Title: 3d A-twist and analytic continuation of path integrals

Speakers: Davide Gaiotto

Series: Mathematical Physics

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Abstract: I will review the relation between the A twist of 3d N=4 gauge theories and

the conformal blocks/chiral cohomology of 2d chiral algebras.

$$\int_\gamma e^{S[\phi]}\, O_1 \cdots O_n\, D_{M_d}\phi \equiv$$

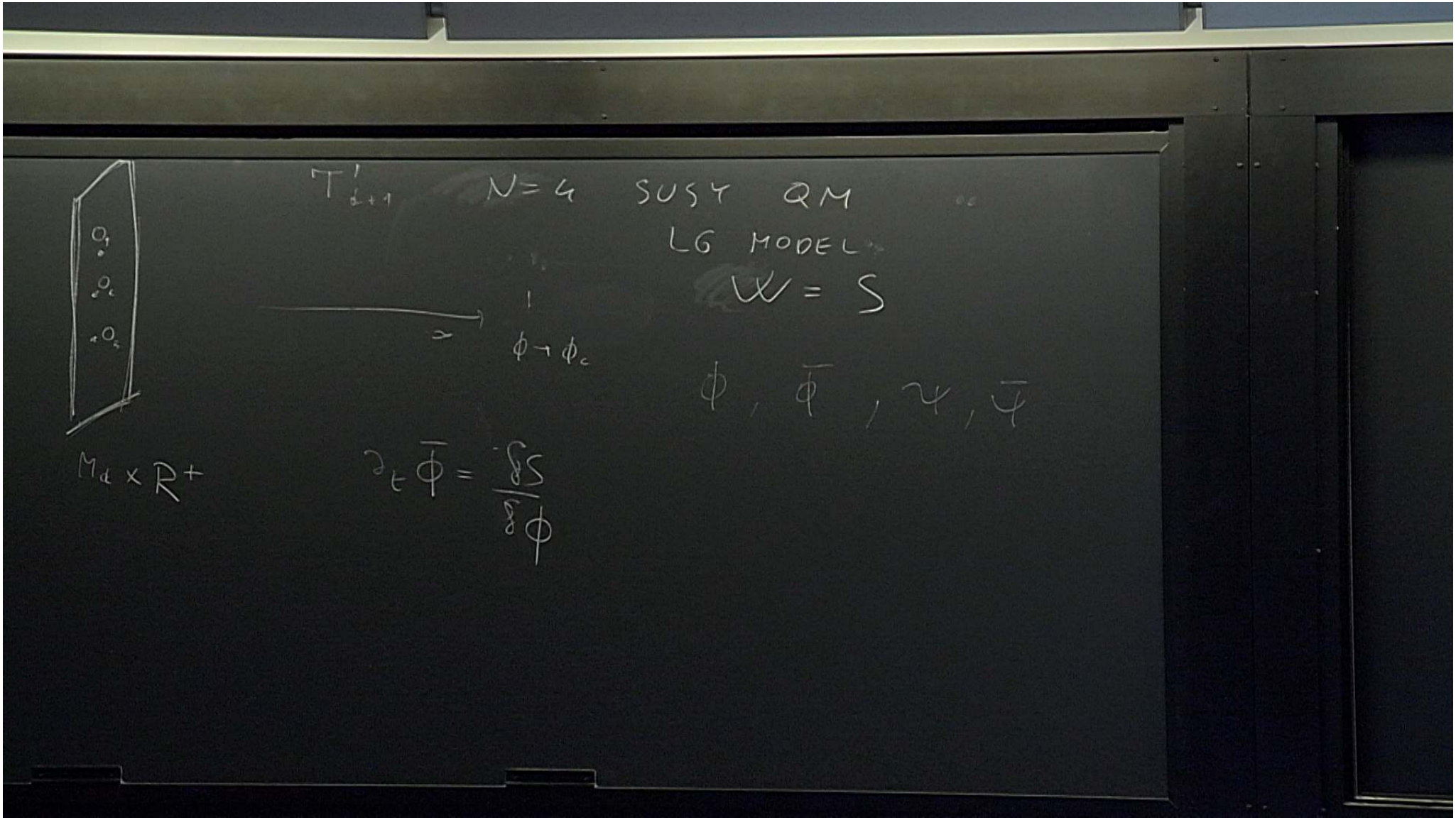
$M_d \times R^+$

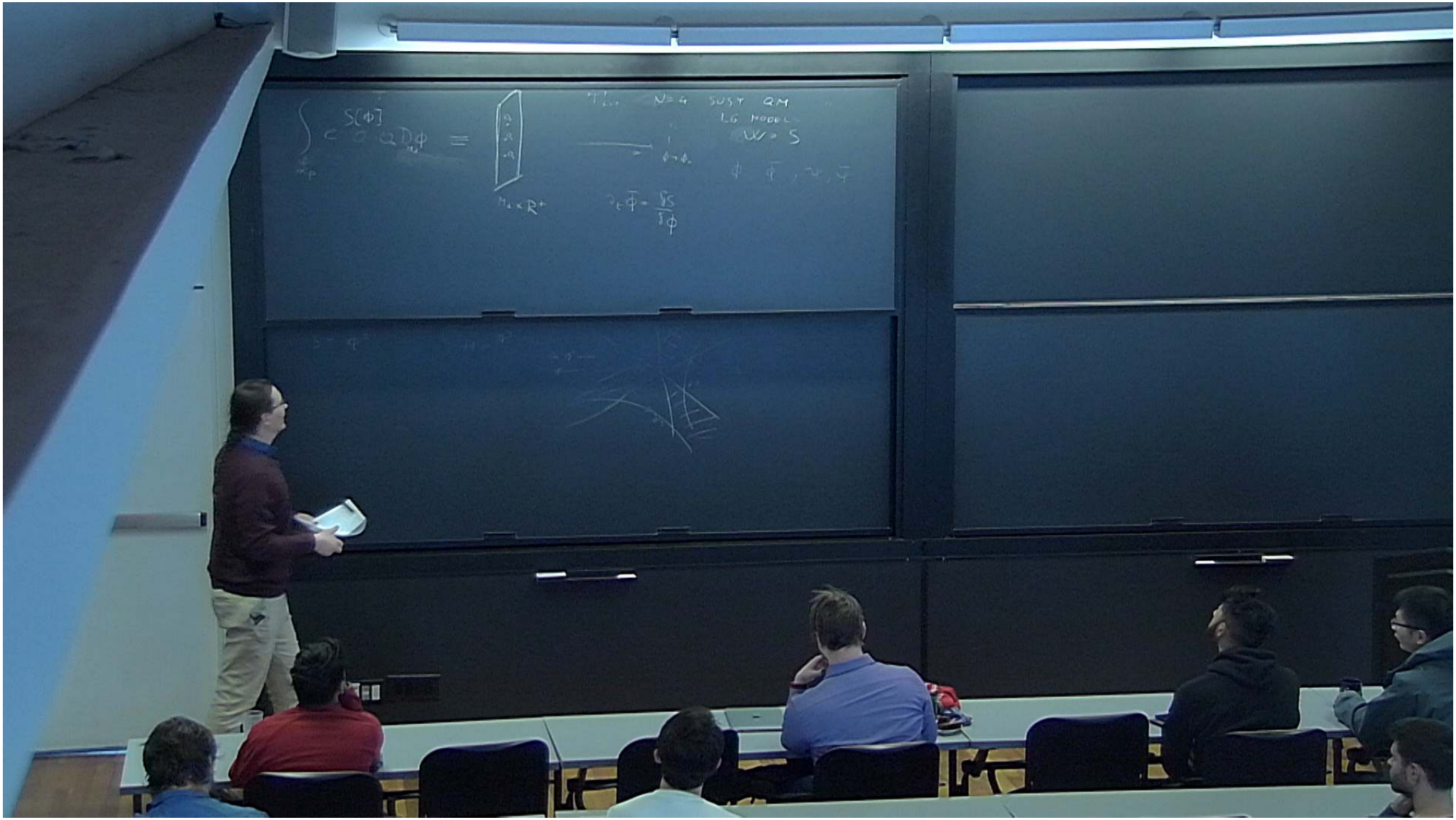
T^1_{d+1} $N=4$ SUSY

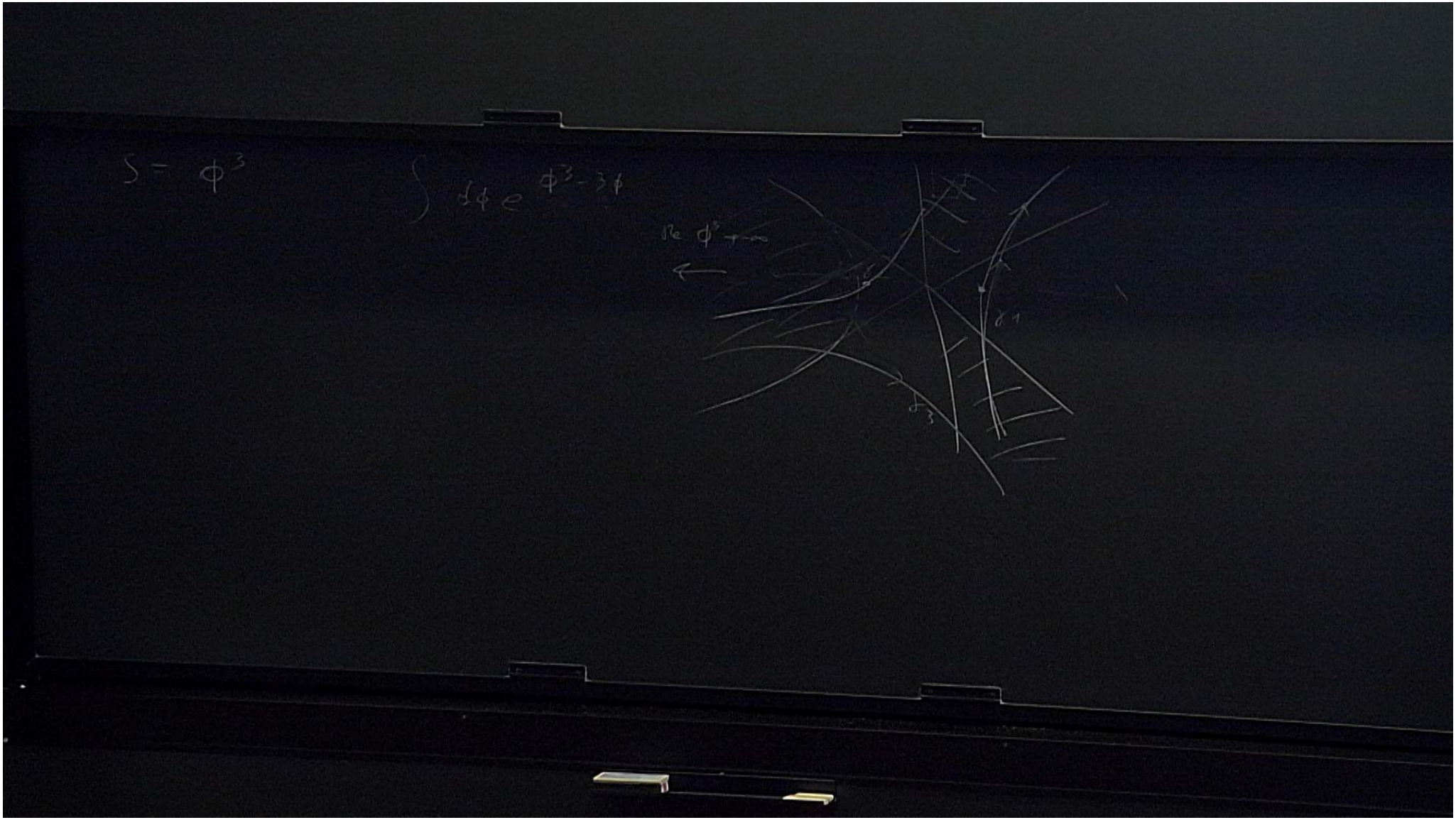
LG MO

$|\gamma\rangle$

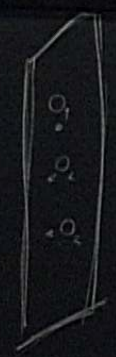
ϕ


T^1_{d+1} $N=4$ SUSY QM
LG MODEL
$W = S$
O_1
O_2
O_3
$\phi \to \phi_c$
$\phi, \bar{\phi}, \psi, \bar{\psi}$
$M_d \times \mathbb{R}^+$
$\partial_t \bar{\phi} = \frac{\delta S}{\delta \phi}$


N=4 SUSY QM
LG MODEL
W = S

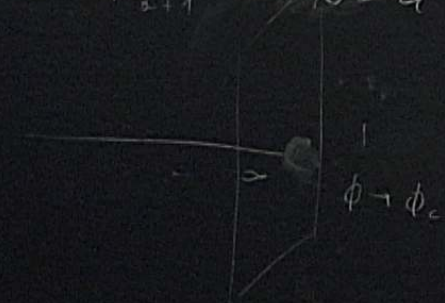

$S = \phi^3$
$\int d\phi\, e^{\phi^3 - 3\phi}$
$\phi^3 \to -\infty$

$$\int_{\mathcal{L}_p} e^{S[\phi]}\, O_1 \cdots O_n\, D_{M_d}\phi \equiv$$



$M_d \times R^+$

T^1_{d+1}



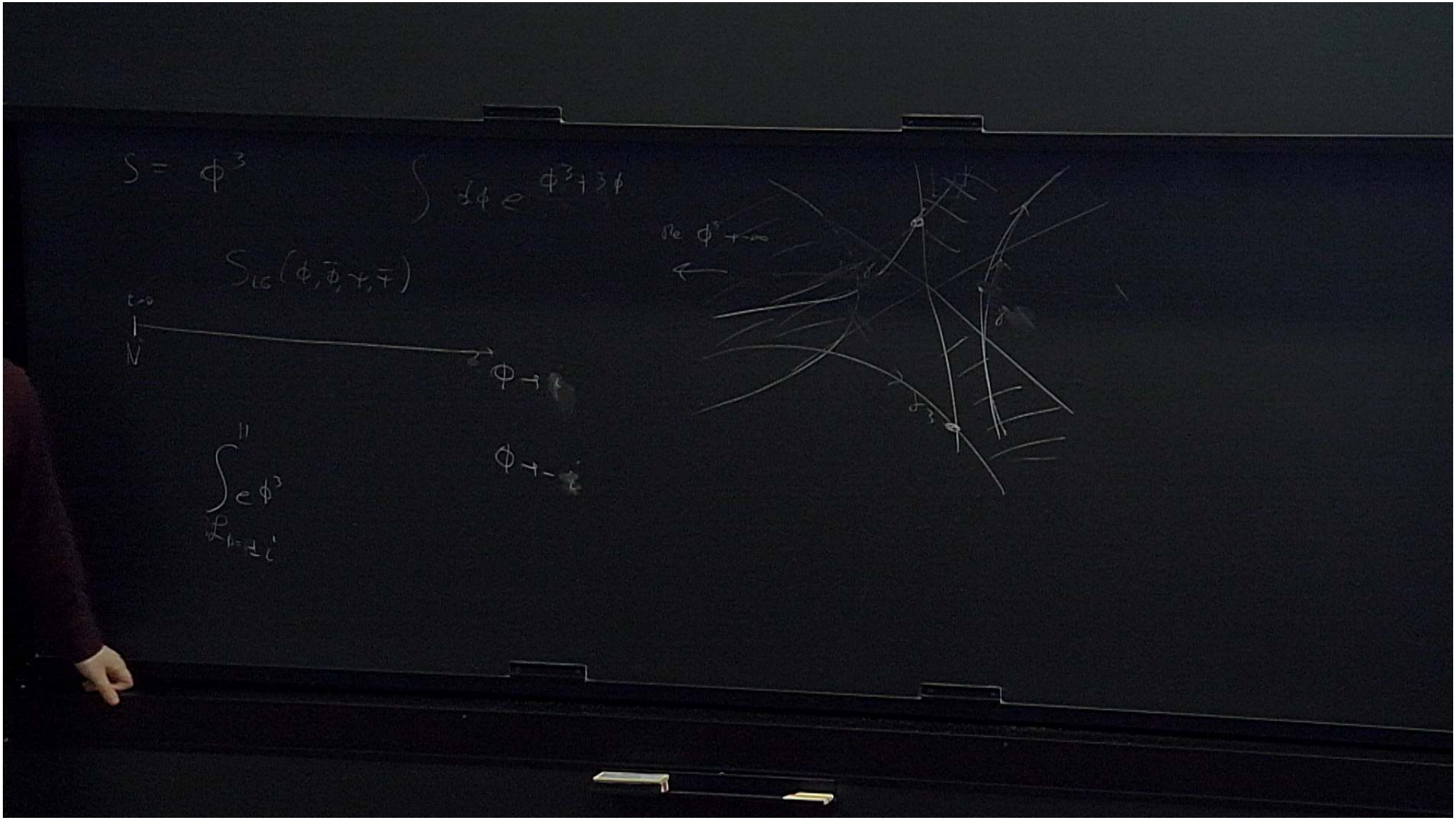
$$\partial_t \bar{\phi} = \frac{\delta S}{\delta \phi}$$

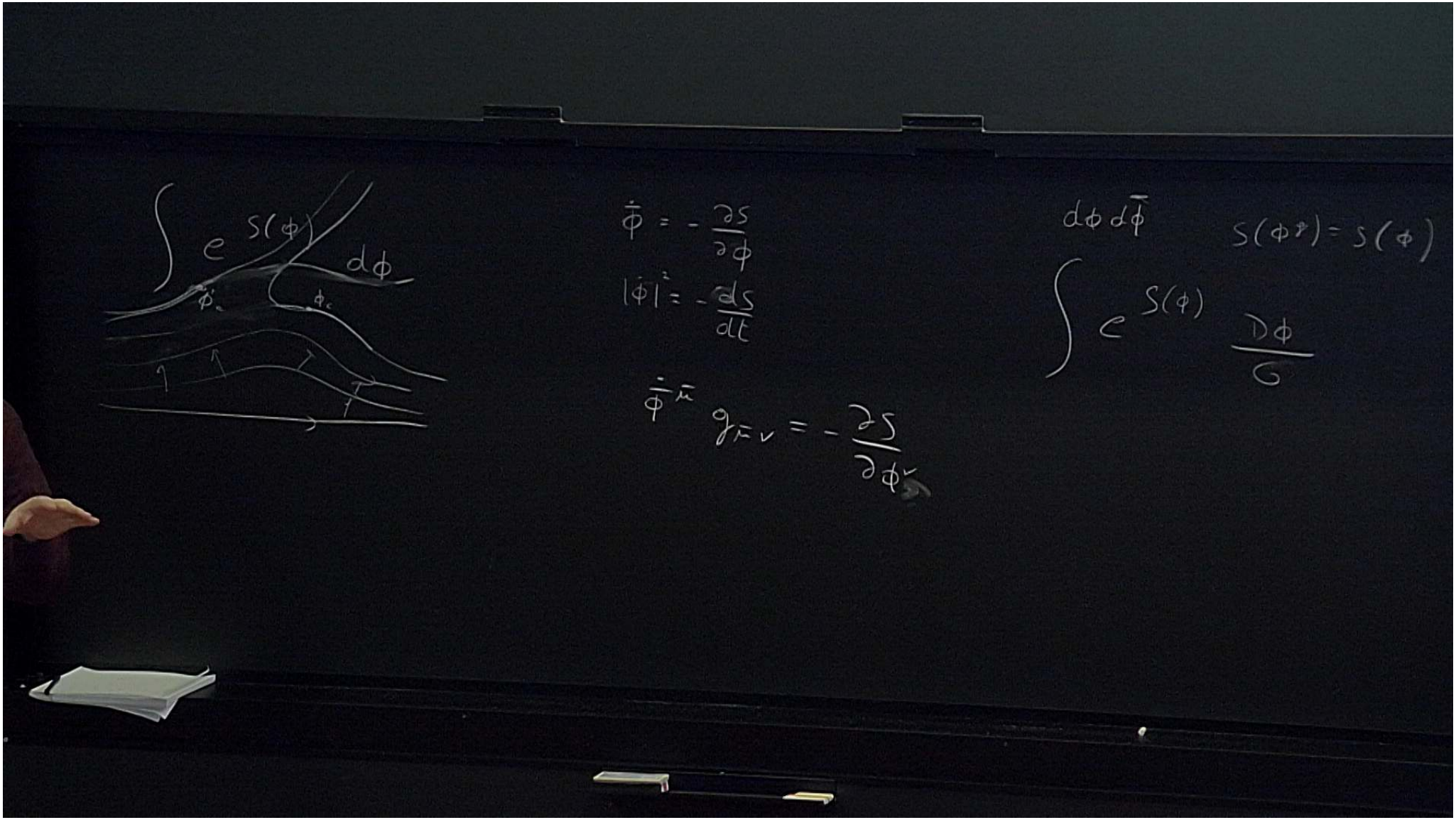
$N=4$ SUSY QM

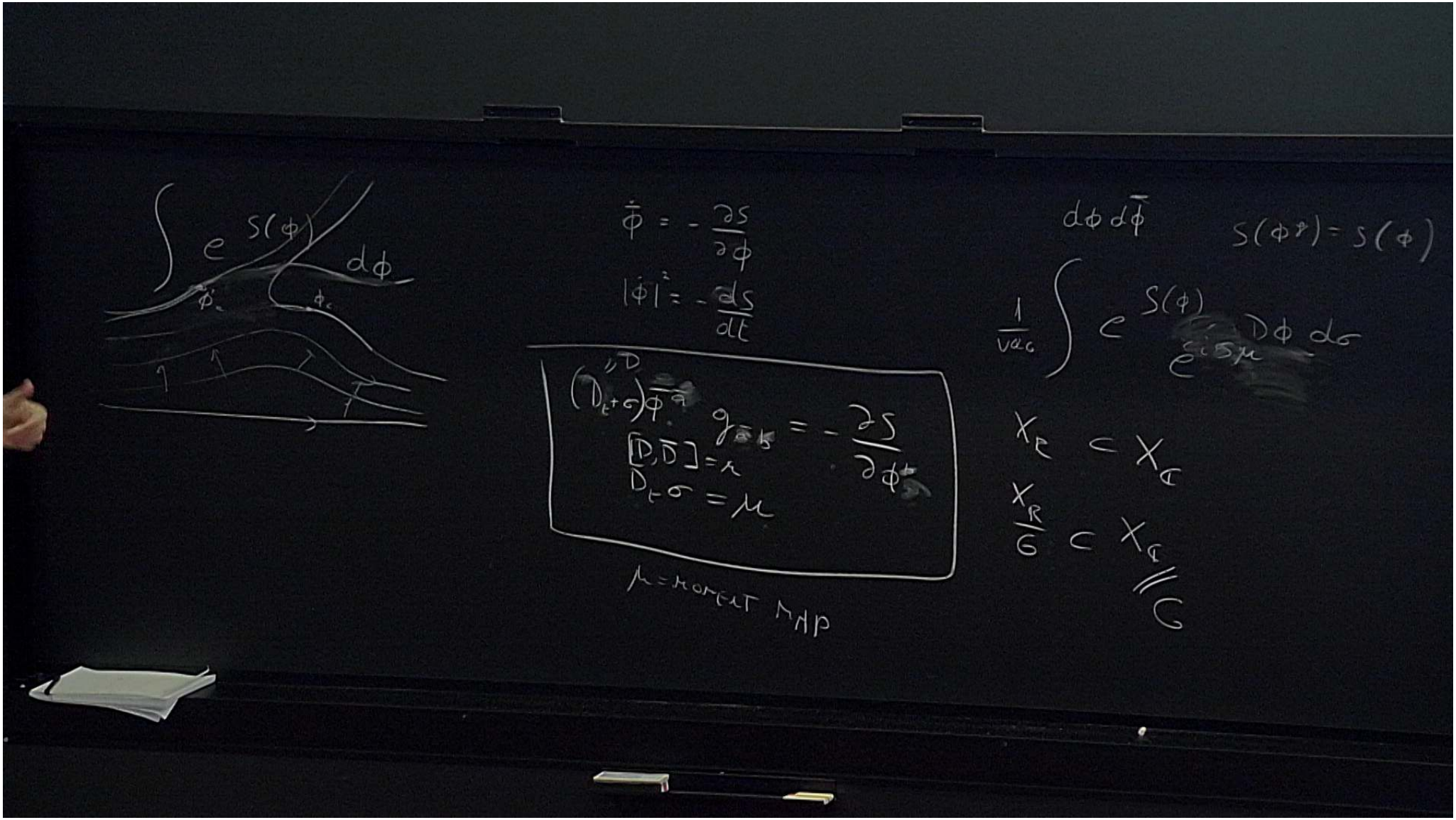
LG MODEL

$W = S$

$\phi, \bar{\phi}, \psi, \bar{\psi}$


$S = \phi^3$
$\int d\phi\, e^{\phi^3 + J\phi}$
$S_{LG}(\phi, \bar{\phi}, \tau, \bar{\tau})$
$t \to \infty$
N
$\phi \to$
$\phi \to -i$
$\int_{\mathbb{R}} e^{\phi^3}$
$\mathbb{R}_{\phi = \pm i}$
$\mathrm{Re}\ \phi^3 \to \infty$
γ_3
γ


$\int e^{S(\phi)} d\phi$
ϕ_-
ϕ_+
$\dot{\phi} = -\frac{\partial S}{\partial \phi}$
$|\dot{\phi}|^2 = -\frac{dS}{dt}$
$\dot{\phi}^\mu g_{\mu\nu} = -\frac{\partial S}{\partial \phi^\nu}$
$d\phi\, d\bar{\phi}$
$S(\phi^\dagger) = S(\phi)$
$\int e^{S(\phi)} \frac{\mathcal{D}\phi}{G}$


$\int e^{S(\phi)} d\phi$
$\dot{\bar{\phi}} = -\frac{\partial S}{\partial \phi}$
$|\dot{\phi}|^2 = -\frac{dS}{dt}$
$(D_t+\sigma)\bar{\phi}^a$
$g_{ab} = -\frac{\partial S}{\partial \phi^b}$
$[D,\bar{D}] = r$
$D_t\sigma = \mu$
μ = MOMENT MAP
$d\phi\, d\bar{\phi}$
$S(\phi^*) = S(\phi)$
$\frac{1}{vac}\int e^{S(\phi)} D\phi\, d\sigma$
$X_R \subset X_{\mathbb{C}}$
$\frac{X_R}{G} \subset X_{\mathbb{C}} /\!/ G$

$d=1$

$S = \int p\,\dot{q}\,d\tau$

$\partial_y \bar{p} = \partial_\tau q$

$\partial_y \bar{q} = -\partial_\tau p$

$(\partial_y + i\partial_\tau)(\bar{p} + iq) = 0$

$\bar{\partial}(\cdots) = 0$

P PHASE SPACE

$\omega = d\lambda$ LOCALLY

$S = \int \pi^* \lambda$

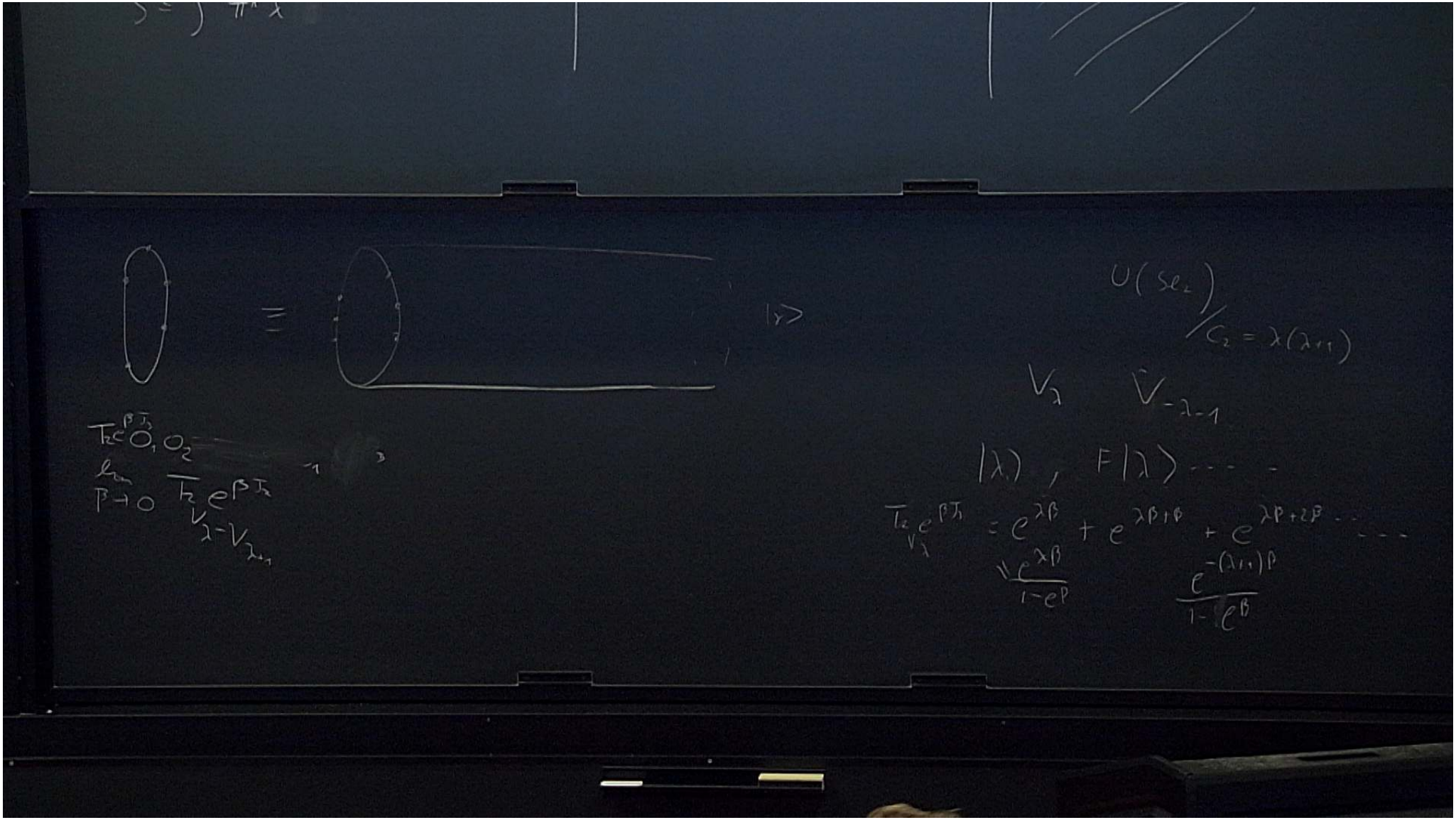
ANALYTIC CONTINUATION OF QM

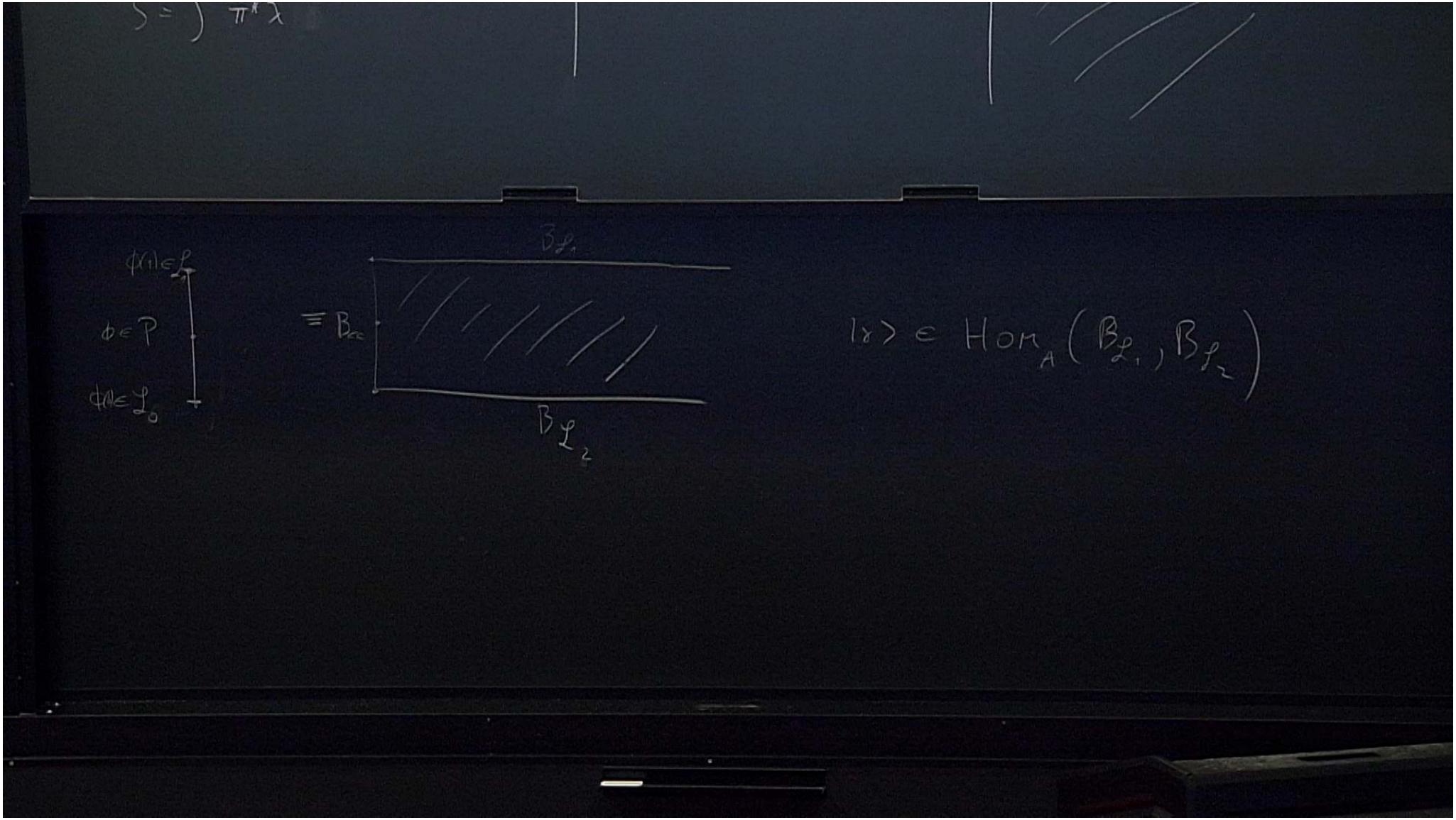
PHASE SPACE

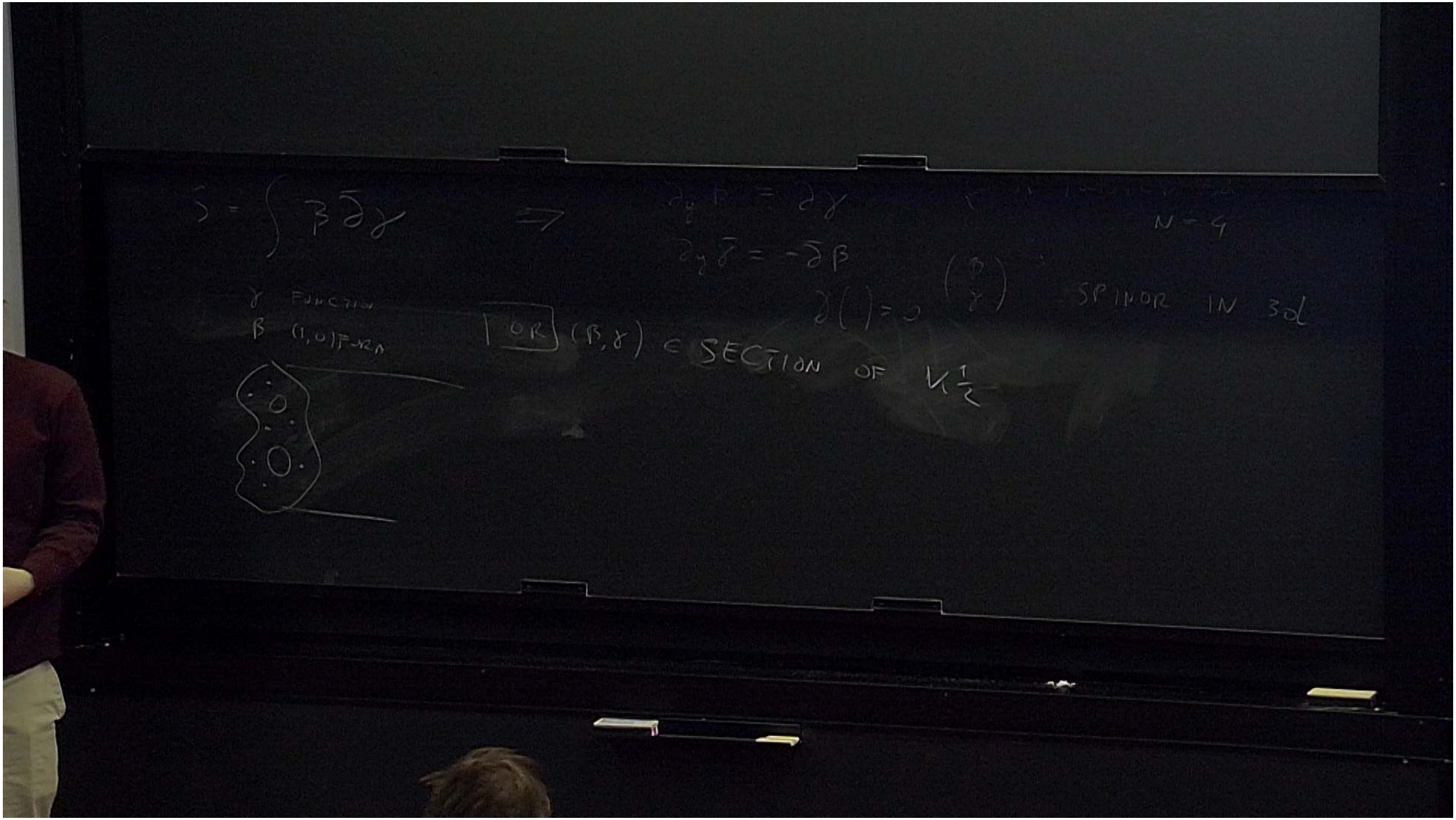
P

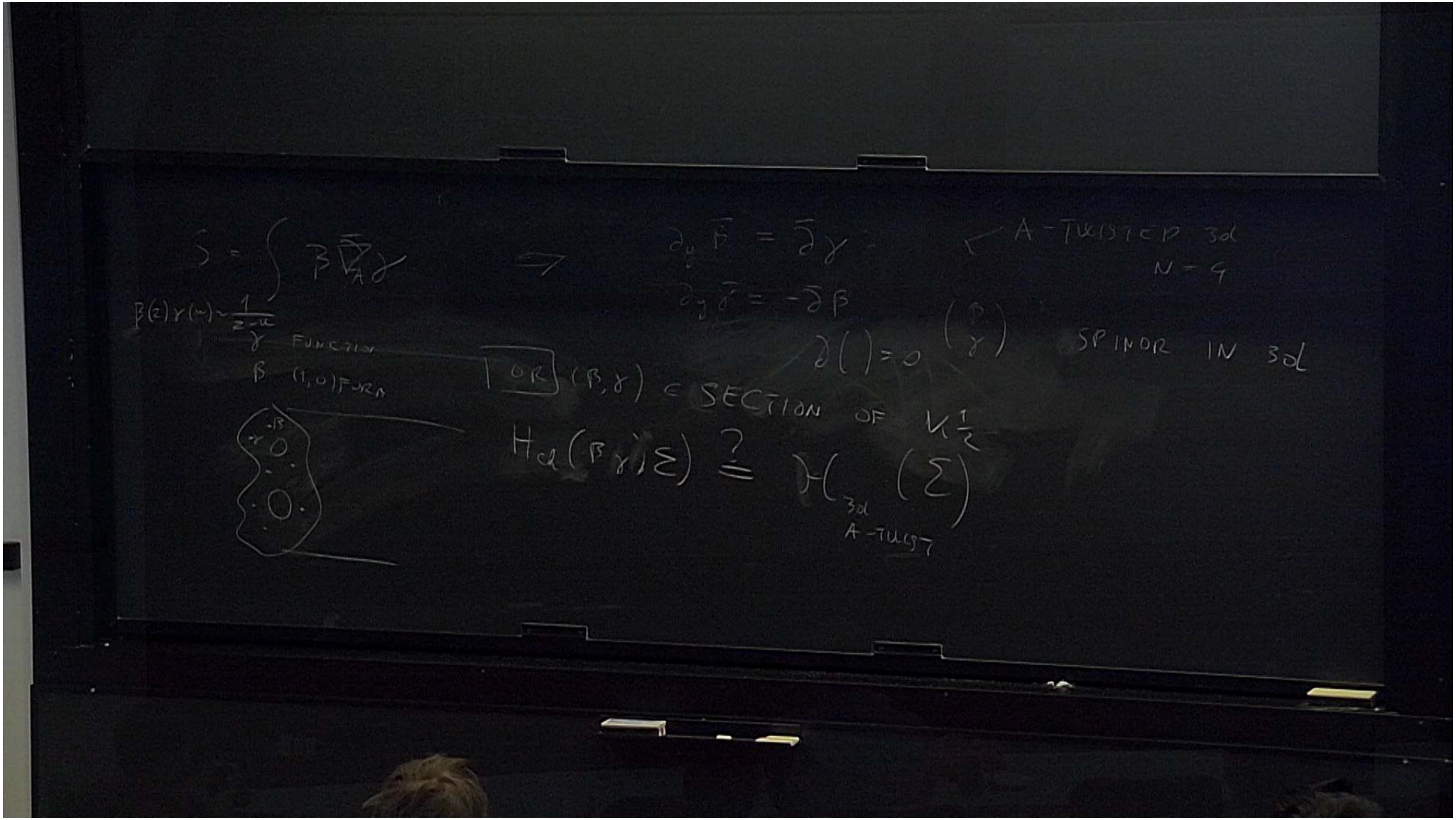
$\equiv$ B_∞

Λ-MODEL ON P_C


|λ>
U(sl2)
C2 = λ(λ+1)
Vλ
V-λ-1
|λ⟩ , F|λ⟩ ...
Tr e^βJ3 O1 O2
lim β→0 Tr e^βJ3
Vλ-Vλ+1
Tr e^βJ3 = e^λβ + e^λβ+β + e^λβ+2β ...
Vλ
e^λβ / 1-e^β
e^-(λ+1)β / 1-e^β


$\phi_1 \in \mathcal{L}_1$
$\phi \in P$
$\phi_0 \in \mathcal{L}_0$
$\equiv B_{\mathcal{L}_0}$
$B_{\mathcal{L}_1}$
$B_{\mathcal{L}_2}$
$|\alpha\rangle \in \mathrm{Hom}_A(B_{\mathcal{L}_1}, B_{\mathcal{L}_2})$


$S = \int \beta \bar{\partial} \gamma$
$\partial_{\bar{y}} \beta = \partial \gamma$
$\partial_{\bar{y}} \gamma = -\partial \beta$
$\partial() = 0$
$\begin{pmatrix} \beta \\ \gamma \end{pmatrix}$
SPINOR IN 3d
N = 4
γ FUNCTION
β (1,0)FORM
OR
$(\beta, \gamma) \in$ SECTION OF $K^{\frac{1}{2}}$


$S = \int \beta \bar{\nabla}_A \gamma$
$\beta(z)\gamma(w) \sim \frac{1}{z-w}$
γ FUNCTION
β (1,0) FORM
$\partial_y \bar{\beta} = \bar{\partial}\gamma$
$\partial_y \bar{\gamma} = -\bar{\partial}\beta$
A-TWISTED 3d $N=4$
$\partial \begin{pmatrix} \beta \\ \gamma \end{pmatrix} = 0$ SPINOR IN 3d
OR $(\beta, \gamma) \in$ SECTION OF $\mathcal{V}_{\frac{1}{2}}$
$H_d(\beta\gamma, \varepsilon) \stackrel{?}{=} \mathcal{V}_{3d\ A\text{-TWIST}}(\varepsilon)$