

Title: String Theory Lecture

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Collection: String Theory 2023/24

Date: April 03, 2024 - 10:15 AM

URL: <https://pirsa.org/24040033>

QFT - STRING

OH 1-2 pm

MONDAY

LECTURE NOTES
POLCHINSKI VOL 1

QFT

REGULARIZED
DEFINITION

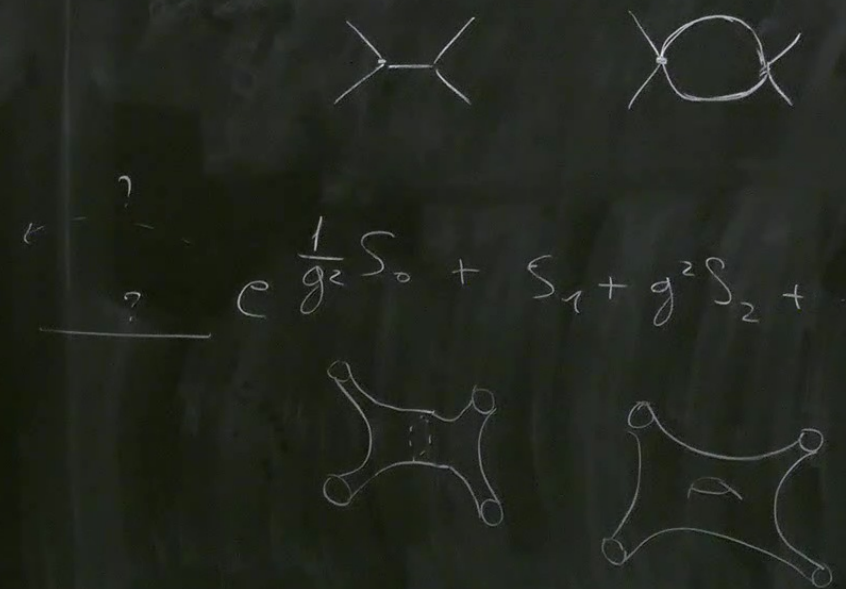
$$\rightarrow \int D\Phi e^{\frac{i}{\hbar} S[\Phi]}$$

$$Z_{\text{EP}} \rightarrow \int D\Phi e^{\frac{i}{\hbar} S[\Phi]} \leftarrow e^{\frac{i}{\hbar} S_{\text{cl}}} + S_{1\text{-Loop}} + \hbar S_{2\text{-Loop}} \dots$$

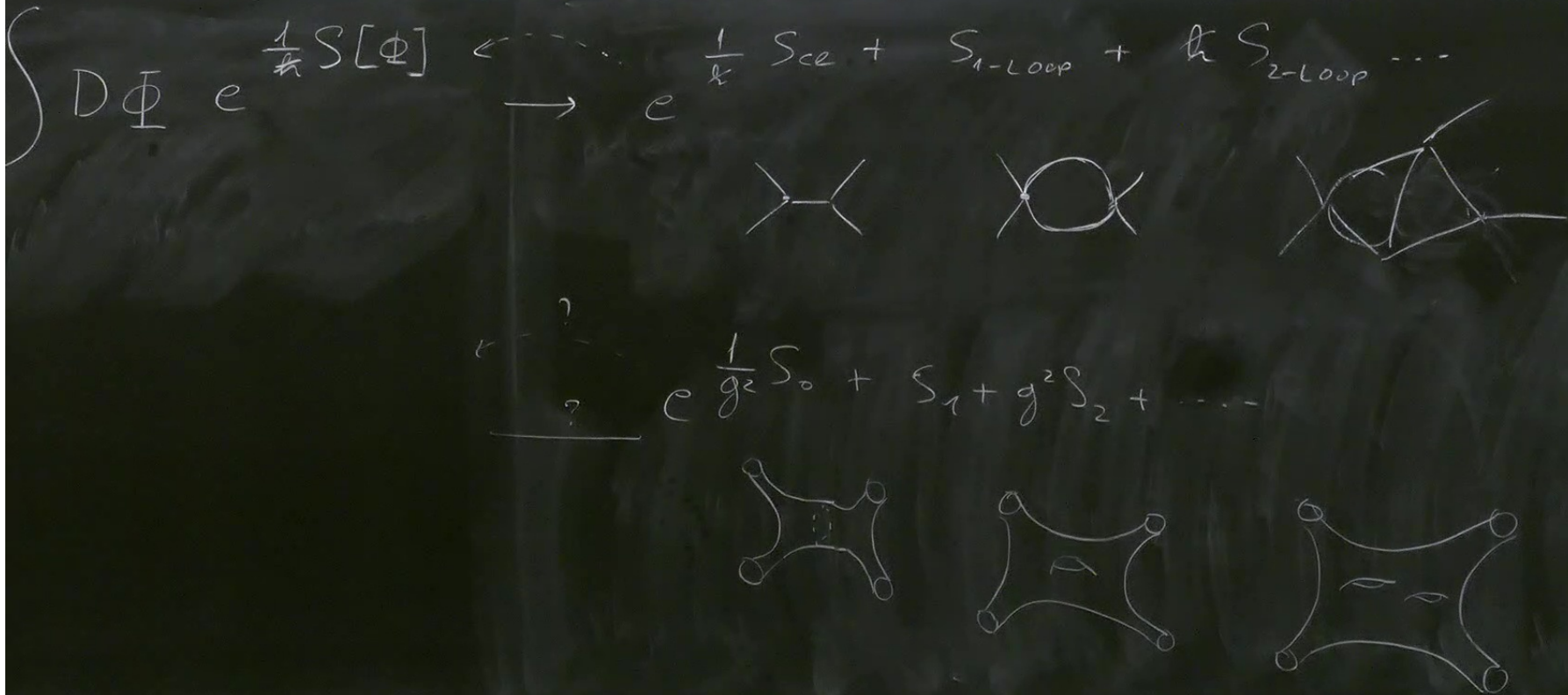


QFT REGULARIZED DEFINITION $\rightarrow \int D\Phi e^{\frac{1}{\hbar} S[\Phi]} \leftarrow e^{\frac{1}{\hbar} S_{\text{tree}} + S_{1\text{-Loop}} + \dots}$

"STRING"
THEORY



$e^{\frac{1}{g^2} S_0 + S_1 + g^2 S_2 + \dots}$



HOLOGRAPHY

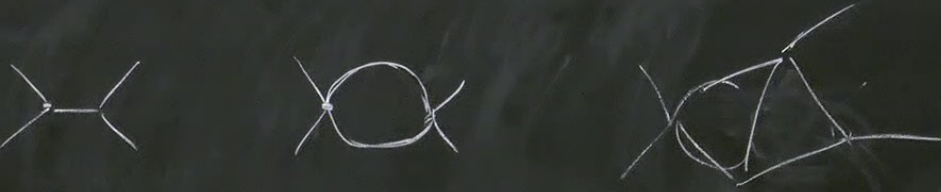
't HOOFT
EXPANSION

QFT OF $N \times N$ MATRICES

$$\int \prod_i D\phi_i e^{\frac{1}{k} \text{Tr} S(\phi)} \xrightarrow[\substack{\hbar \rightarrow 0 \\ kN = \lambda \\ \text{FIXED}}]{\hbar \rightarrow 0} e^{\frac{1}{\hbar} (S_{\text{cl}} + \dots)}$$

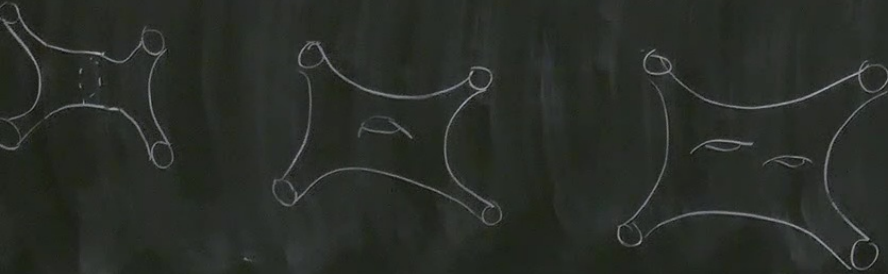
$$\underbrace{(s_{0,0} + \lambda s_{0,1} + \lambda^2 s_{0,2} + \dots)}_{S_0(\lambda)} + \underbrace{(s_{1,0} + \lambda s_{1,1} + \lambda^2 s_{1,2} + \dots)}_{S_1(\lambda)} + \lambda \underbrace{(s_{2,0} + \lambda s_{2,1} + \dots)}_{S_2(\lambda)}$$

$S_{\text{cl}} + S_{1\text{-Loop}} + \text{th } S_{2\text{-Loop}} \dots$

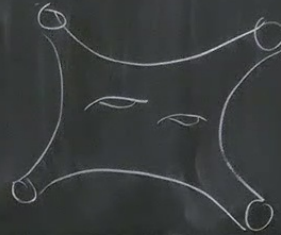
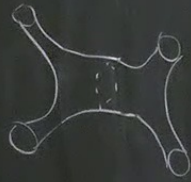


EFFECTIVE
QFT w/ GRAVITON

$S_0 + S_1 + g^2 S_2 + \dots$



IR

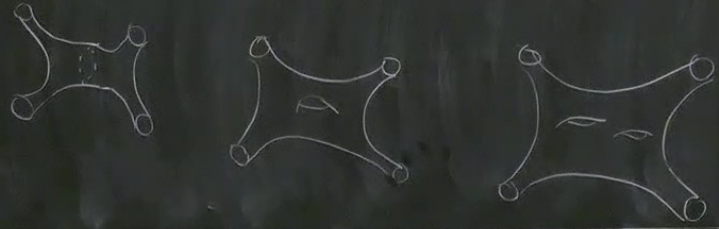


$$\underbrace{(S_{0,0} + \lambda S_{0,1} + \lambda^2 S_{0,2} + \dots)}_{S_0(\lambda)} + \underbrace{(S_{1,0} + \lambda S_{1,1} + \lambda^2 S_{1,2} + \dots)}_{S_1(\lambda)} + \lambda \underbrace{(S_{2,0} + \lambda S_{2,1} + \dots)}_{S_2(\lambda)}$$

$$\langle \Phi \rangle e^{\frac{1}{\hbar} S[\Phi]} \leftarrow e^{\frac{1}{\hbar} S_{cl} + S_{1-Loop} + \hbar S_{2-Loop} \dots}$$



$$e^{\frac{1}{g^2} S_0 + S_1 + g^2 S_2 + \dots}$$



EFFECTIVE QFT W/ GRAVITON

IR

NO COUPLINGS!

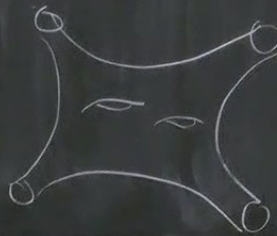
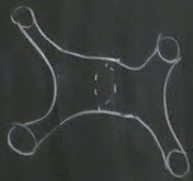
$S_0(\lambda)$

$S_1(\lambda)$

$S_2(\lambda)$

$$e^{\frac{1}{g^2} S_0 + S_1 + g^2 S_2 + \dots}$$

IR

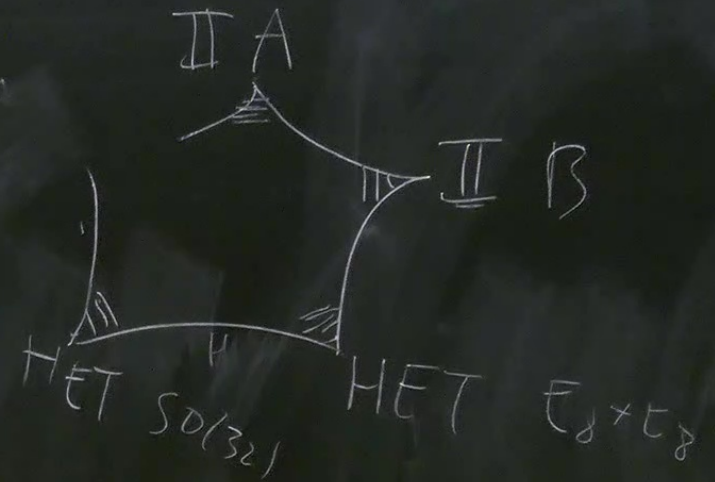


NO COUPLINGS!
BUT
BOUNDARY CONDITIONS?
VACUA?

$$\underbrace{(S_0 + \lambda S_{0,1} + \lambda^2 S_{0,2} + \dots)}_{S_0(\lambda)} + \underbrace{(S_{1,0} + \lambda S_{1,1} + \lambda^2 S_{1,2} + \dots)}_{S_1(\lambda)} + \dots + \underbrace{(S_{2,0} + \lambda S_{2,1} + \dots)}_{S_2(\lambda)}$$

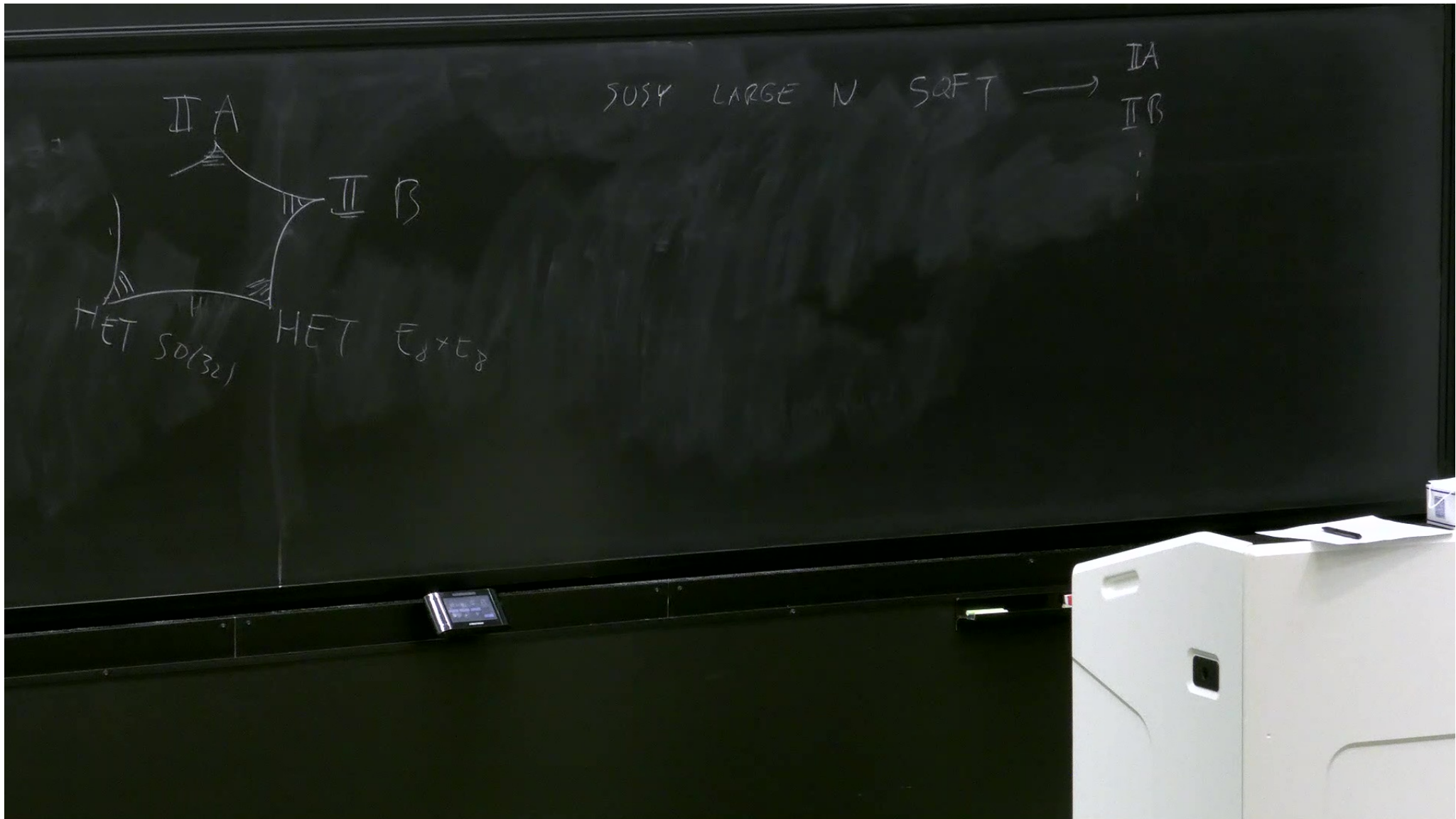
SUSY \rightarrow SIMPLIFICATIONS
EXACT COMPUTATIONS

SUSY STRINGS \rightarrow NO TACHYONS
DUALITIES



VACUA ?

$$\underbrace{\lambda S_{0,1} + \lambda^2 S_{0,2} + \dots}_{S_0(\lambda)} + \underbrace{\left(S_{1,0} + \lambda S_{1,1} + \lambda^2 S_{1,2} + \dots \right)}_{S_1(\lambda)} + \lambda \underbrace{\left(S_{2,0} + \lambda S_{2,1} + \dots \right)}_{S_2(\lambda)}$$



SUSY LARGE N SOFT \longrightarrow IIA
IIB
⋮

