Title: Liouville theory and Holographic Cosmology

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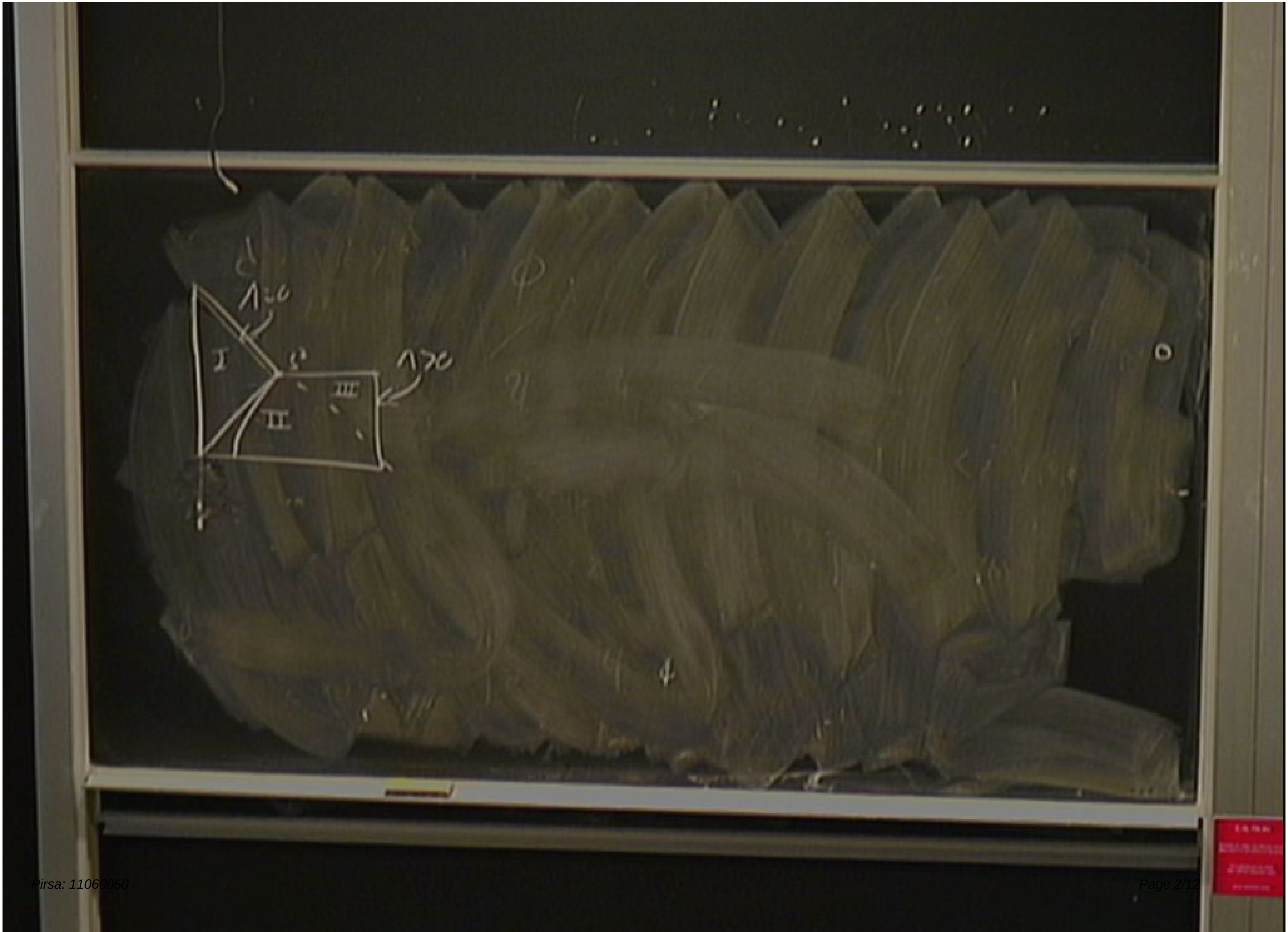
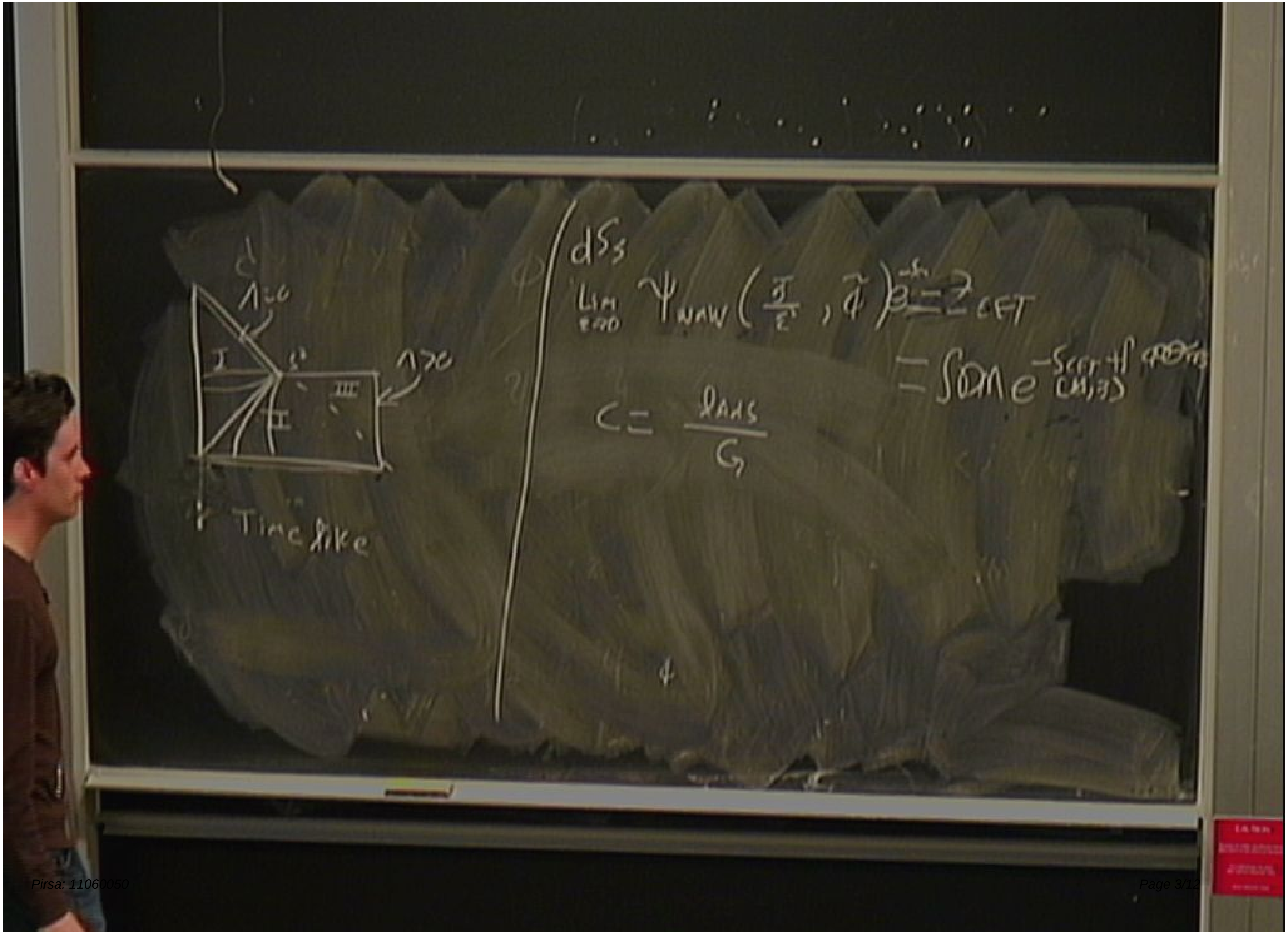
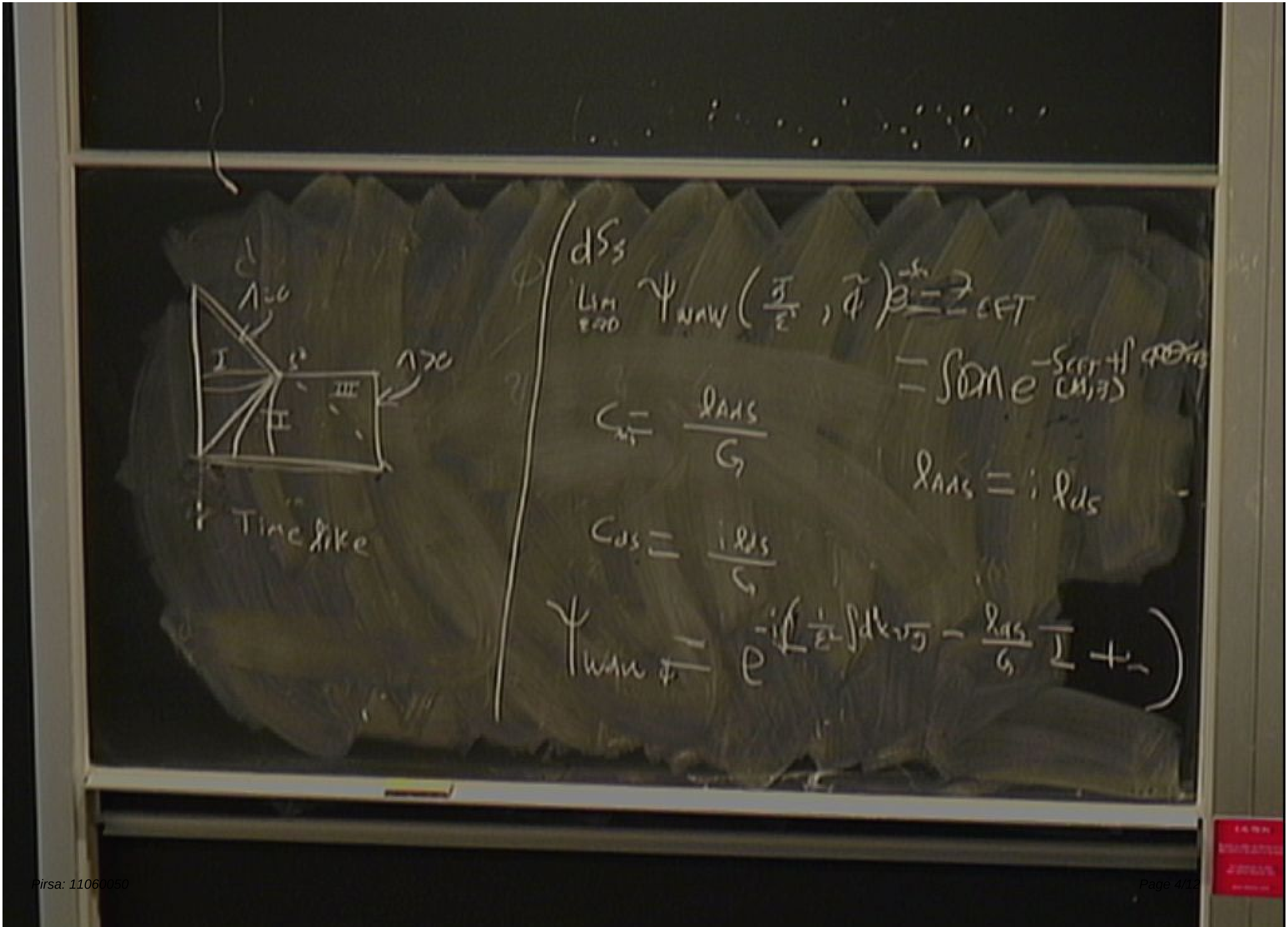
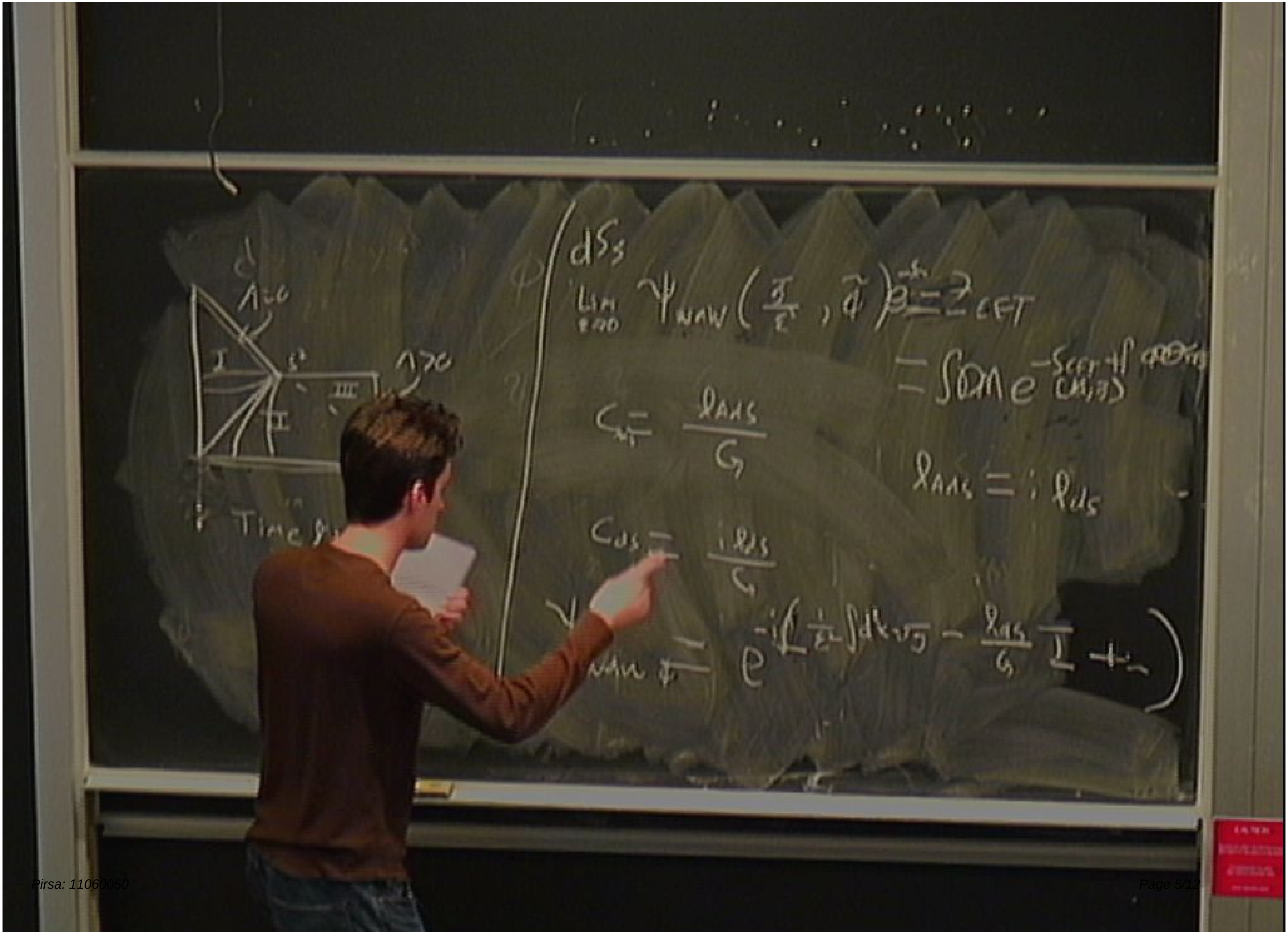
Abstract: I will explain how Liouville theory with complex values of its parameters arises naturally in speculative holographic cosmologies. We will encounter Liouville theory of both the ``spacelike'' and ``timelike'' variety. I will then use this as motivation to present some new results on the analytic continuation of Liouville theory recently obtained with Maltz and Witten.


I
II
III


dS3
Λ<0
Λ>0
I
II
III
Timelike
= Z CFT
c = lAdS / G


Λ<0
Λ>0
Time like
dS3
Z CFT


dS3
lim ψNAW = ZCFT
Time

$$\Sigma = \int d^2\sigma\, d^2\sigma' \sqrt{g(\sigma)}\,\sqrt{g(\sigma')}\; R(\sigma)\, R(\sigma')\; G(\sigma,\sigma')$$

$$\int D\bar{\psi}\, D\bar{\eta}\;\; f(\bar{\xi},\bar{\eta})\; \underset{c^*}{\psi^{*}}\; \underset{c}{\psi}$$

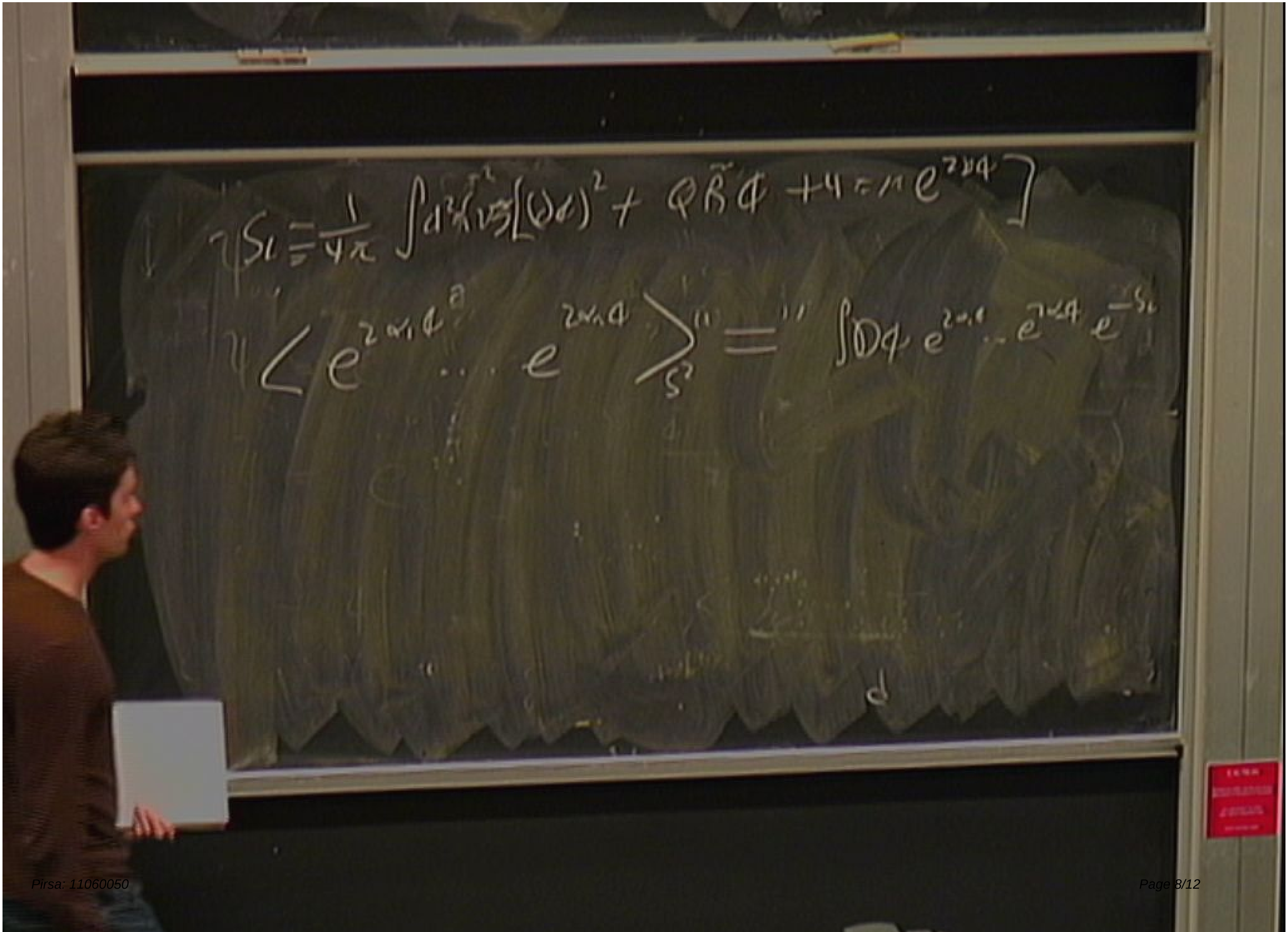
$$\Sigma = \int d^2\sigma \, d^2\sigma' \sqrt{g(\sigma)} \sqrt{g(\sigma')} \, R(\sigma) R(\sigma') \, G(\sigma, \sigma')$$

$$\Delta = \frac{Q}{2} + \frac{1}{2}\sqrt{Q^2 - 4\alpha^2}$$

$$\int \mathcal{D}\tilde{\psi} \, \mathcal{D}\tilde{\eta} \; f(\tilde{\psi}, \tilde{\eta}) \, \psi^* \, \psi$$

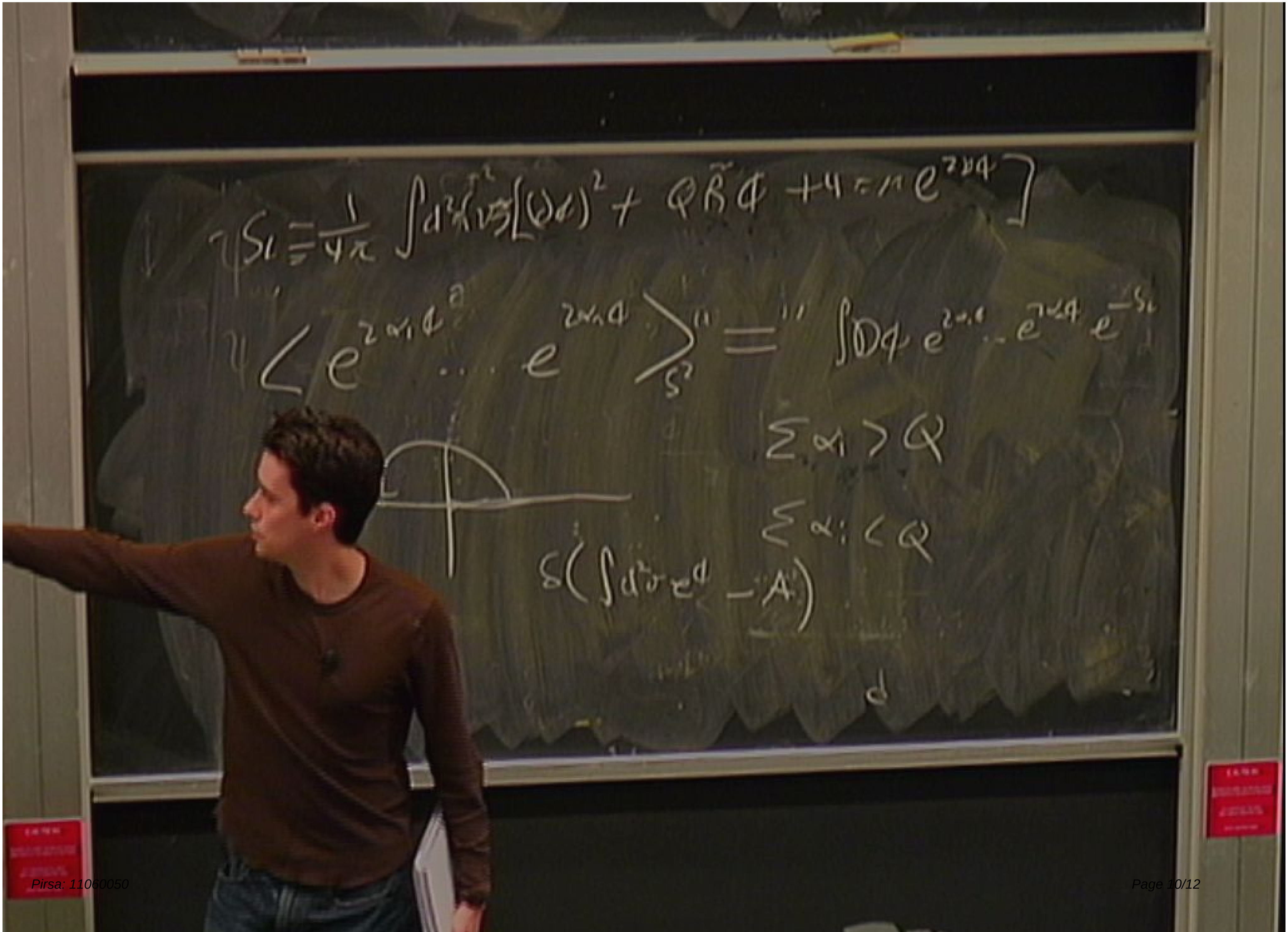
$$c^* \qquad c$$

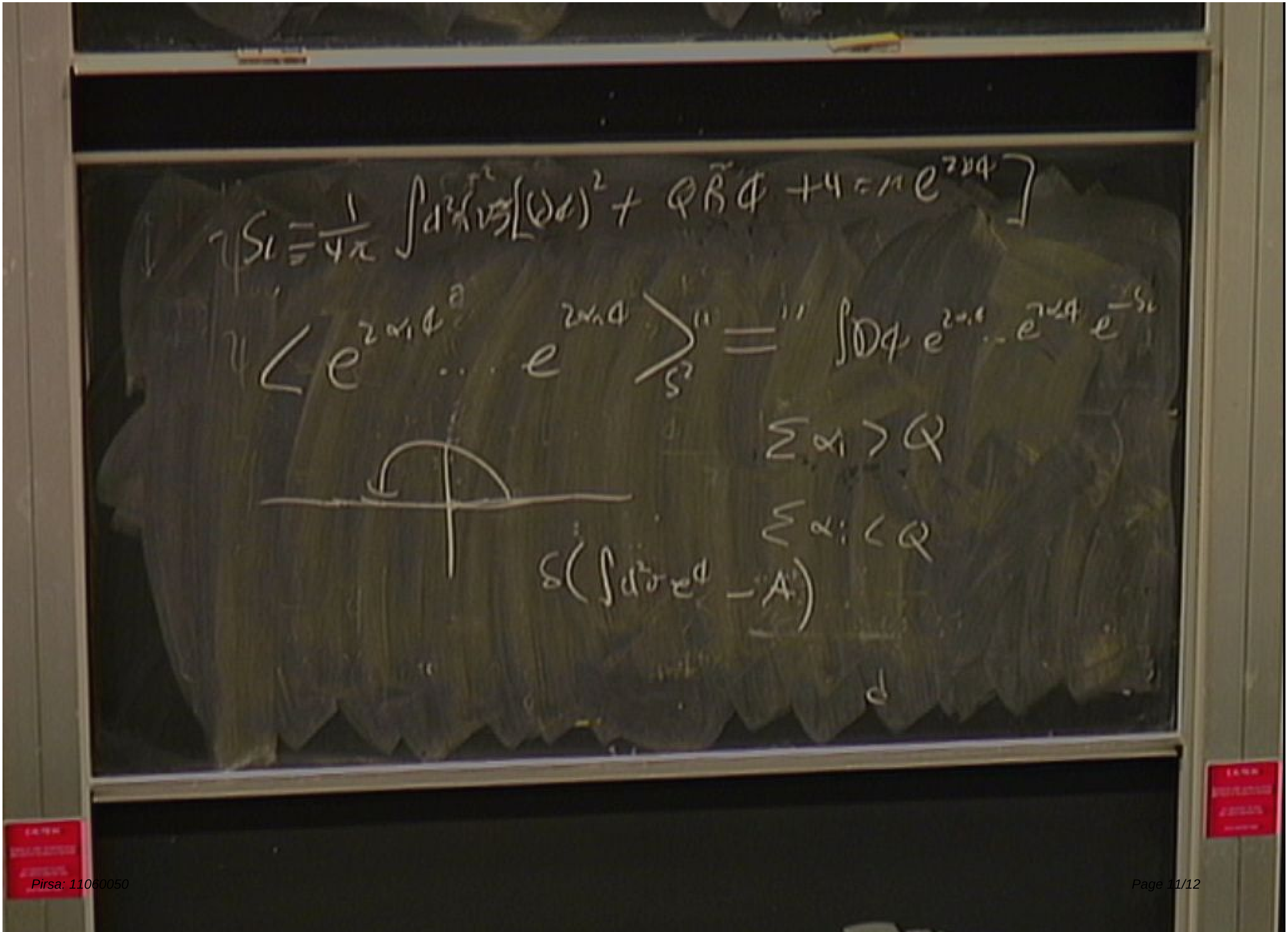
$$c^* T c = 0 + O(1)$$

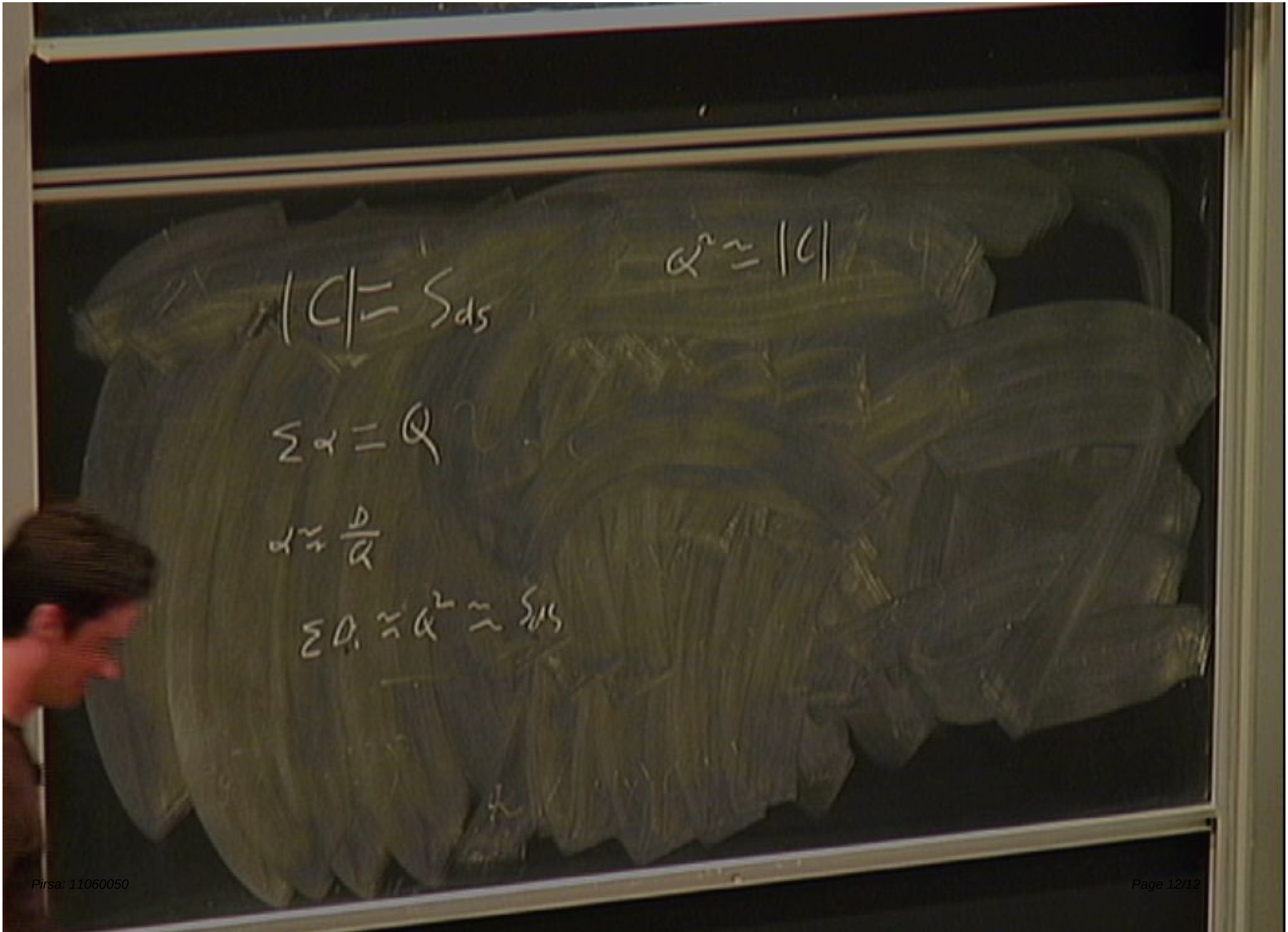

S_L = 1/4π ∫ d²x √g [(∂φ)² + Q R φ + 4πμ e^{2bφ}]
⟨e^{2α₁φ} ... e^{2αₙφ}⟩_{S²} " = " ∫Dφ e^{2α₁φ} ... e^{2αₙφ} e^{−S_L}

$$S_L = \frac{1}{4\pi}\int d^2x \sqrt{g}\left[(\partial\phi)^2 + Q\tilde{R}\phi + 4\pi\mu e^{2b\phi}\right]$$

$$\langle e^{2\alpha_1\phi} \cdots e^{2\alpha_n\phi} \rangle_{S^2} \; \text{"="} \; \int D\phi \, e^{2\alpha_1\phi} \cdots e^{2\alpha_n\phi} e^{-S_L}$$


Σ α_i > Q
Σ α_i < Q


S_L = 1/4π ∫ d²x √g [(∂φ)² + Q R̂ φ + 4πμ e^{2bφ}]
⟨e^{2α₁φ} … e^{2αₙφ}⟩_{S²} = ∫Dφ e^{2α₁φ} … e^{2αₙφ} e^{−S_L}
Σ αᵢ > Q
Σ αᵢ < Q
δ(∫d²x e^φ − A)


|C| ≃ S_ds
Q^2 ≃ |C|
Σα ≃ Q
α ≃ D/Q
ΣD_i ≃ Q^2 ≃ S_ds