^2}$$

$$\hookrightarrow \Lambda_{\text{SYM}} \approx \frac{1}{R} e^{\frac{8\pi^2}{3\sqrt{N\alpha'}}$$

$$\Lambda_{\text{SYM}} \ll \frac{1}{R} \quad R \gg \frac{1}{\sqrt{N\alpha'}}$$

Compactifications

Decouple: $\Lambda_{\text{SYM}} \ll \frac{1}{R_{S^2}}, \sqrt{N\alpha'}$

$$g_{\text{YM}, \text{Ad}}^2 \left(\frac{1}{R} \right) = \frac{\alpha'}{R^2}$$

$$\hookrightarrow \Lambda_{\text{SYM}} \approx \frac{1}{R} e^{-\frac{8\pi^2}{3N\alpha'/R^2}}$$

$$\Lambda_{\text{SYM}} \ll \frac{1}{R} \quad R \gg \frac{1}{\sqrt{N\alpha'}}$$

Compactifications

Decouple: $\Lambda_{\text{SYM}} \ll \frac{1}{R_{S^2}}, \frac{1}{\sqrt{N\alpha'}}$

$$g_{\text{YM}, \text{Ad}}^2 \left(\frac{1}{R} \right) = \frac{\alpha'}{R^2}$$

$$\hookrightarrow \Lambda_{\text{SYM}} \approx \frac{1}{R} e^{-\frac{8\pi^2}{3N\alpha' \Lambda^2}}$$

$$\Lambda_{\text{SYM}} \ll \frac{1}{R} \quad R \gg \frac{1}{\sqrt{N\alpha'}}$$

Compactifications

Decouple: $\Lambda_{\text{SYM}} \ll \frac{1}{R_{S^2}}, \frac{1}{\sqrt{N\alpha'}}$

$$g_{\text{YM, Ad}}^2 \left(\frac{1}{R} \right) = \frac{\alpha'}{R^2}$$

$$\Lambda_{\text{SYM}} \approx \frac{1}{R} e^{-\frac{8\pi^2}{3N\alpha'/R^2}}$$

$$\Lambda_{\text{SYM}} \ll \frac{1}{R} \quad R \gg \frac{1}{\sqrt{N\alpha'}}$$

Compactifications

Decouple: $\Lambda_{\text{SYM}} \ll \frac{1}{R_{S^2}}, \frac{1}{\sqrt{N\alpha'}}$

$$g_{\text{YM, Ad}}^2 \left(\frac{1}{R} \right) = \frac{\alpha'}{R^2}$$

$$\hookrightarrow \Lambda_{\text{SYM}} \approx \frac{1}{R} e^{-\frac{8\pi^2}{3N\alpha'/R^2}}$$

$$\Lambda_{\text{SYM}} \ll \frac{1}{R} \quad R \gg \frac{1}{\sqrt{N\alpha'}}$$

Compactifications

Decouple: $\Lambda_{\text{SYM}} \ll \frac{1}{R_{S^2}}, \frac{1}{\sqrt{N\alpha'}}$

$$g_{\text{YM}, \text{Ad}}^2 \left(\frac{1}{R} \right) = \frac{\alpha'}{R^2}$$

$$\Lambda_{\text{SYM}} \approx \frac{1}{R} e^{-\frac{8\pi^2}{3N\alpha'/R^2}}$$

$$\Lambda_{\text{SYM}} \ll \frac{1}{R}$$

SYM
$R \gg \frac{1}{\sqrt{N\alpha'}}$

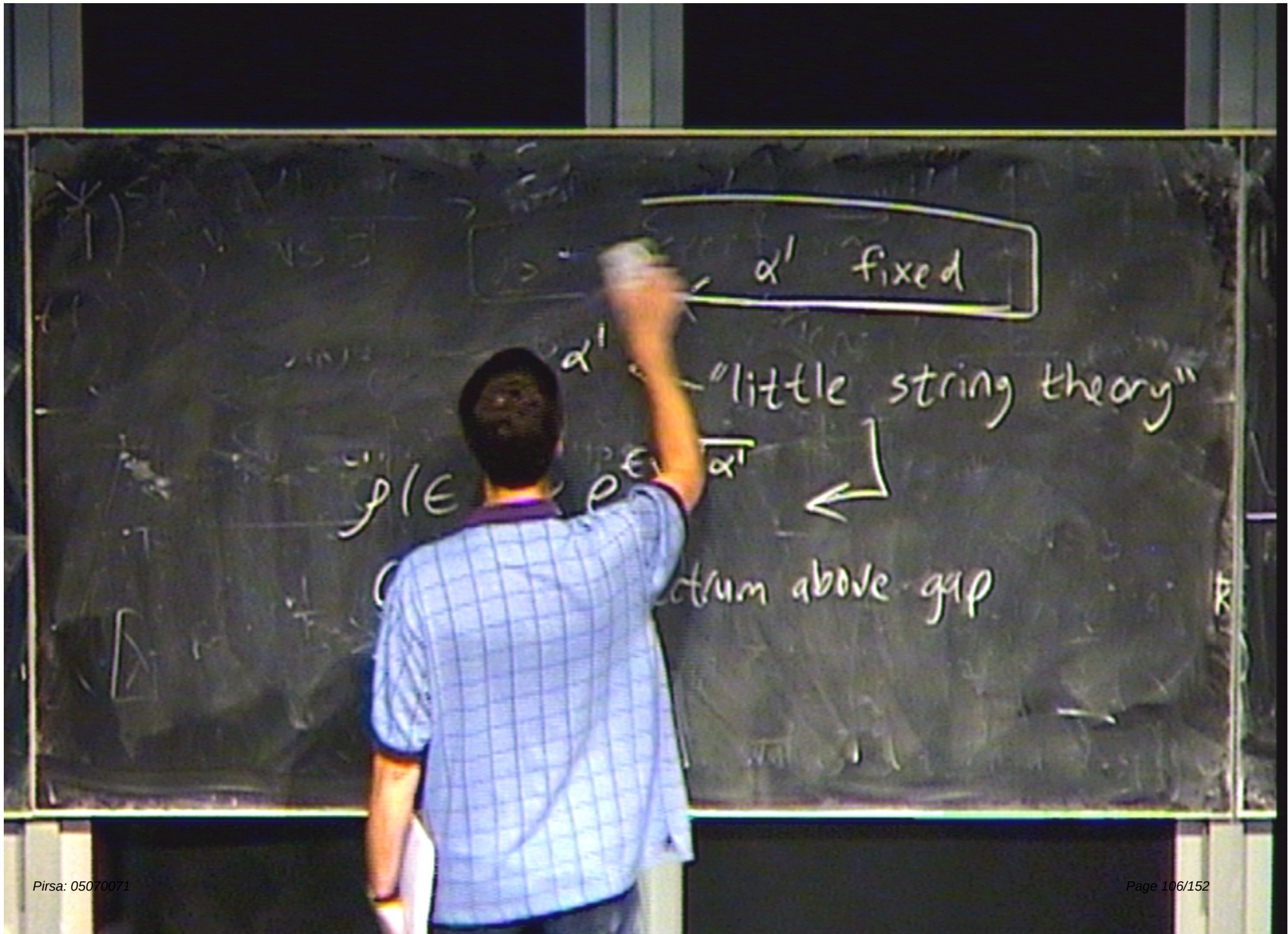
$$N \text{ NS5}, \quad \boxed{g_s \rightarrow 0, \quad \alpha' \text{ fixed}}$$

$$d=6 \text{ } SU(N), \quad g_{\text{YM}}^2 = \alpha' \leftarrow \text{"little string theory"}$$

$$\rho(\epsilon) \propto e^{\epsilon \sqrt{N \alpha'}}$$

Continuous spectrum above

T-duality



*1) Maldacena-Nuñez

*1) Maldacena-Nuñez

$\rho \rightarrow \infty$ Similar to before

* Maldacena-Núñez

$\rho \rightarrow \infty$

Similar to before

$$\mathbb{R}^6 \longrightarrow \mathbb{R}^4 \times S^2$$

radius of $S^2 \propto \rho$



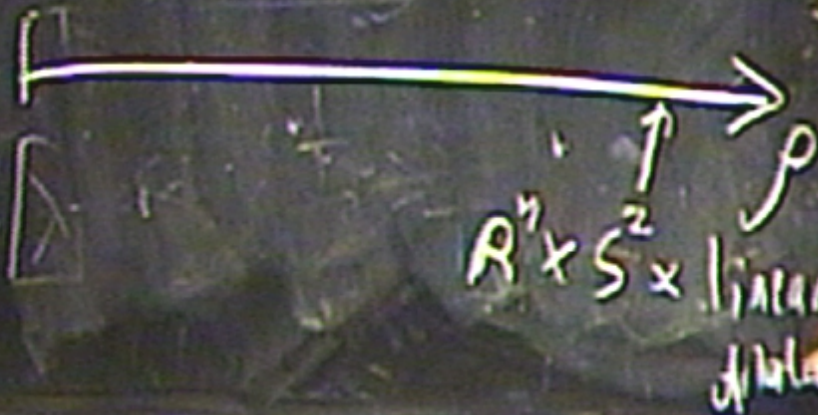
* Maldacena-Núñez

$\rho \rightarrow \infty$

Similar to before

$$\mathbb{R}^6 \longrightarrow \mathbb{R}^4 \times S^2$$

radius of $S^2 \propto \rho$

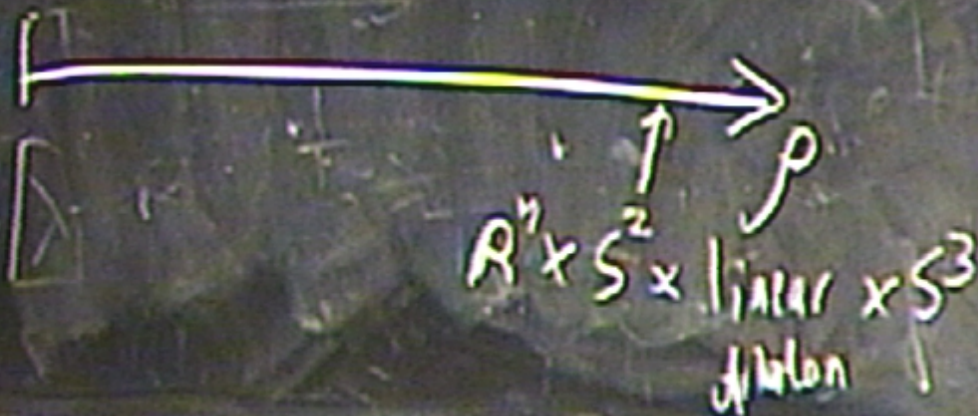


* Maldacena-Núñez

$\rho \rightarrow \infty$ Similar to before

$$\mathbb{R}^6 \longrightarrow \mathbb{R}^4 \times S^2$$

radius of S^2



$$\mathbb{R}^4 \times S^2 \times \text{linear} \times S^3$$

dilation

$$\rho \rightarrow 0$$

radius of $S^2 \rightarrow$

* Maldacena-Núñez

$\rho \rightarrow \infty$ Similar to before

$$\mathbb{R}^6 \rightarrow \mathbb{R}^4 \times S^2$$

radius of $S^2 \propto \rho$

$$\mathbb{R}^7 \times S^3$$

$$\rho = \rho_0$$

$$\mathbb{R}^4 \times S^2 \times \text{linear} \times S^3$$

dilation

$$\rho \rightarrow 0$$

radius of $S^2 \rightarrow 0$
 $(d\rho^2 + \rho^2 d\Omega_2^2)$

* Maldacena-Núñez

$\rho \rightarrow \infty$ Similar to before

$$R^4 \rightarrow R^4 \times S^2$$

radius of $S^2 \propto \rho$

$$R^7 \times S^3$$

$$\rho = \rho_0$$

$$g_s = e^{\phi_0}$$

$$R^4 \times S^2 \times \text{linear} \times S^3$$

dilation

$$\rho \rightarrow 0$$

radius of $S^2 \rightarrow 0$
 $(d\rho^2 + \rho^2 d\Omega_2^2)$

* Maldacena-Núñez

$\rho \rightarrow \infty$ Similar to before

$$\mathbb{R}^6 \rightarrow \mathbb{R}^4 \times S^2$$

radius of $S^2 \propto \rho$

$$\mathbb{R}^7 \times S^3$$

$$\rho = \rho_0$$

$$g_s = e^{\phi_0}$$

$$\mathbb{R}^4 \times S^2 \times \text{linear } \times S^3$$

dilaton

$$\rho \rightarrow 0$$

radius of $S^2 \rightarrow 0$
 $(d\rho^2 + \rho^2 d\Omega_2^2)$

* Maldacena-Núñez

$\rho \rightarrow \infty$ Similar to before

$$R^6 \rightarrow R^4 \times S^2$$

radius of $S^2 \propto \rho$

$$R^7 \times S^3$$

$\rho = \rho_0$

$$g_s^{\rho_0} = e^{\phi_0}$$

$R^4 \times S^2 \times \text{linear } \times S^3$
dilation

$\rho \rightarrow 0$

radius of $S^2 \rightarrow 0$
($d\rho^2 + \rho^2 d\Omega_2^2$)

* Maldacena-Núñez

$\rho \rightarrow \infty$ Similar to before

$$R^6 \rightarrow R^4 \times S^2$$

radius of $S^2 \propto \rho$

$$R^7 \times S^3$$

$\rho = \rho_0$

$$g_s = e^{\phi_0}$$

$R^4 \times S^2 \times \text{linear } \times S^3$
dilation

ρ

$\rho \rightarrow 0$

radius of $S^2 \rightarrow 0$
($dp^2 + \rho^2 d\Omega_2^2$)

$$R_{S^2} \gg \sqrt{N \alpha'}$$

$$\frac{R^2}{N \alpha'}$$

$$R_{S^2} \gg \sqrt{N \alpha'}$$

$$\frac{R^2}{N \alpha'} \propto \phi_0$$

decoupling

$$\phi_0 \rightarrow \infty$$

other limit

$$R_{S^2} \gg \sqrt{N \alpha'}.$$

$$\frac{R^2}{N \alpha'} \propto \phi_0.$$

decoupling

$$\phi_0 \rightarrow \infty$$

other limit

$$\phi_0 \rightarrow -\infty$$

Good SUSRA approximation

$$R_{S^2} \gg \sqrt{N \alpha'}$$

$$\frac{R^2}{N \alpha'} \propto \phi_0$$

decoupling

$$\phi_0 \rightarrow \infty$$

other limit

$$\phi_0 \rightarrow -\infty$$

Good SUPER approximation

$$G_{\mu\nu}, B_{\mu\nu}, \phi$$

* Maldacena-Núñez

$$\rho \rightarrow \infty$$

Similar to before

$$\mathbb{R}^4 \rightarrow \mathbb{R}^n \times S^2$$

radius of $S^2 \propto \rho$

Explicit

$$\mathbb{R}^7 \times S^3$$

$$\rho = \rho_0$$

$$g_s^{\text{AdS}} = e^{\phi_0}$$

$$\mathbb{R}^n \times S^2 \times \text{linear} \times S^3$$

dilation

$$\rho \rightarrow 0$$

radius of $(d\rho^2 + \rho^2)$

Compactifications

1) Mass gap

$$Z_{\text{vac}}(A) \neq 1$$

R

Compactifications

1) Mass gap $\mathbb{Z}$

2) Confinement

Discrete spectrum

NSS

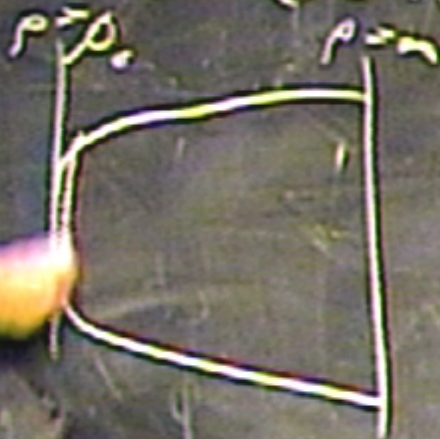


$\vec{R}$ vial

Compactifications

1) Mass gap

2) Confinement



Discrete spectrum

NSS



$\bar{R}$

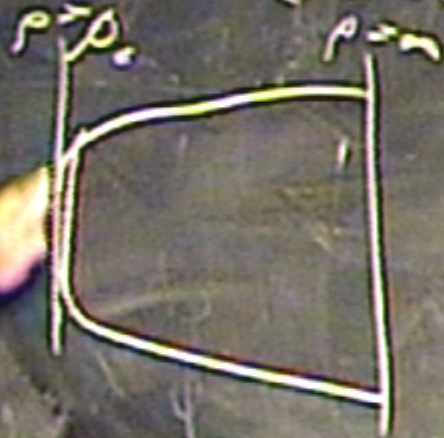
Compactifications

1) Mass gap

Discrete spectrum

2) Confinement

NSS



$\vec{R}$ viciu

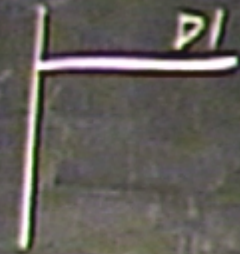
Compactifications

1) Mass gap

Discrete spectrum

2) Confinement

NSS



$$V \propto T_s R$$

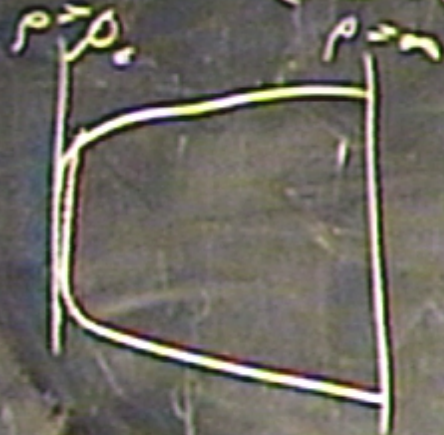
$\vec{R}$ vial

Compactifications

1) Mass gap

Discrete spectrum

2) Confinement



NSS

DI

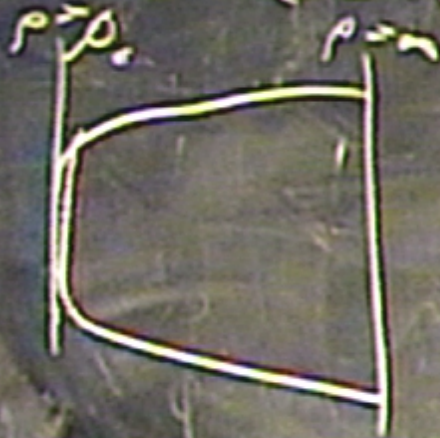
$$V \propto T_s R$$

$\vec{R}$ vector

Compactifications

1) Mass gap

2) Confinement



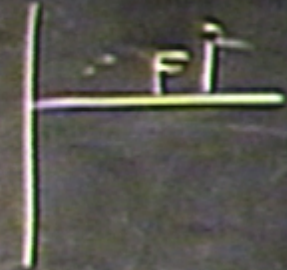
$$V \propto T_s R$$

Discrete spectrum

NSS



DS

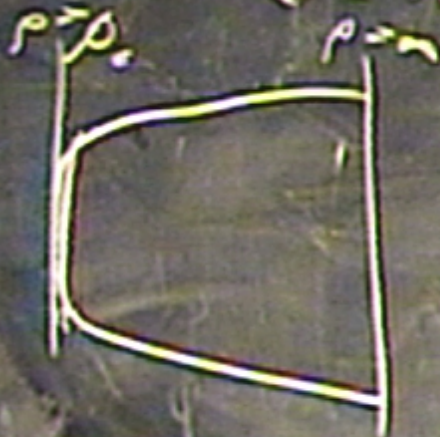


$\bar{R}$ vial

Compactifications

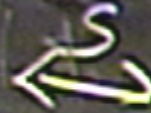
1) Mass gap

2) Confinement

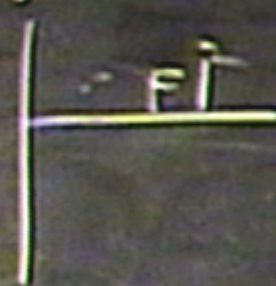


Discrete spectrum

NSS



DS



$$V \propto T_s R$$

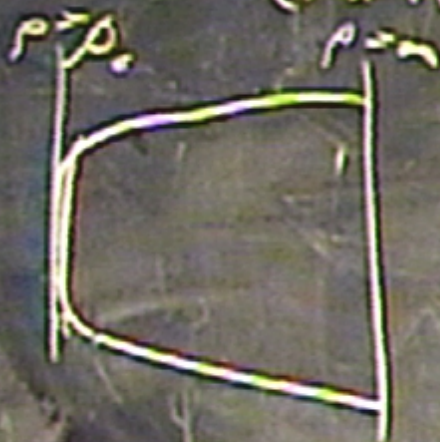
$$\frac{1}{g_s^2 \alpha'} \quad \bar{R}$$

$\bar{R}$ vial

Compactifications

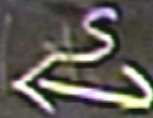
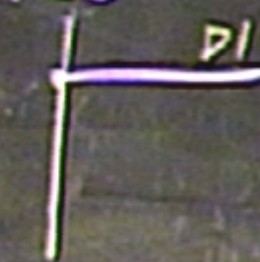
1) Mass gap

2) Confinement



Discrete spectrum

NSS



DS



$$V \propto T_s R$$

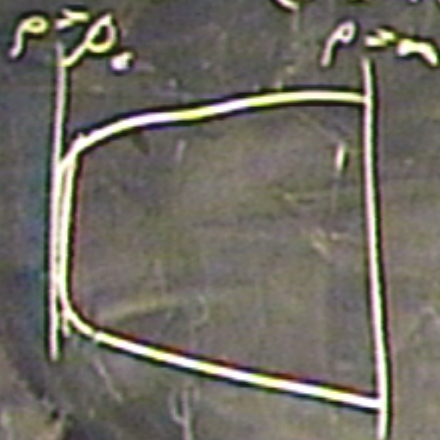
$$\frac{1}{g_s^2 \alpha'} \bar{R}$$

$\bar{R}$

Compactifications

1) Mass gap

2) Confinement



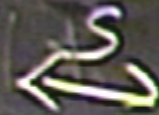
Discrete spectrum

NSS

DI

DS

FI



$$V \propto T_s R$$

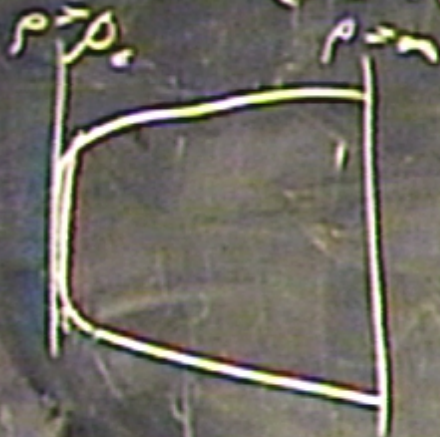
$$\frac{1}{g_{YM}^2} \propto \frac{1}{\alpha'}$$

$\bar{R}$

Compactifications

1) Mass gap

2) Confinement



Discrete spectrum

NSS



$$V \propto T_s R$$

$$\frac{1}{g_s^2 \alpha'} \bar{R}$$

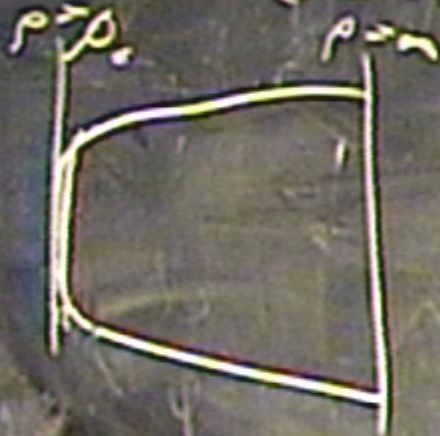
DS



Compactifications

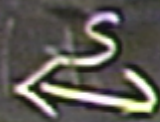
1) Mass gap

2) Confinement



Discrete spectrum

NSS



DS



$$V \propto T_s R$$

$$\frac{1}{g_{YM}^2 \alpha'} R$$

R

*3) $\chi \leq \beta$

$U(1) \rightarrow$

$$\rho = \rho_0$$

$$\boxed{g_s^{\text{max}} = e\phi_0}$$

$R^4 \times S^2 \times$ linear dilaton

$$*3) XSB \hookrightarrow U(1) \rightarrow \mathbb{Z}_2$$

$$\boxed{g_s^{p_0} = e^{\phi_0}}$$

$$R^n \times S^2 \times \text{linear} \times \text{dilation}$$

3) XSB

$n=1$
SYM

$$U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

$p=p_0$

$$g_s^{\text{YM}} = e\phi_0$$

$\uparrow$ ρ

$$R^7 \times S^2 \times \text{linear} \times S^3$$

dilation

$$*3) \text{XSB} \quad n=1 \quad \text{SYM} \quad U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

$$\rho = \rho_0$$

$$\boxed{g_s^{\text{YM}} = e^{\phi_0}}$$

$$\begin{array}{c} \uparrow \rho \\ R^7 \times S^2 \times \text{linear} \times S^3 \\ \text{dilatons} \end{array}$$

3) XSB

$n=1$
SYM

$$U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

$$\rho = \rho_0$$

$$g_s^{\text{YM}} = e^{\phi_0}$$

$$R^n \times S^2 \times \text{linear} \times S^3$$

AdS

$$3) \text{ XSB } \quad n=1 \quad \text{SYM} \quad U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

Can see in SUGRA

$$\rho = \rho_0$$

$$g_s = e^{\phi_0}$$

$$R^7 \times S^2 \times \text{linear} \times S^3$$

dilaton

$$3) \text{ XSB} \quad \begin{matrix} n=1 \\ \text{SYM} \end{matrix} \quad U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

Can see in SUGRA $U(1) \rightarrow \mathbb{Z}_{2N}$

$$\rho = \rho_0$$

$$\boxed{g_s^{\text{IR}} = e^{\phi_0}}$$

$$R^n \times S^2 \times \text{linear} \times S^3$$

dilaton

$$*3) \text{XSB} \quad \begin{matrix} n=1 \\ \text{SYM} \end{matrix} \quad U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

Can see in SUGRA $U(1) \rightarrow \mathbb{Z}_{2N}$

$$\rho = \rho_0$$

$$\boxed{g_s^{\text{IR}} = e^{\phi_0}}$$

$$\begin{matrix} \uparrow \rho \\ R^n \times S^2 \times \text{linear} \times S^3 \\ \text{dilatons} \end{matrix}$$

$$3) \text{XSB} \quad n=1 \quad \text{SYM} \quad U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

Can see in SUGRA

$$U(1) \rightarrow \mathbb{Z}_{2N} \\ \mathbb{Z}_2 \leftarrow$$

$$\rho = \rho_0 \\ \boxed{g_s^{\text{IR}} = e^{\phi_0}}$$

$$\begin{array}{c} \uparrow \rho \\ R^7 \times S^2 \times \text{linear} \times S^3 \\ \text{dilaton} \end{array}$$

3) XSB

$n=1$
SYM

$$U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

Can see in SUGRA

$$U(1) \rightarrow \mathbb{Z}_{2N}$$

$$\mathbb{Z}_2 \leftarrow$$

$$\boxed{g_s = e^{\phi_0}}$$

$$R^7 \times S^2 \times \text{linear} \times S^3$$

dilaton

3) XSB

$n=1$
SYM

$$U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

Can see in SUGRA

$$U(1) \rightarrow \mathbb{Z}_{2N}$$

$$\mathbb{Z}_2 \leftarrow$$

$$\rho = \rho_0$$

$$g_s^{\text{IR}} = e^{\phi_0}$$

$$R^n \times S^2 \times \text{linear} \times S^3$$

dilaton

3) XSB

$n=1$
SYM

$$U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$$

can see in SUGRA

$$U(1) \rightarrow \mathbb{Z}_{2N}$$

$$\mathbb{Z}_2 \leftarrow$$

4)

$$\rho = \rho_0$$

$$g_s = \epsilon$$

$$R^n \times S^2 \times \text{linear} \times S^3$$

dilaton

3) χSB $\eta=1$ $U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$
 Sym

Can see in SUGRA

$U(1) \rightarrow \mathbb{Z}_{2N}$

4) Instantons, baryons, - -

$\mathbb{Z}_2 \leftarrow$

III

Same universality
class as $\eta=1$ Sym

$p=p_0$
 $\boxed{g_s^{\eta=1} = e^{\phi_0}}$

$R^n \times S^2 \times \text{linear} \times S^3$
 $\uparrow$ ρ
dilation

3) XSB $\eta=1$ SYM $U(1) \rightarrow \mathbb{Z}_{2N} \rightarrow \mathbb{Z}_2$

Can see in SUGRA

$U(1) \rightarrow \mathbb{Z}_{2N}$

4) Instantons, baryons, - -

$\mathbb{Z}_2 \leftarrow$

|||

Same universality class as $\eta=1$ SYM

$p=p_0$
 $\boxed{g_s^{p_0} = e^{\phi_0}}$

$R^n \times S^2 \times \text{linear} \times S^3$
 dilaton

Compactifications

Disadvantage: high energy mysterious

Advantage: Weak coupling

Compactifications

1) Disadvantage: high energy mysterious

Advantage: Weak coupling
 $\lambda \rightarrow \infty$
no RR field

$$\lambda \rightarrow 0$$

Compactifications

Disadvantage: high energy mysterious

Advantage: Weak coupling
 $\lambda \rightarrow \infty$
no RR field

$\lambda \rightarrow 0$ Strong coupling
curvatures

Compactifications

1) Disadvantage: high energy mysterious

Advantage: Weak coupling
 $\lambda \rightarrow \infty$
curvature
no RR field

$\lambda \rightarrow 0$ Strong coupling
curvature

RR field

Compactifications

1) Disadvantage: high energy mysterious

Advantage: Weak coupling
curvature
no RR field

$$\lambda \rightarrow \infty$$

$$\lambda \rightarrow 0$$

Strong coupling
curvatures
RR fields