Title: PSI 2018/2019 - String Theory Review - Lecture 13

Speakers: Davide Gaiotto

Collection: PSI 2018/2019 - String Theory Review (Gaiotto)

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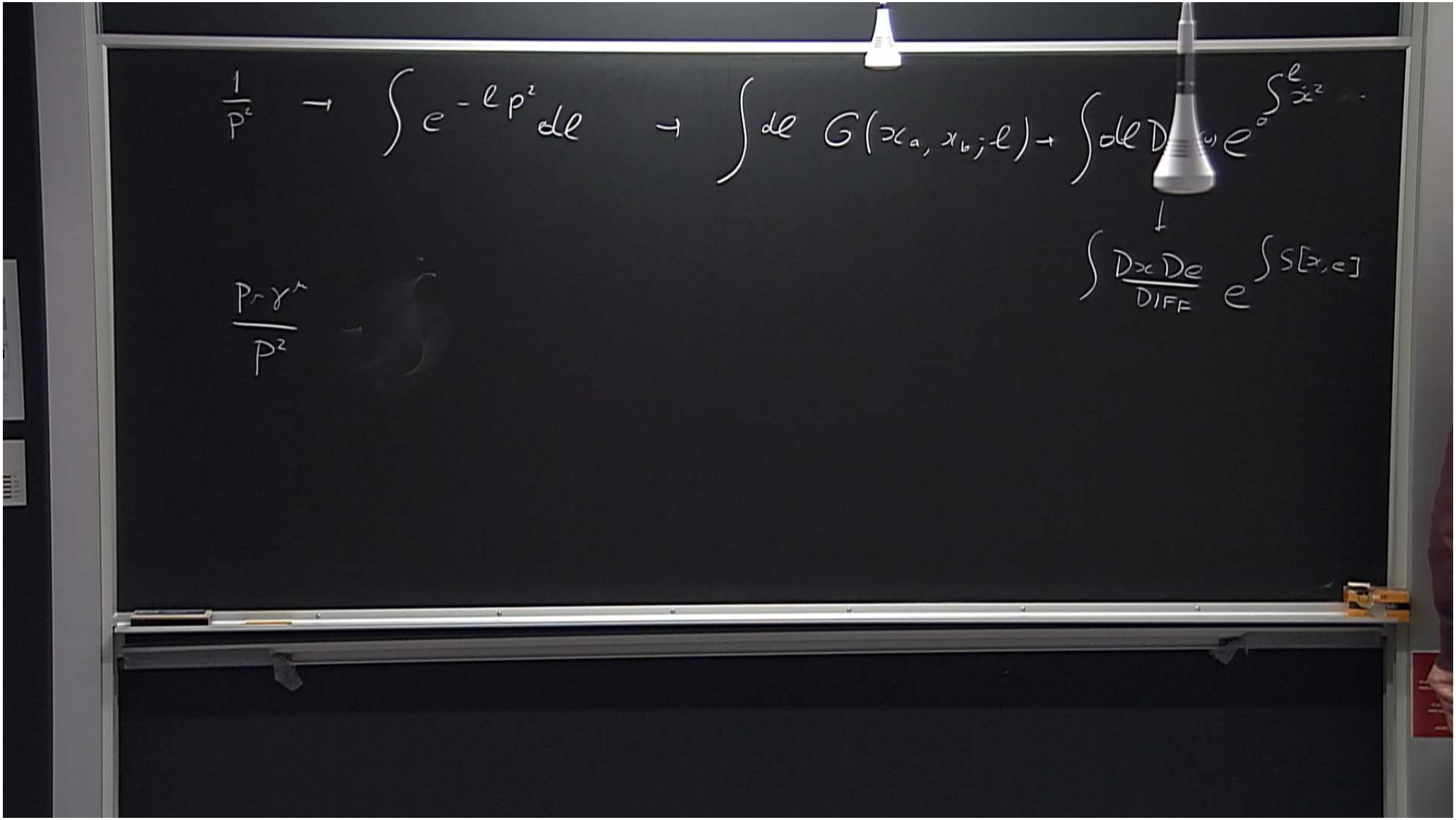
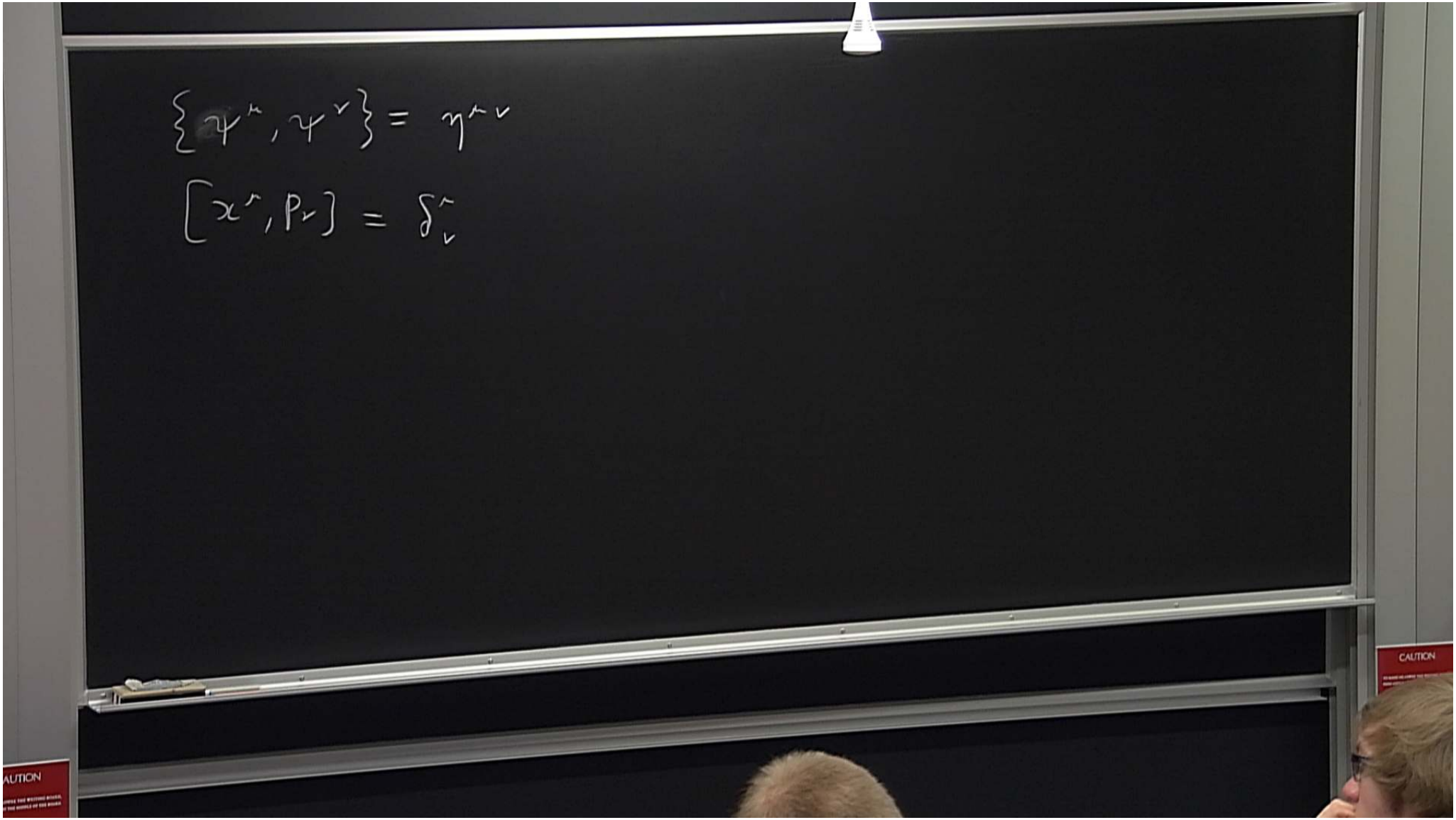
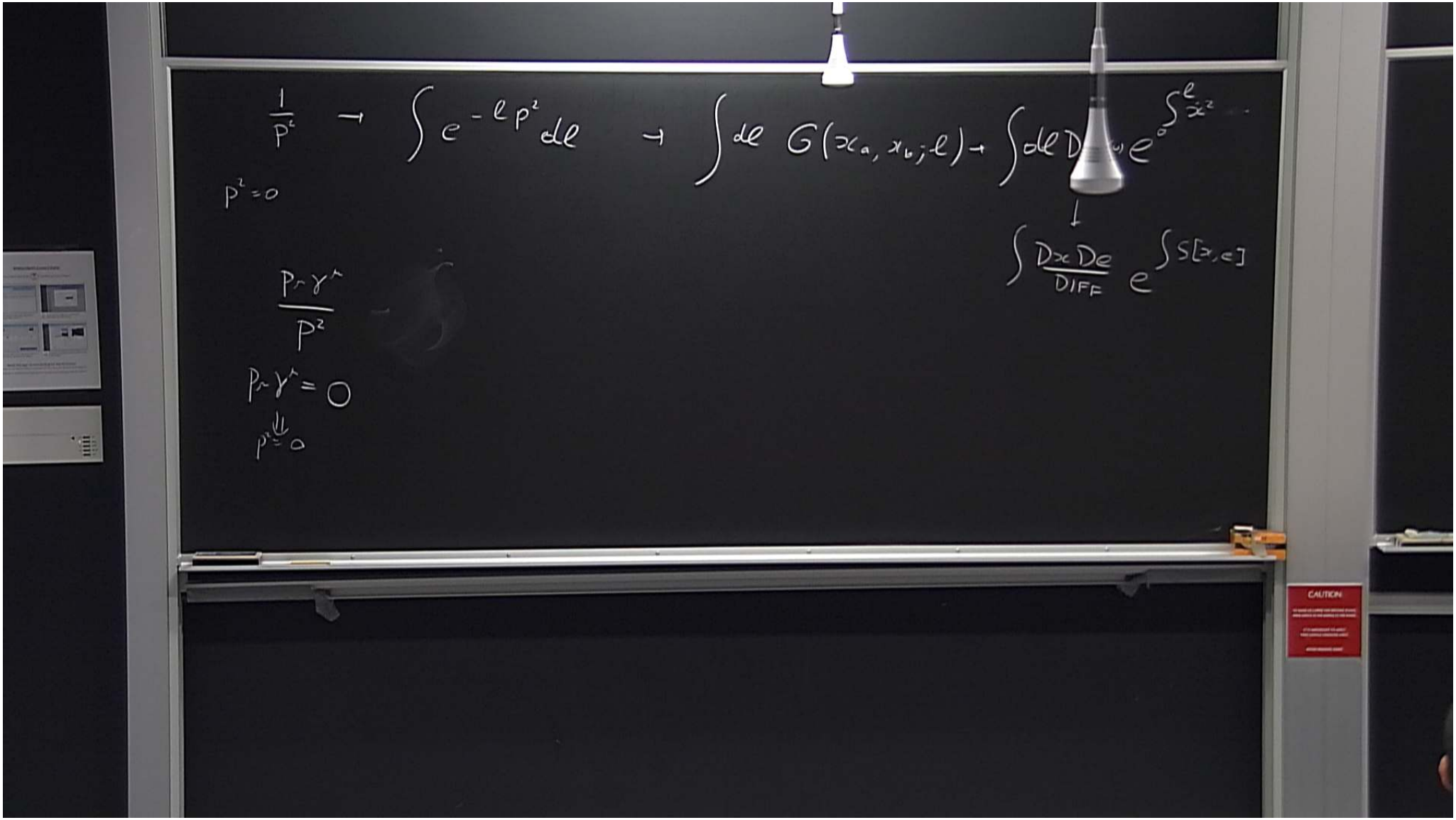
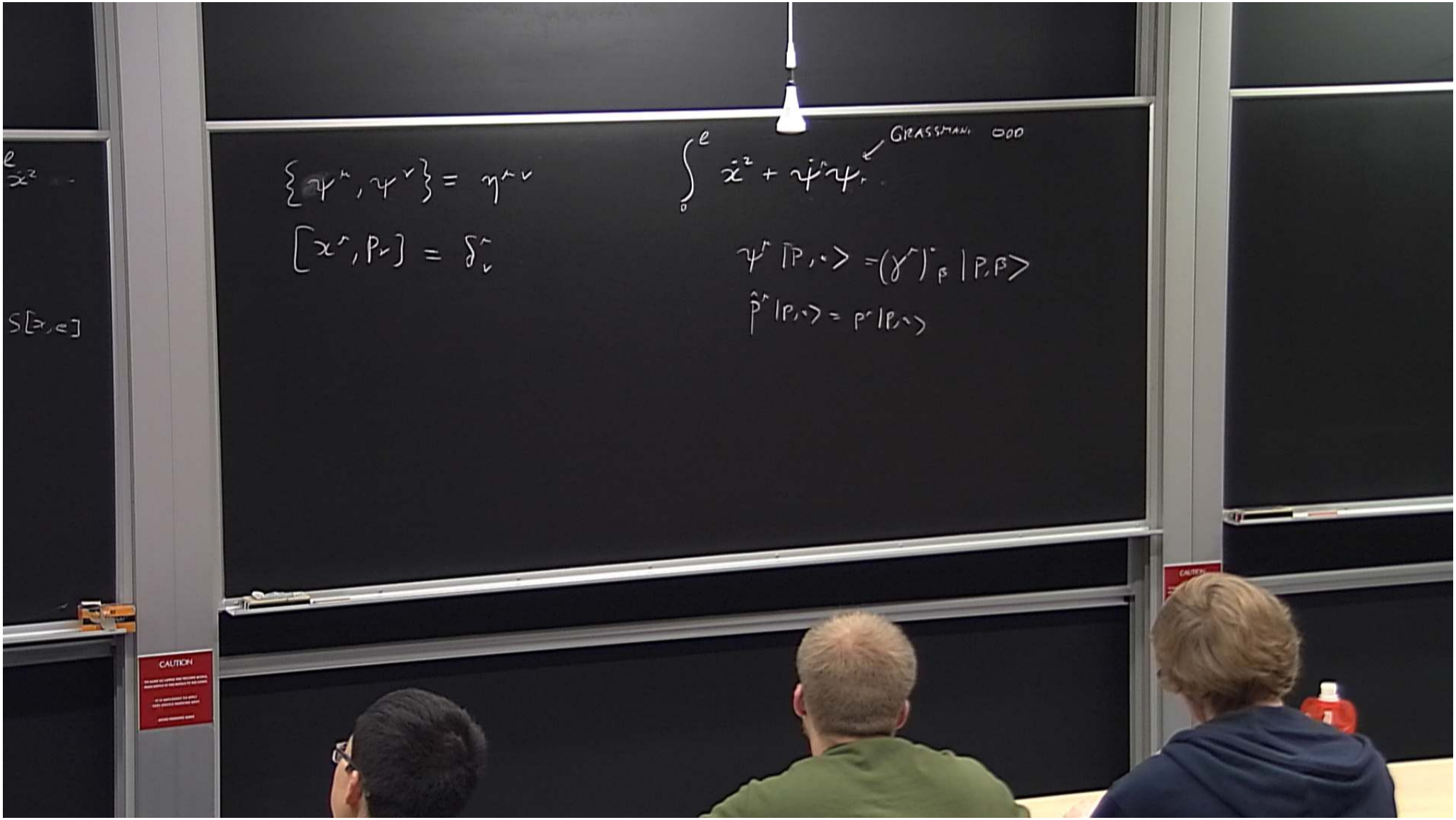
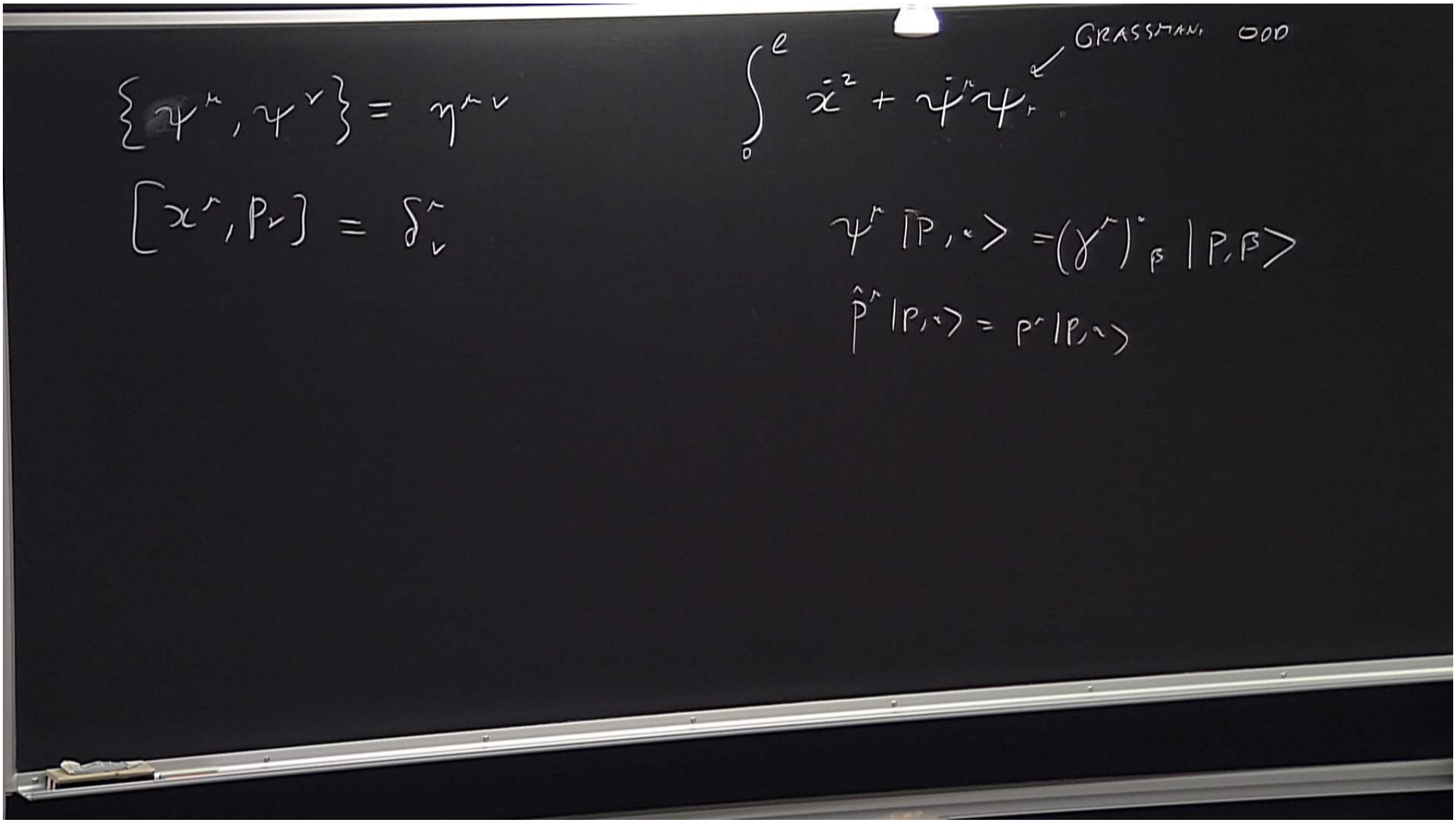
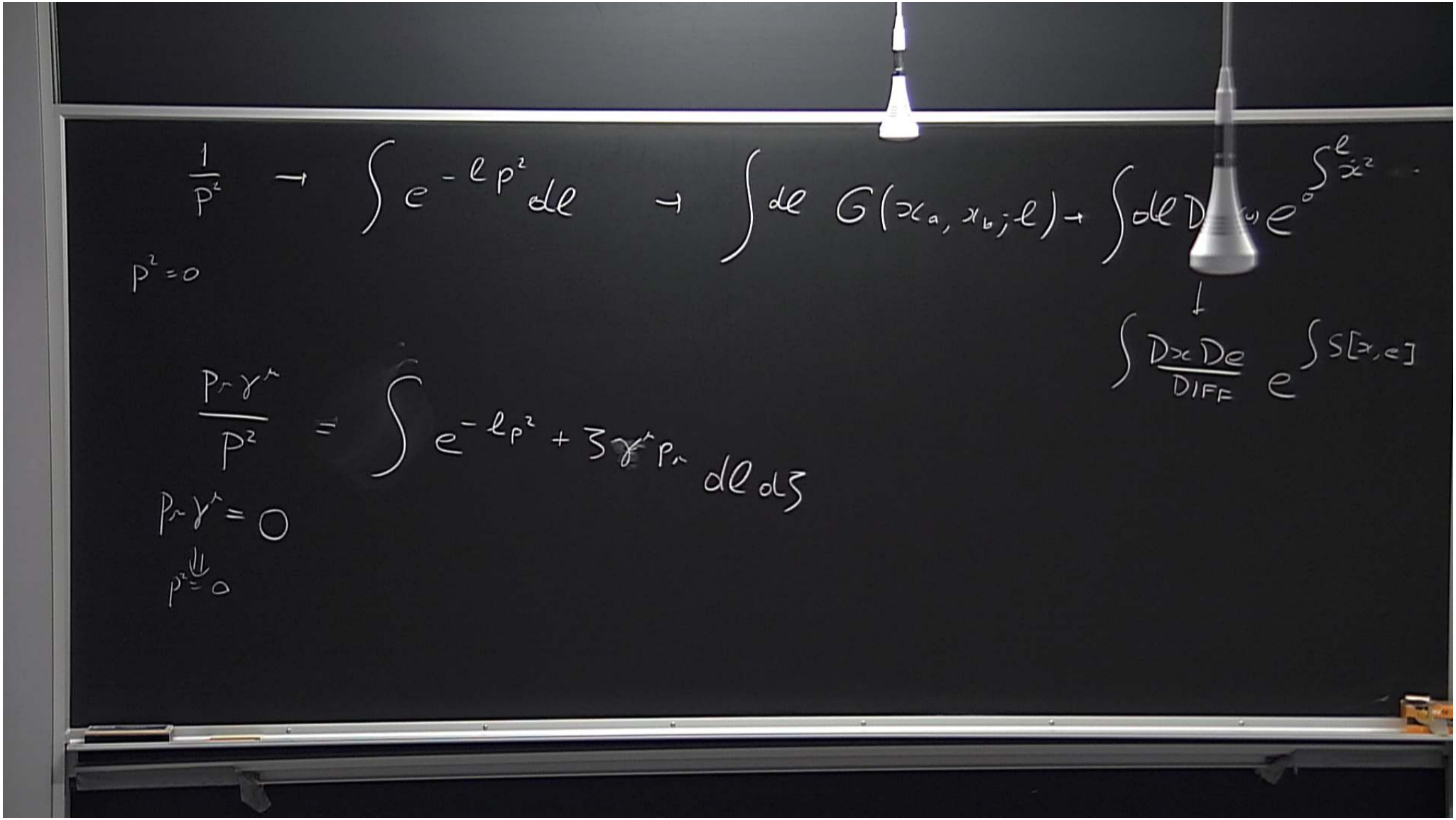

$\frac{1}{p^2} \to \int e^{-\ell p^2} d\ell \to \int d\ell\, G(x_a, x_b; \ell) \to \int d\ell\, D$
$e^{\int_0^\ell \dot{x}^2}$
$\int \frac{Dx\,De}{DIFF} e^{\int S[x,e]}$
$\frac{p_\mu \gamma^\mu}{p^2}$

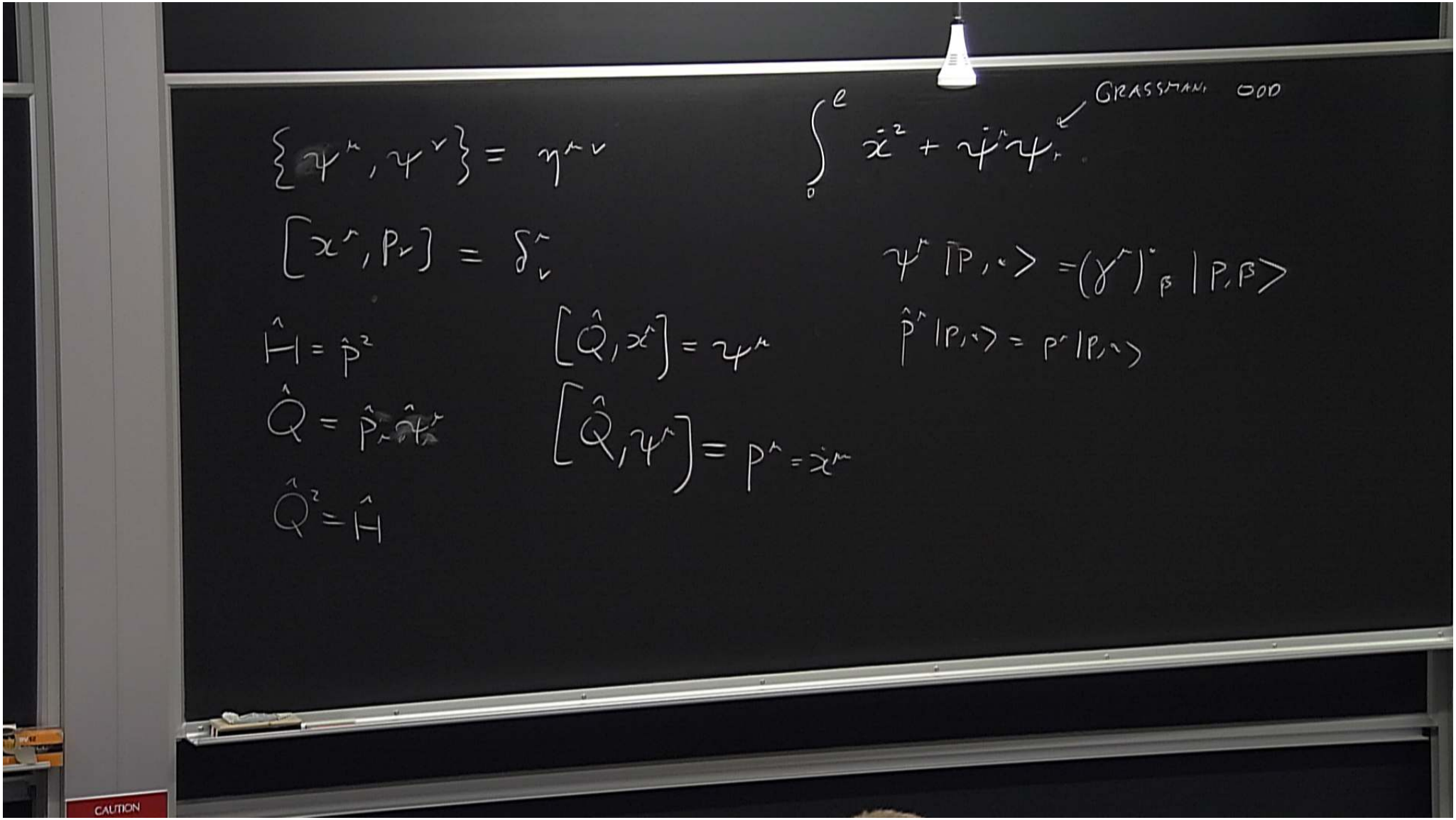

$\{\psi^\mu, \psi^\nu\} = \eta^{\mu\nu}$
$[x^\mu, p_\nu] = \delta^\mu_\nu$
CAUTION

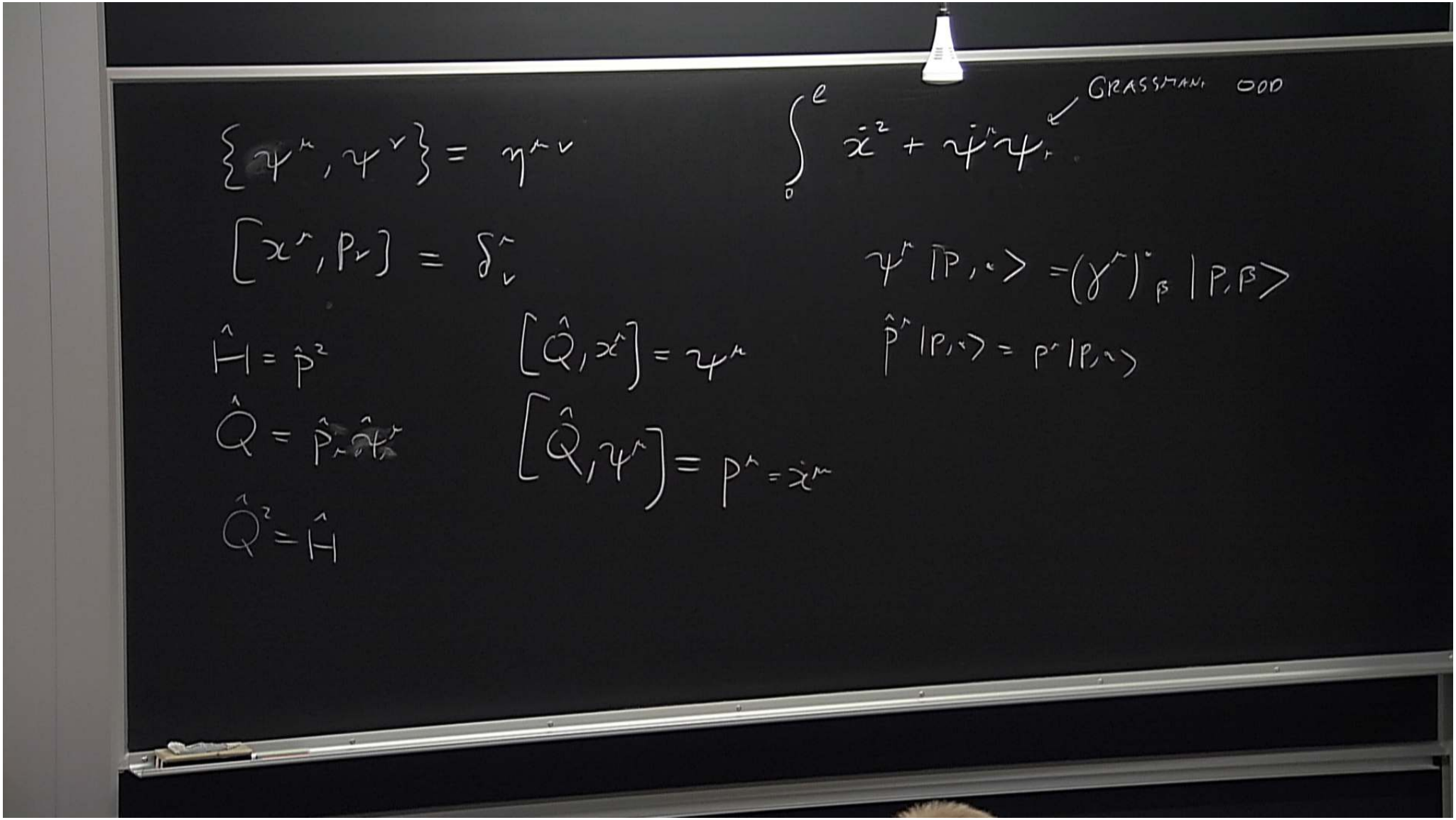

$\frac{1}{p^2} \to \int e^{-\ell p^2} d\ell \to \int d\ell\, G(x_a, x_b; \ell) \to \int d\ell\, D[\quad] e^{\int_0^\ell \dot{x}^2}$
$p^2 = 0$
$\int \frac{Dx\, De}{DIFF} e^{\int S[x,e]}$
$\frac{p\!\!\!/\, \gamma^\mu}{p^2}$
$p\!\!\!/\, \gamma^\mu = 0$
$p^2 \neq 0$
CAUTION

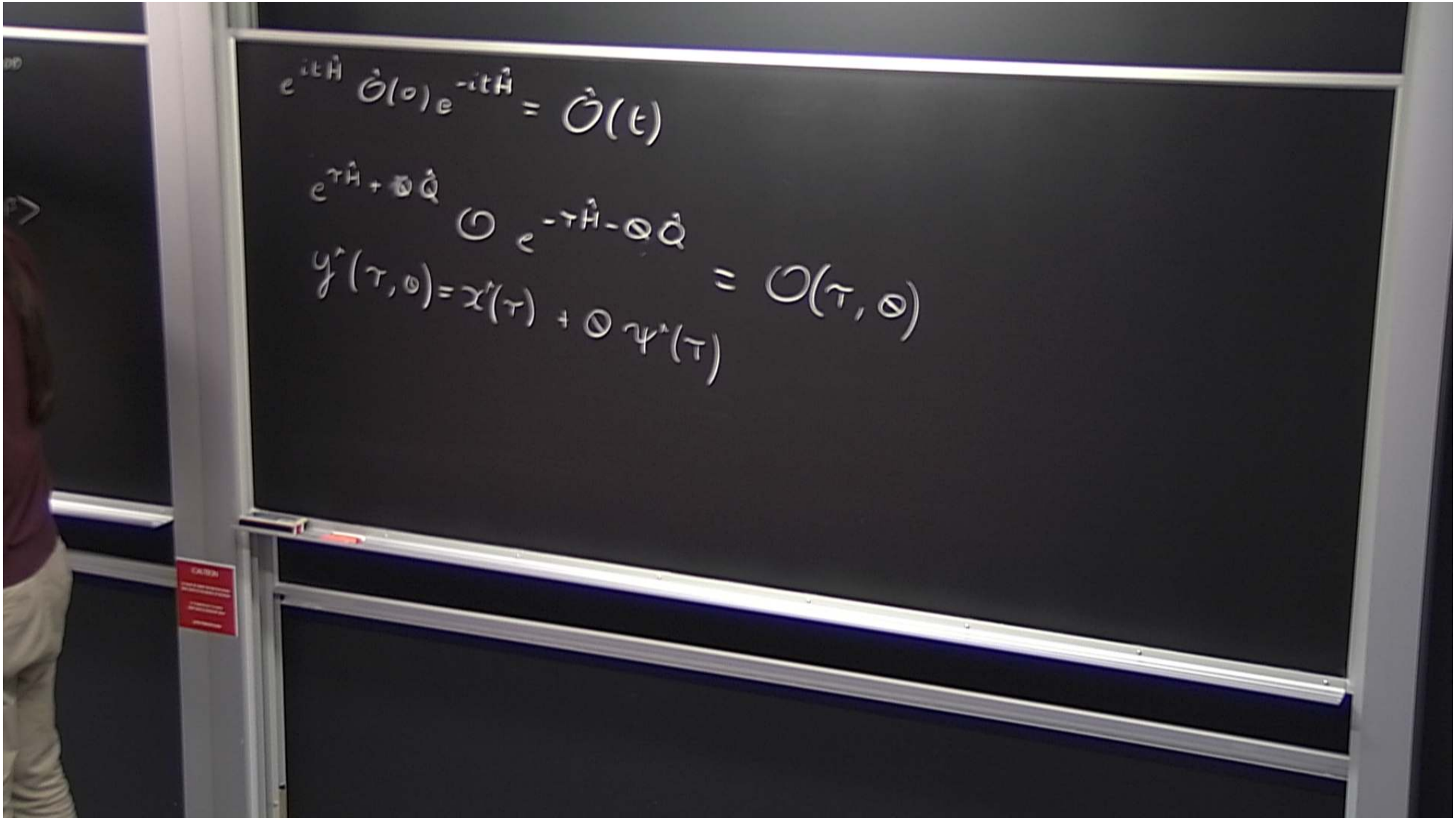

$\{\psi^\mu, \psi^\nu\} = \eta^{\mu\nu}$
$[x^\mu, P_\nu] = \delta^\mu_\nu$
$\int_0^e \dot{x}^2 + \psi^\mu \psi_\mu$
GRASSMANN ODD
$\psi^\mu |P,\alpha\rangle = (\gamma^\mu)^\alpha_\beta |P,\beta\rangle$
$\hat{P}^\mu |P,\alpha\rangle = P^\mu |P,\alpha\rangle$
CAUTION

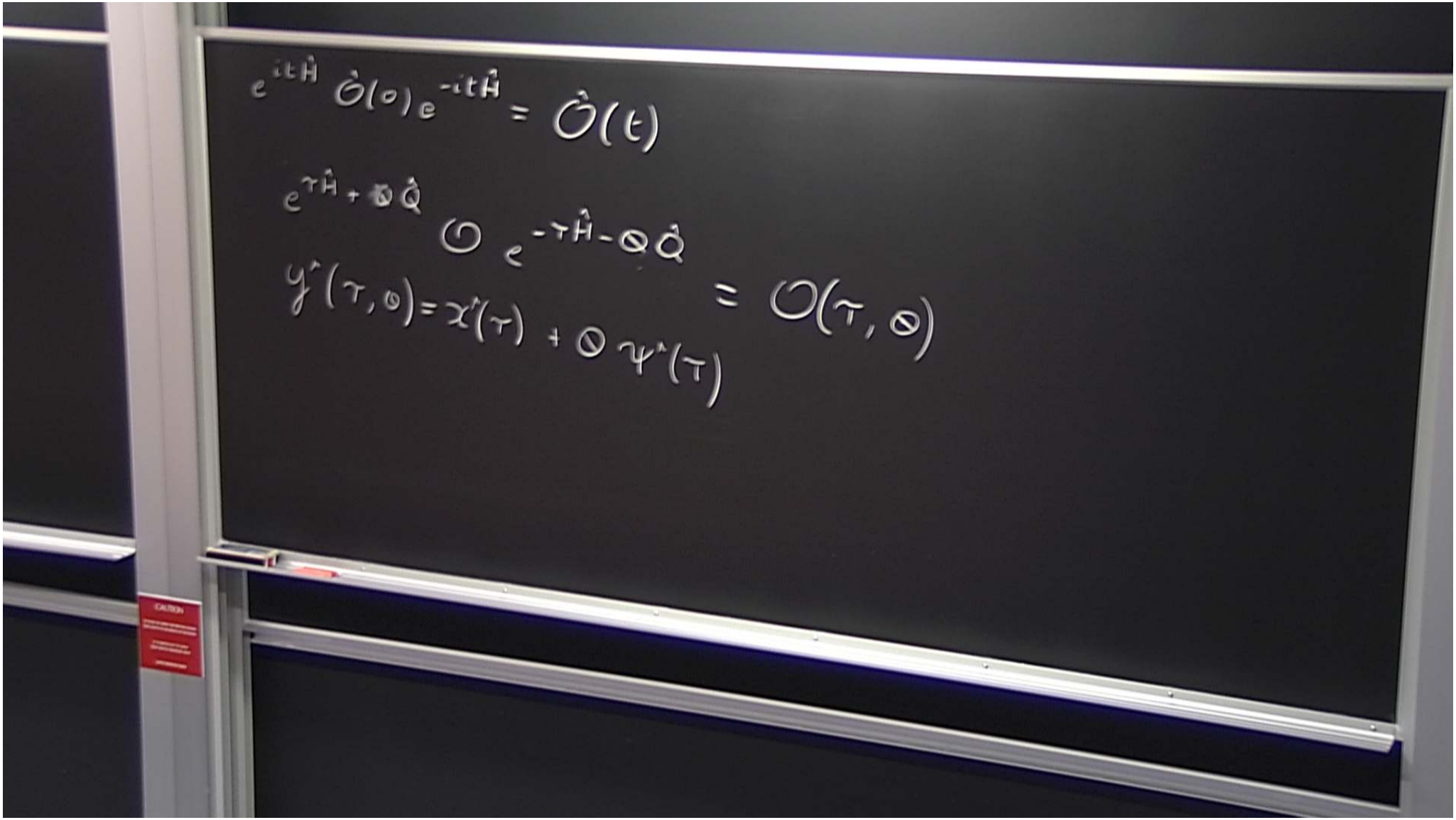

$\{\psi^\mu, \psi^\nu\} = \eta^{\mu\nu}$
$[x^\mu, p_\nu] = \delta^\mu_\nu$
$\int_0^e \dot{x}^2 + \psi^\mu \dot{\psi}_\mu$
GRASSMANN ODD
$\psi^\mu |p,\alpha\rangle = (\gamma^\mu)^\alpha_\beta |p,\beta\rangle$
$\hat{p}^\mu |p,\alpha\rangle = p^\mu |p,\alpha\rangle$


$\frac{1}{p^2} \to \int e^{-\epsilon p^2} d\epsilon \to \int d\epsilon\, G(x_a, x_b; \epsilon) \to \int d\epsilon\, D[x]\, e^{\int_0^\epsilon \dot{x}^2}$
$p^2 = 0$
$\int \frac{Dx\, D\epsilon}{DIFF} e^{\int S[x,\epsilon]}$
$\frac{p_\mu \gamma^\mu}{p^2} = \int e^{-\epsilon p^2 + 3 \gamma^\mu p_\mu} d\epsilon\, d\xi$
$p_\mu \gamma^\mu = 0$
$p^2 = 0$


$\{\psi^\mu, \psi^\nu\} = \eta^{\mu\nu}$
$\int_0^e \dot{x}^2 + \psi^\mu \dot{\psi}_\mu$
GRASSMANN ODD
$[x^\mu, p_\nu] = \delta^\mu_\nu$
$\psi^\mu |p,\alpha\rangle = (\gamma^\mu)^\alpha_\beta |p,\beta\rangle$
$\hat{H} = \hat{p}^2$
$[\hat{Q}, x^\mu] = \psi^\mu$
$\hat{p}^\mu |p,\alpha\rangle = p^\mu |p,\alpha\rangle$
$\hat{Q} = \hat{p}_\mu \hat{\psi}^\mu$
$[\hat{Q}, \psi^\mu] = p^\mu = \dot{x}^\mu$
$\hat{Q}^2 = \hat{H}$
CAUTION


$\{\psi^\mu, \psi^\nu\} = \eta^{\mu\nu}$
$\int_0^e \dot{x}^2 + \psi^\mu \dot{\psi}_\mu$
GRASSMANN ODD
$[x^\mu, p_\nu] = \delta^\mu_\nu$
$\psi^\mu |p,\alpha\rangle = (\gamma^\mu)^\alpha_\beta |p,\beta\rangle$
$\hat{H} = \hat{p}^2$
$[\hat{Q}, x^\mu] = \psi^\mu$
$\hat{p}^\mu |p,\alpha\rangle = p^\mu |p,\alpha\rangle$
$\hat{Q} = \hat{p}_\mu \psi^\mu$
$[\hat{Q}, \psi^\mu] = p^\mu = \dot{x}^\mu$
$\hat{Q}^2 = \hat{H}$


$e^{itH} \hat{O}(0) e^{-itH} = \hat{O}(t)$
$e^{\tau H + \theta Q}$ O $e^{-\tau H - \theta Q}$ $= O(\tau, \theta)$
$\psi^\dagger(\tau, 0) = \chi^\dagger(\tau) + \theta \psi^\dagger(\tau)$


$e^{itH}\,\hat{O}(0)\,e^{-itH} = \hat{O}(t)$
$e^{\tau\hat{H}+\theta\hat{Q}}\;\mathcal{O}\;e^{-\tau\hat{H}-\theta\hat{Q}} = \mathcal{O}(\tau,\theta)$
$\hat{y}(\tau,\theta) = \hat{x}(\tau) + \theta\,\hat{\psi}(\tau)$