Title: Lecture - Twisted Holography b

Speakers:

Collection: Celestial Holography Summer School 2024

Date: July 26, 2024 - 11:30 AM

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$$\Delta = 1 \qquad \oint I^A J_B(z)\, dz = m^{(0)A}{}_{B} \quad \longleftrightarrow \quad \overset{P}{\mathbb{1}}$$

$$\hat{gl}_{n|n}$$

$$\Delta = \tfrac{3}{2} \qquad \oint I^A Z^\alpha J_B\, z^{n=0,1}\, dz = m^{(1)A\,\alpha}{}_{B\,n} \quad \longleftrightarrow \quad P^{\alpha}_{n} \quad \alpha \in SU(2),\; n \in SL(2)$$

$$P^\alpha_n \cdot P^\beta_m =$$

$$\Delta = 2 \qquad I Z^\alpha Z^\beta J \qquad \frac{1}{\epsilon} I^A Z^\alpha J_B(z)\, \frac{1}{\epsilon} I^C Z^\beta J_D(w)$$

$I Z^\alpha Z^\beta J$

IJ

$$I Z^{\alpha_1} \cdots Z^{\alpha_n} J \longrightarrow P^{(n)}{}^{(\alpha_1 \cdots \alpha_n)}_{(n_1 \cdots n_n)} = P^{(\alpha_1}_{(n_1} \cdots P^{\alpha_n)}_{n_n)}$$

$$P^{\alpha}_{n} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

$$P^{\alpha}_{n} * P^{\beta}_{m} = P^{(2)}{}^{(\alpha \beta)}_{(n,m)} + \lambda \, \epsilon^{\alpha\beta} \epsilon_{nm}$$

$$ad - bc = \lambda \qquad SL_2(\mathbb{C})$$

$$\det P = \lambda$$

$\lambda = \hbar N$

$SU(2)$

$SL(2)$

$I Z^{\alpha_1} \cdots Z^{\alpha_m} J \rightarrow$

$$p^{\alpha}_{n} \cdot p^{\beta}_{m} = p^{(2)\,(\alpha\beta)}_{\quad (n,m)} + \lambda\, \epsilon^{\alpha\beta} \epsilon_{nm}$$

$$\det p = \lambda$$

$$P = \mathcal{O}(SL_2(\mathbb{C}))$$

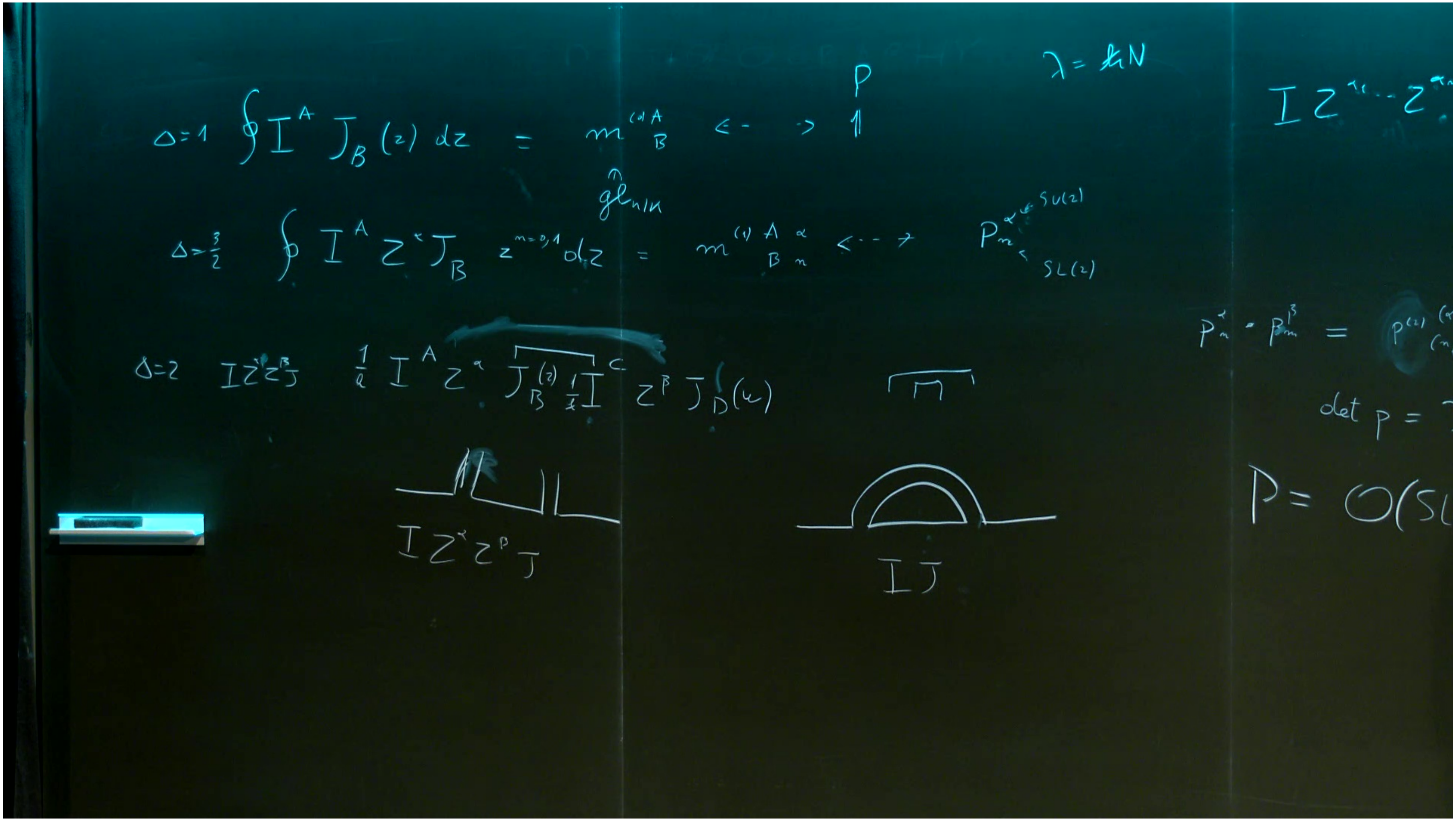
$\lambda \; \epsilon^{\alpha\beta} \epsilon_{mn}$

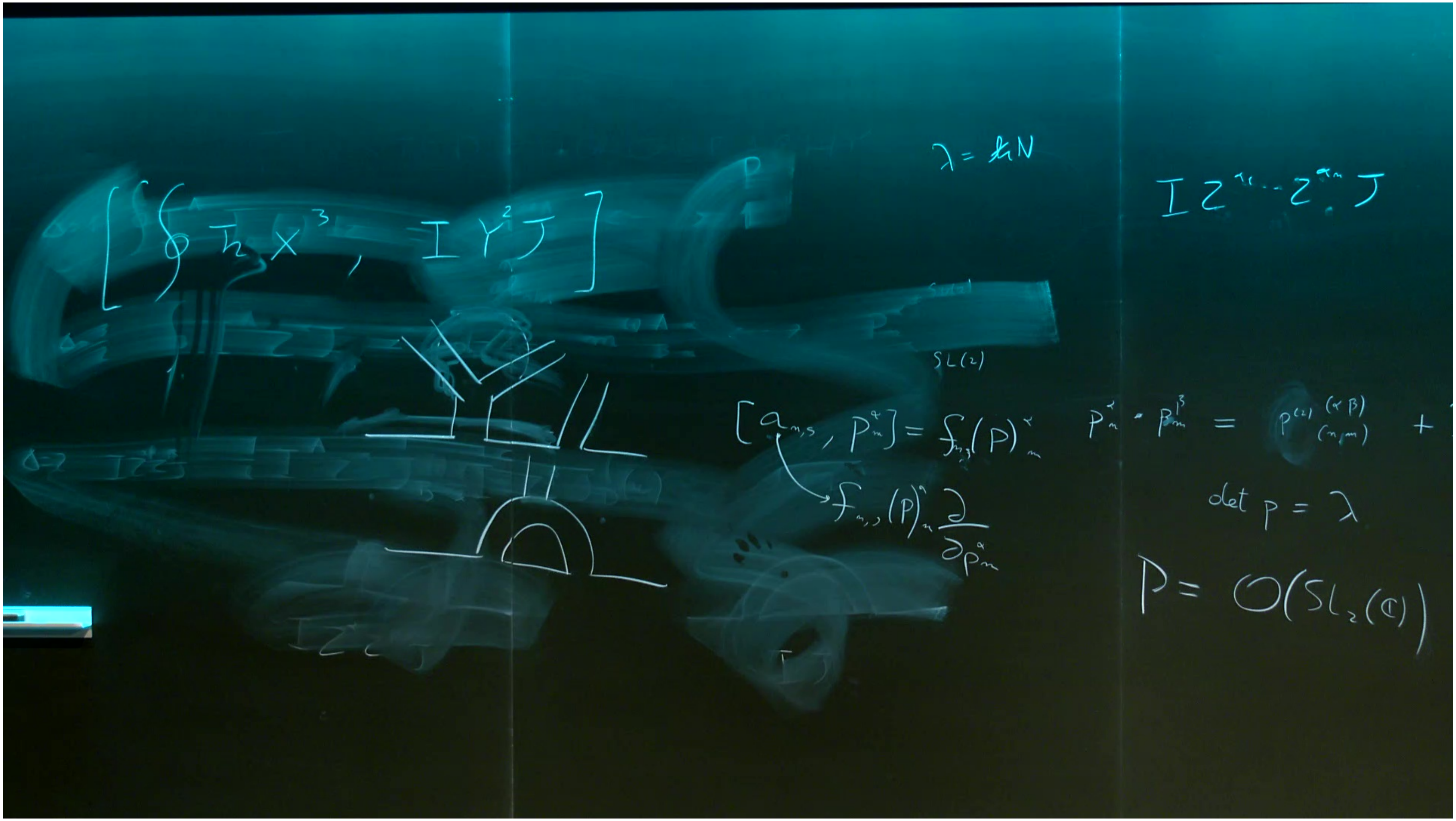
SPACE-FILLING D-BRANES

$$hCS \quad \int A \bar{\partial} A \, \Omega^{CY}$$

$$\bar{\partial} A + A \wedge A = 0$$

$$A \to A + \bar{\partial}\Lambda + [A, \Lambda]$$


$\lambda = k N$
$\Delta = 1 \quad \oint I^A J_B(z)\, dz = m^{(0)A}{}_B \longleftrightarrow \mathbb{1}$
$\widehat{gl}_{n|n}$
$\Delta = \frac{3}{2} \quad \oint I^A Z^\alpha J_B\, z^{n=0,1} dz = m^{(1)A\,\alpha}{}_{B\,n} \longleftrightarrow P^\alpha_n$
$SU(2)$
$SL(2)$
$\Delta = 2 \quad I Z^\alpha Z^\beta J \quad \frac{1}{k} I^A Z^\alpha J^{(2)}_B \frac{1}{k} I^C Z^\beta J_D(w)$
$I Z^\alpha Z^\beta J$
IJ
$P^\alpha_n \cdot P^\beta_m =$
$\det P =$
$P = O(S$


λ = k N
I Z^α1 ... Z^αn J
[∮ Tr X^3 , I Y^2 J]
SL(2)
[a_{n,s} , p^α_m] = f_{n,s}(p)^α_m
f_{n,s}(p)^α_m ∂/∂p^α_m
p^α_n * p^β_m = p^(2) (αβ) (n,m) +
det p = λ
P = O(SL_2(C))

$\lambda = \hbar N$

$[Y^2 J]$

$I\, Z^{\alpha_1} \cdots Z^{\alpha_m} J \to$

SPACE -

hCS

$SL(2)$

$[a_{m,s}, P^{\alpha}_{n}] = f_{m,s}(P)^{\alpha}_{n}$

$f_{m,s}(P)^{\alpha}_{n} \dfrac{\partial}{\partial p^{\alpha}_{n}}$

HOL VECTOR FIELD

DIV-FREE

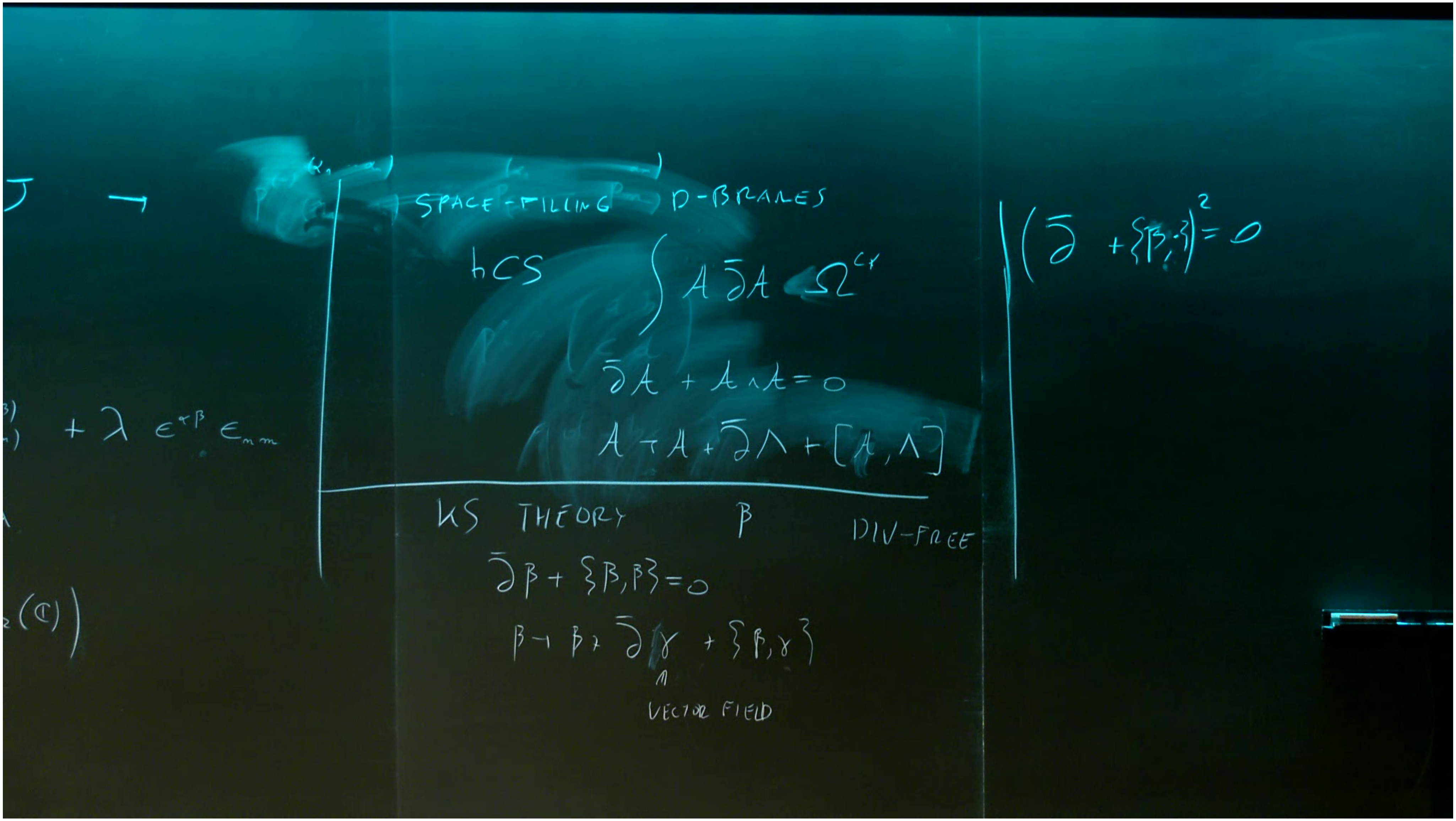
$P^{\alpha}_{n} \cdot P^{\beta}_{m} = P^{(2)\,(\alpha\beta)}_{(n,m)} + \lambda\, \epsilon^{\alpha\beta} \epsilon_{nm}$

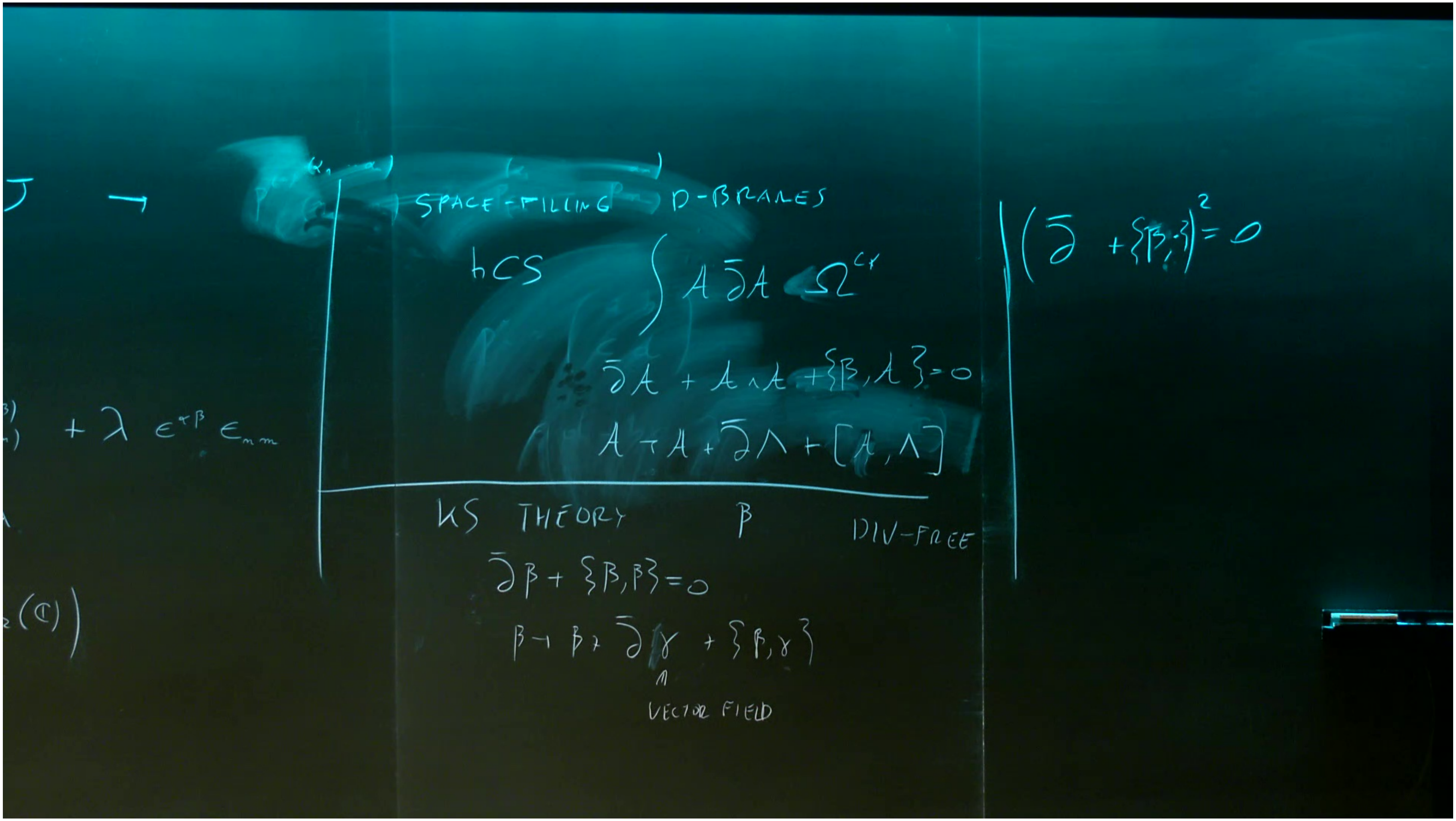
$\det p = \lambda$

$P = \mathcal{O}(SL_2(\mathbb{C}))$

KS

$\bar\partial \beta$


SPACE-FILLING D-BRANES
hCS $\int A \bar\partial A \, \Omega^{CY}$
$\bar\partial A + A \wedge A = 0$
$A \to A + \bar\partial \Lambda + [A, \Lambda]$
KS THEORY β DIV-FREE
$\bar\partial \beta + \{\beta, \beta\} = 0$
$\beta \to \beta + \bar\partial \gamma + \{\beta, \gamma\}$
VECTOR FIELD
$(\bar\partial + \{\beta, \cdot\})^2 = 0$
$+ \lambda \epsilon^{\alpha\beta} \epsilon_{mn}$


SPACE-FILLING D-BRANES
hCS $\int A \bar\partial A \, \Omega^{CY}$
$\bar\partial A + A \wedge A + \{\beta, A\} = 0$
$A \to A + \bar\partial \Lambda + [A, \Lambda]$
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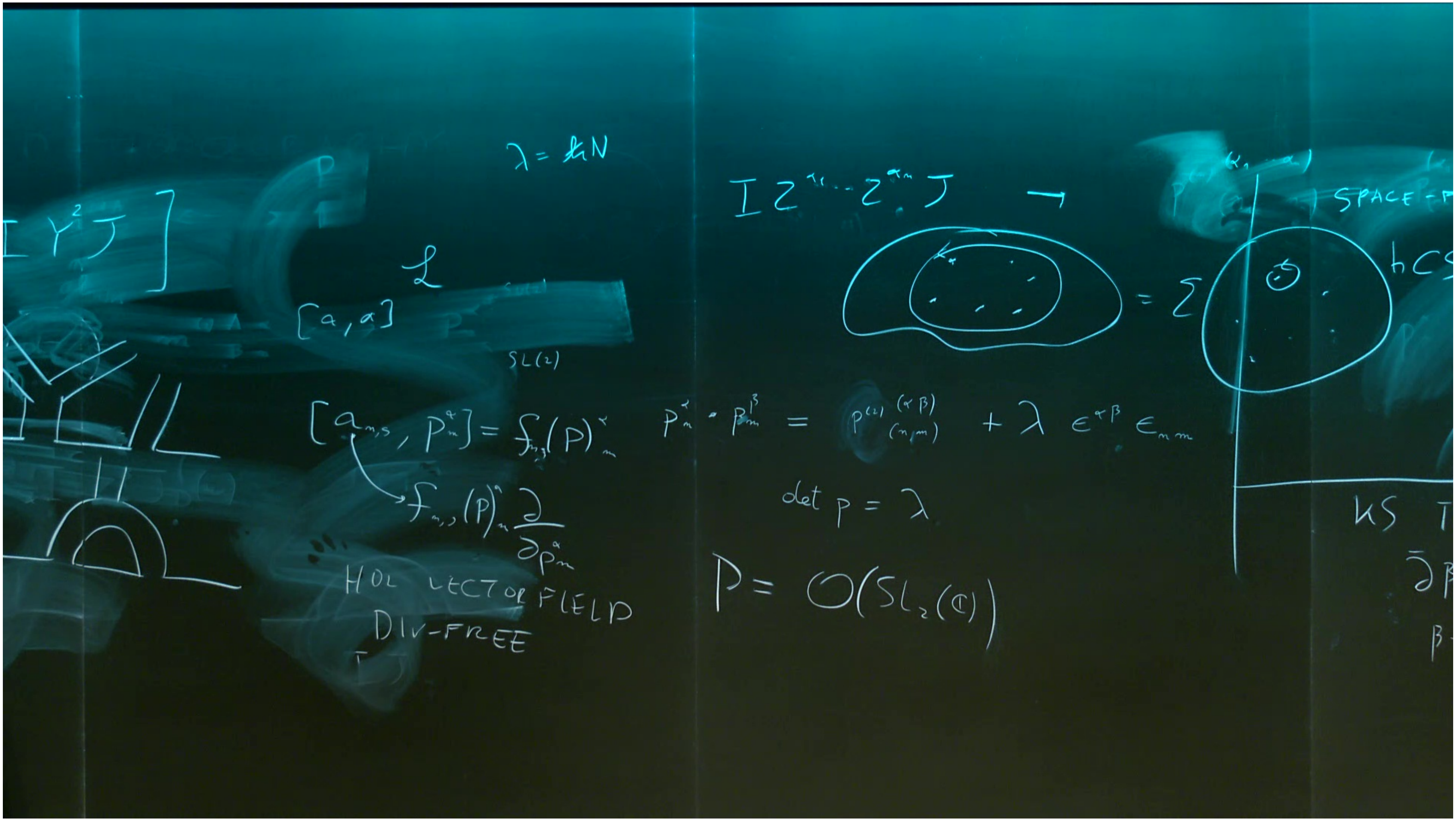
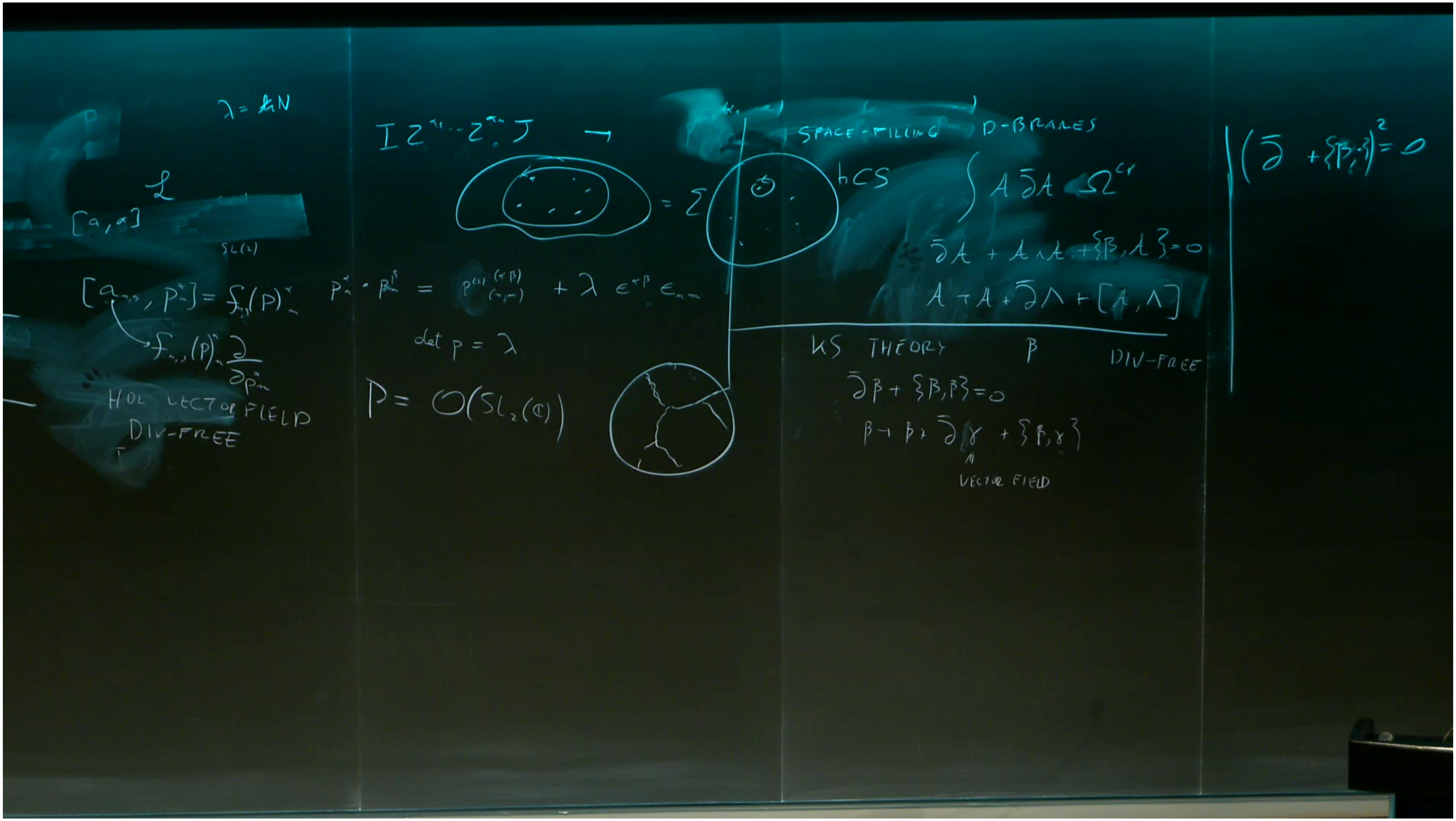
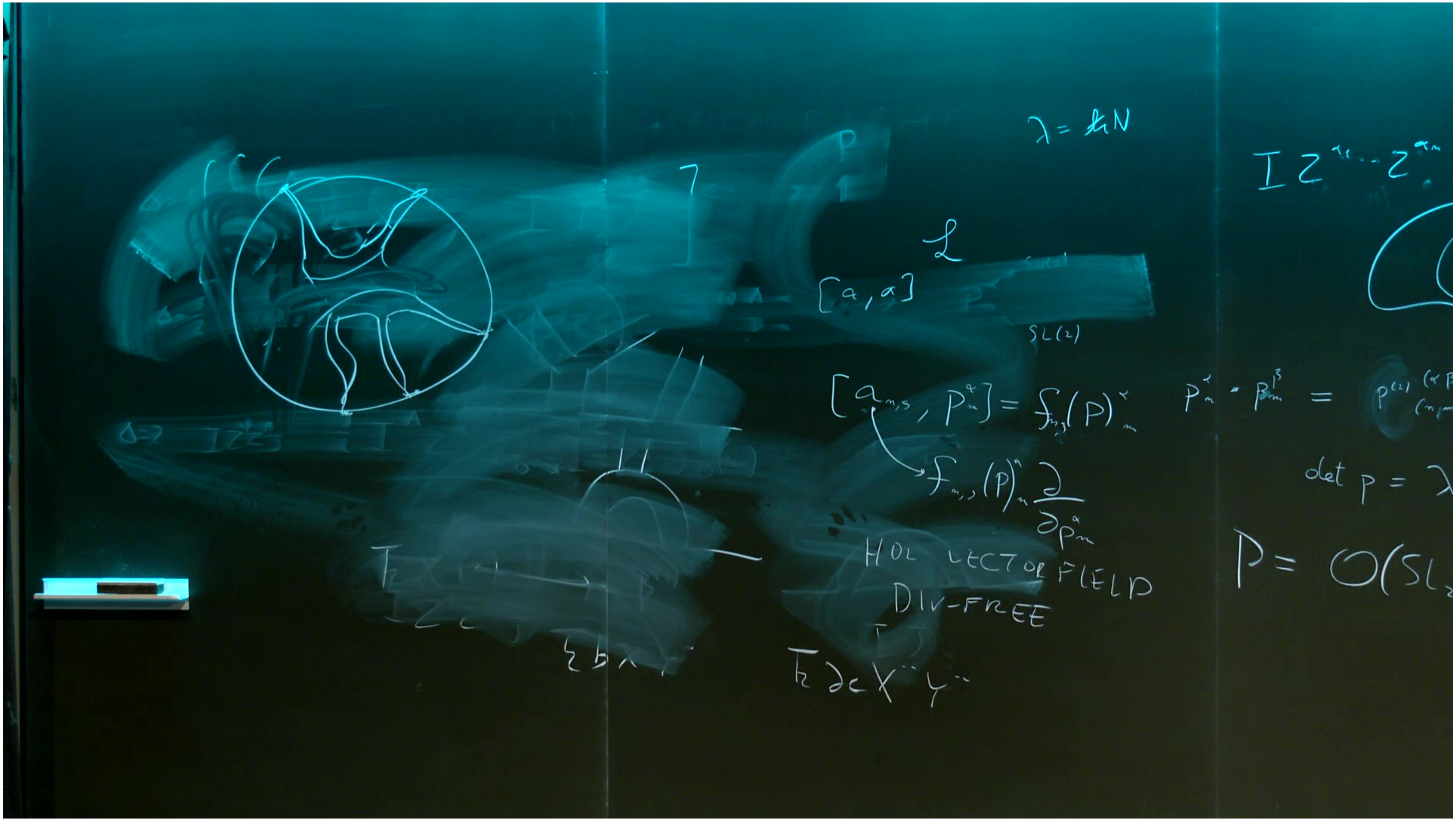
VECTOR FIELD
$(\bar\partial + \{\beta, \cdot\})^2 = 0$
$+ \lambda \, \epsilon^{\alpha\beta} \epsilon_{nm}$

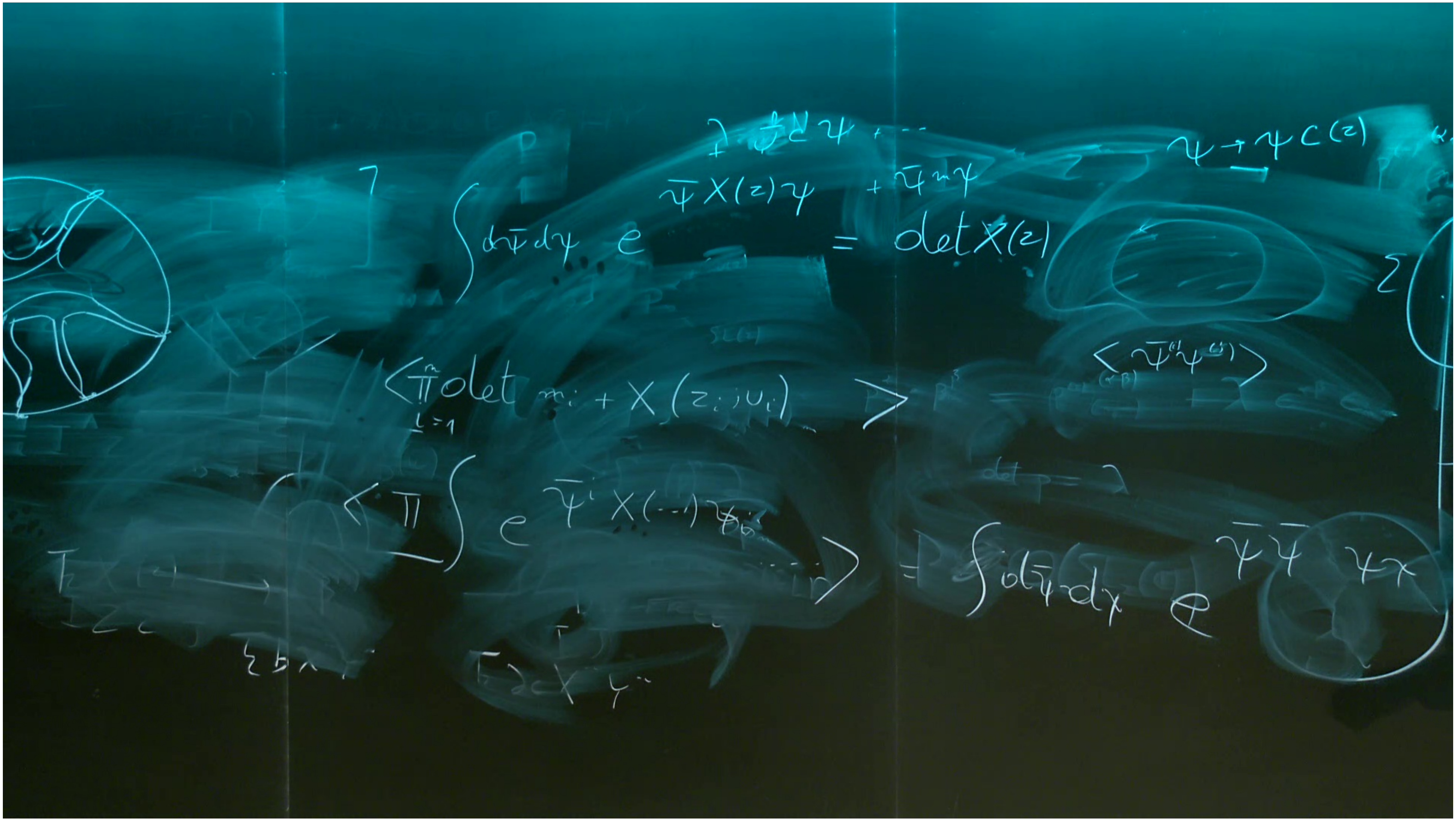

SL(2)
det p = λ
HOL VECTOR FIELD
DIV-FREE
SPACE-
KS

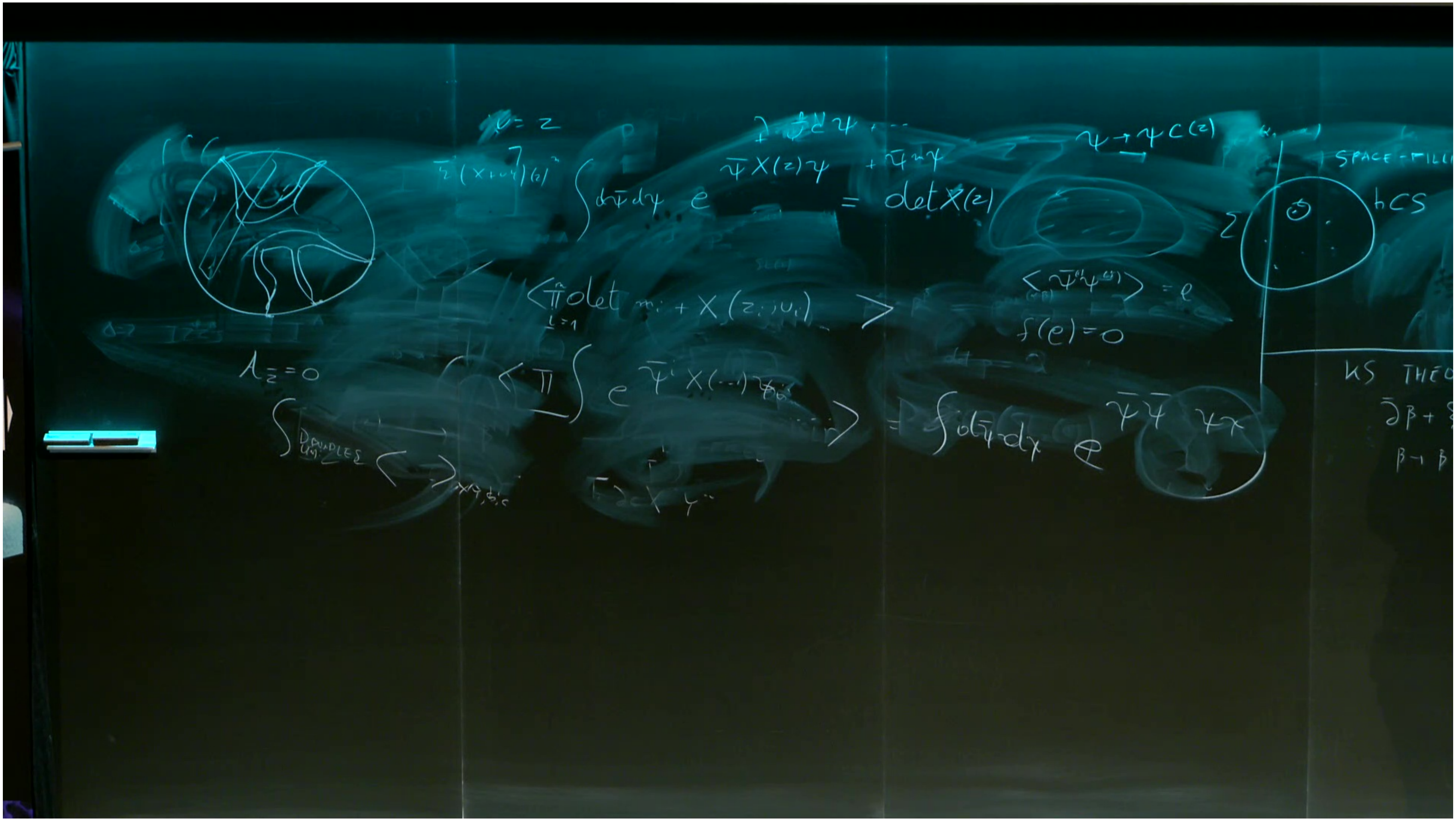


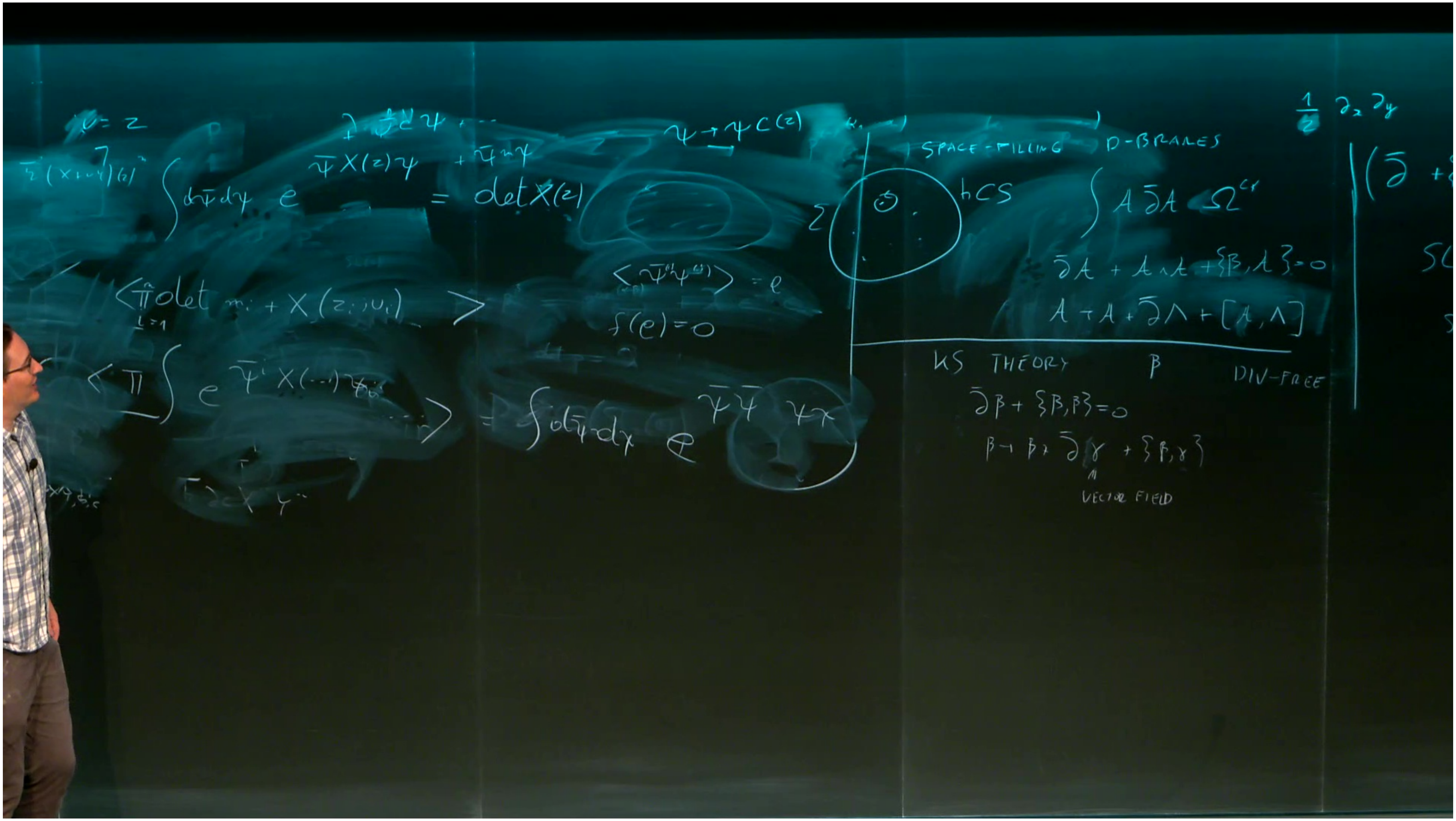
SPACE-FILLING D-BRANES
hCS
KS THEORY
DIV-FREE
HOL VECTOR FIELD
DIV-FREE
det p = λ
VECTOR FIELD

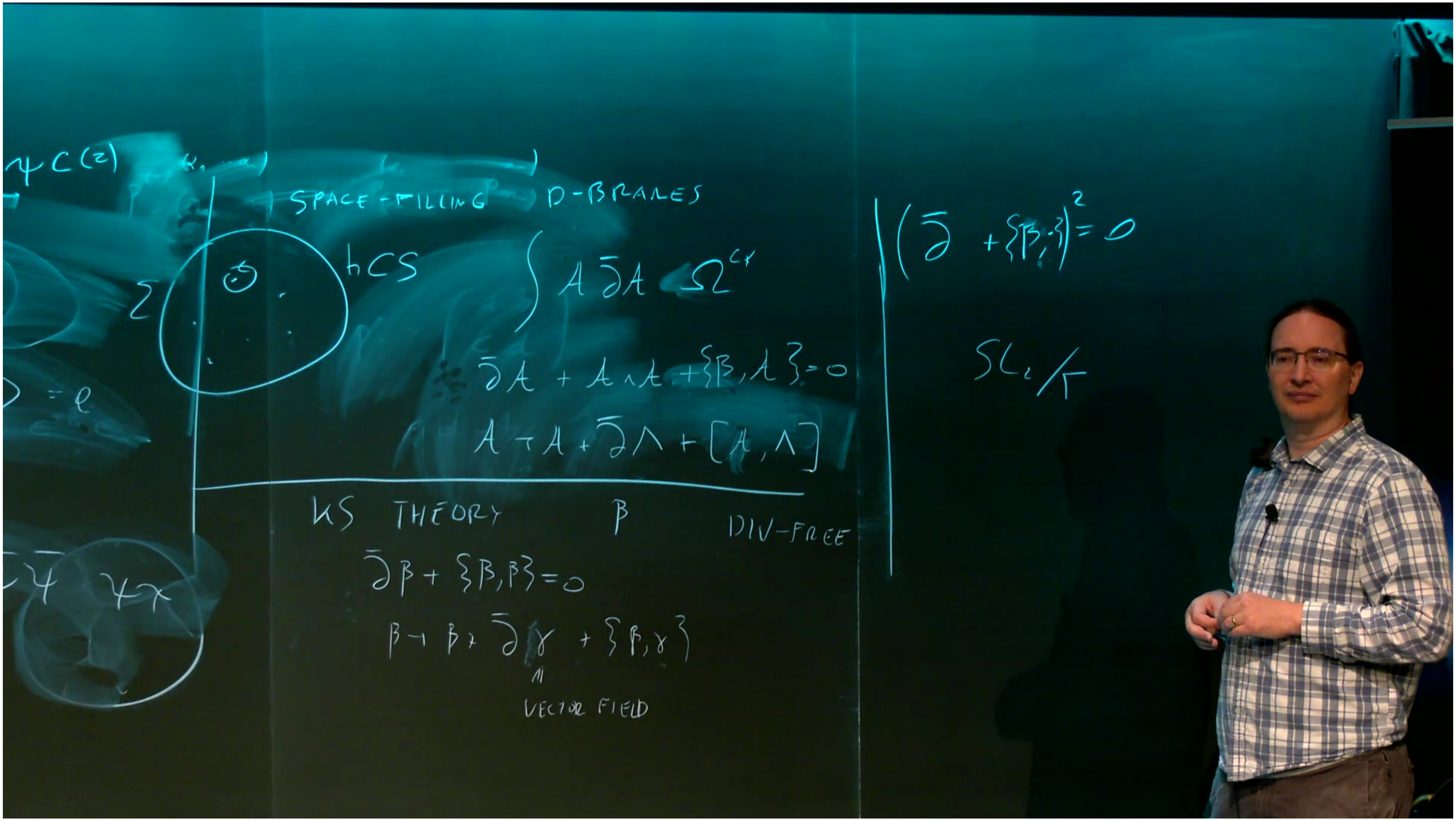


λ = ħN
IZ
ℒ
[a, a]
SU(2)
SL(2)
[a_{m,s}, P^α_m] = f_{m,s}(P)^α_m
f_{m,s}(P)^α_m ∂/∂P^α_m
HOL VECTOR FIELD
DIV-FREE
Tr ∂cX Y
det P = λ
P = O(SL


$\psi \to \psi C(z)$
$\int d\bar\psi d\psi \, e^{\bar\psi X(z)\psi + \bar\psi m \psi} = \det X(z)$
$\langle \bar\psi^{(\alpha)}\psi^{(\beta)} \rangle$
$\langle \prod_{i=1}^{n} \det m_i + X(z_i; u_i) \rangle$
$= \int d\bar\psi d\psi \, e^{\bar\psi\psi}$


SPACE-FILL
hCS
= det X(z)
f(e)=0
KS THEO
BUNDLES


SPACE-FILLING D-BRANES
hCS
$\int A \bar\partial A \; \Omega$
$\bar\partial A + A \wedge A + \{\beta, A\} = 0$
$A \to A + \bar\partial \Lambda + [A, \Lambda]$
KS THEORY
β
DIV-FREE
$\bar\partial \beta + \{\beta, \beta\} = 0$
$\beta \to \beta + \bar\partial \gamma + \{\beta, \gamma\}$
VECTOR FIELD
$= \det X(z)$
$f(e) = 0$
$\psi \to \psi C(z)$


SPACE-FILLING D-BRANES
hCS
KS THEORY
DIV-FREE
VECTOR FIELD