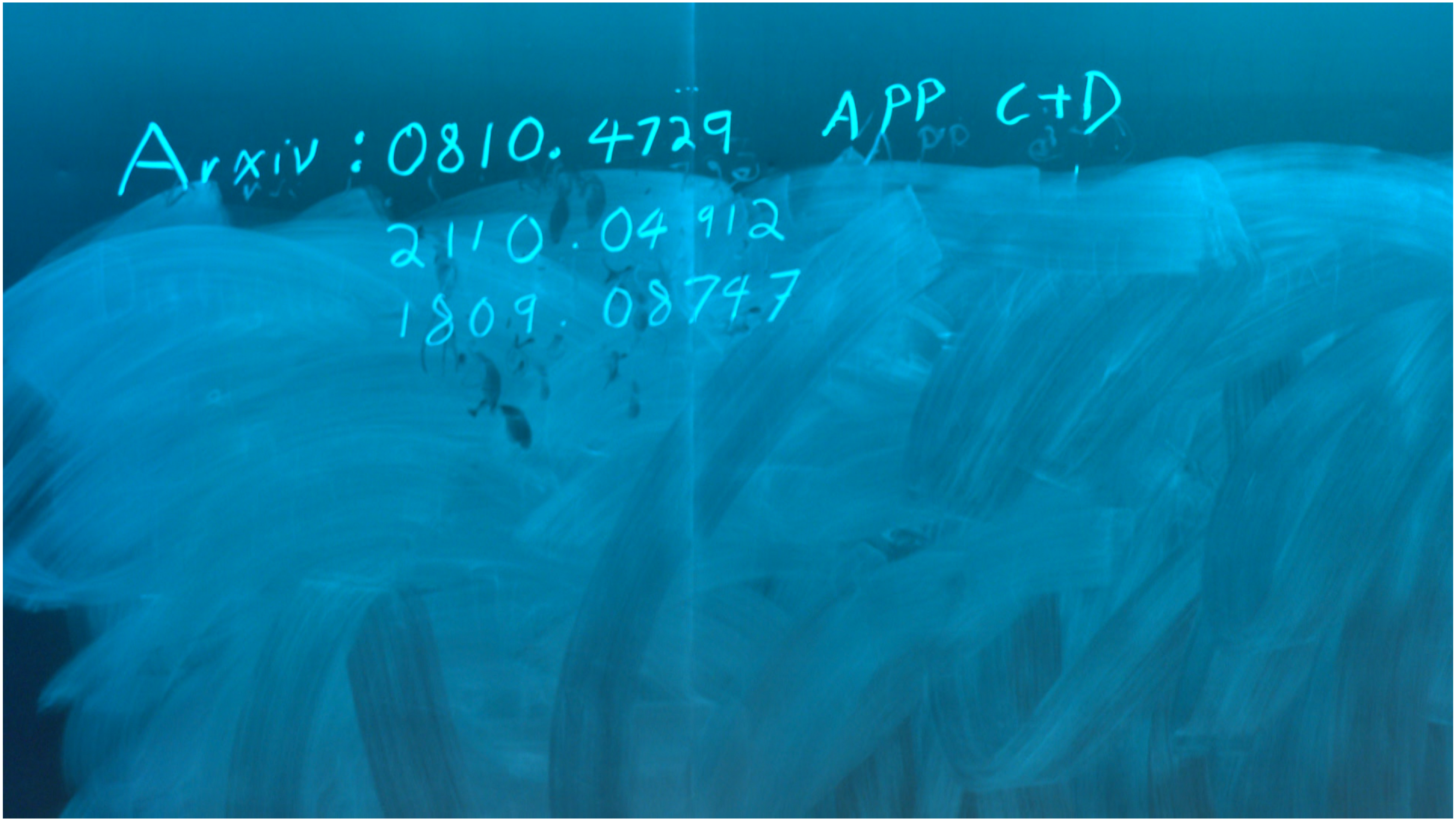
Title: Properties of cavities

Speakers: Konrad Lehnert

Collection: School on Table-Top Experiments for Fundamental Physics

Date: September 22, 2022 - 3:15 PM

URL: https://pirsa.org/22090024


Arxiv: 0810.4729 APP C+D
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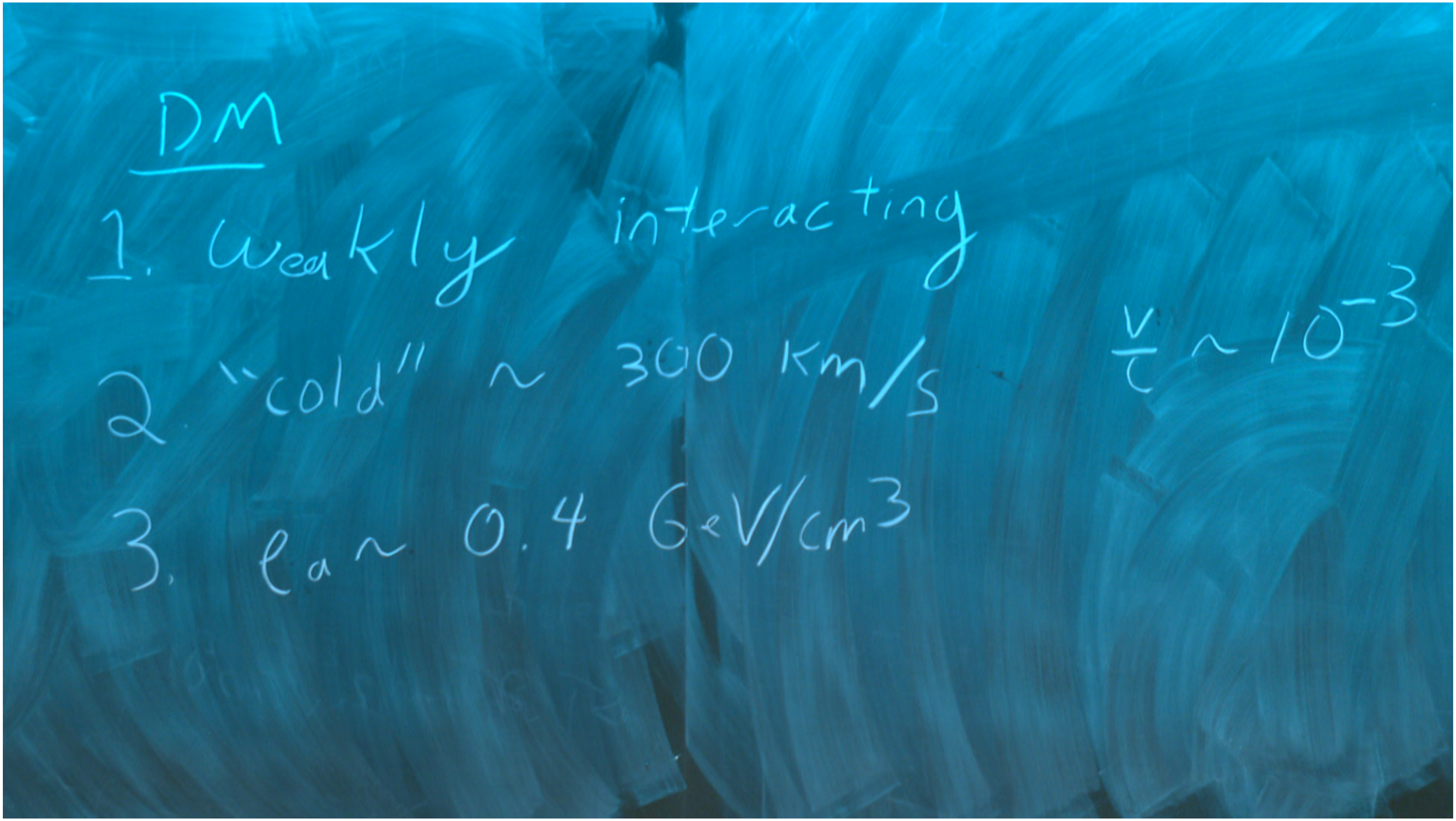
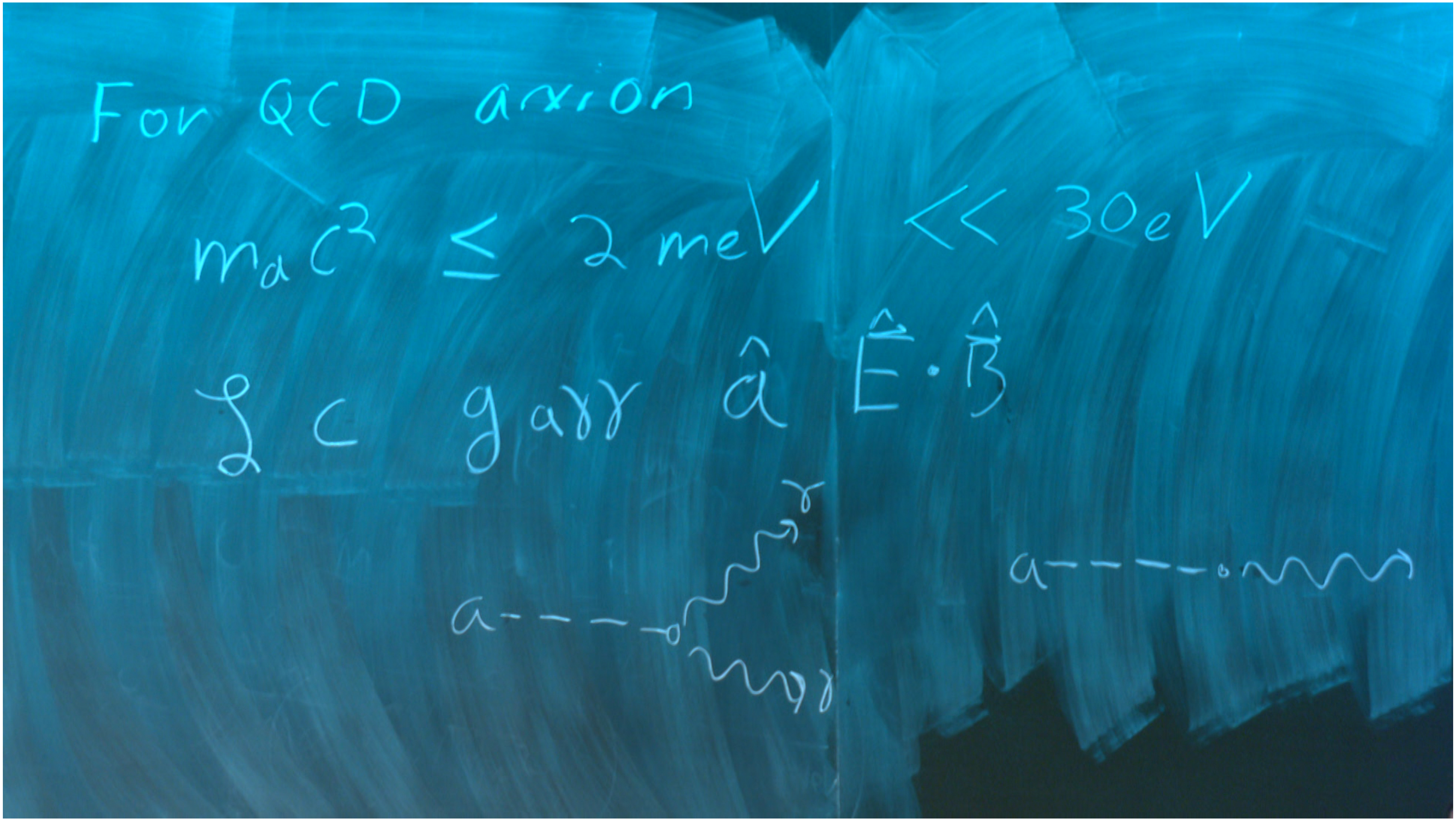
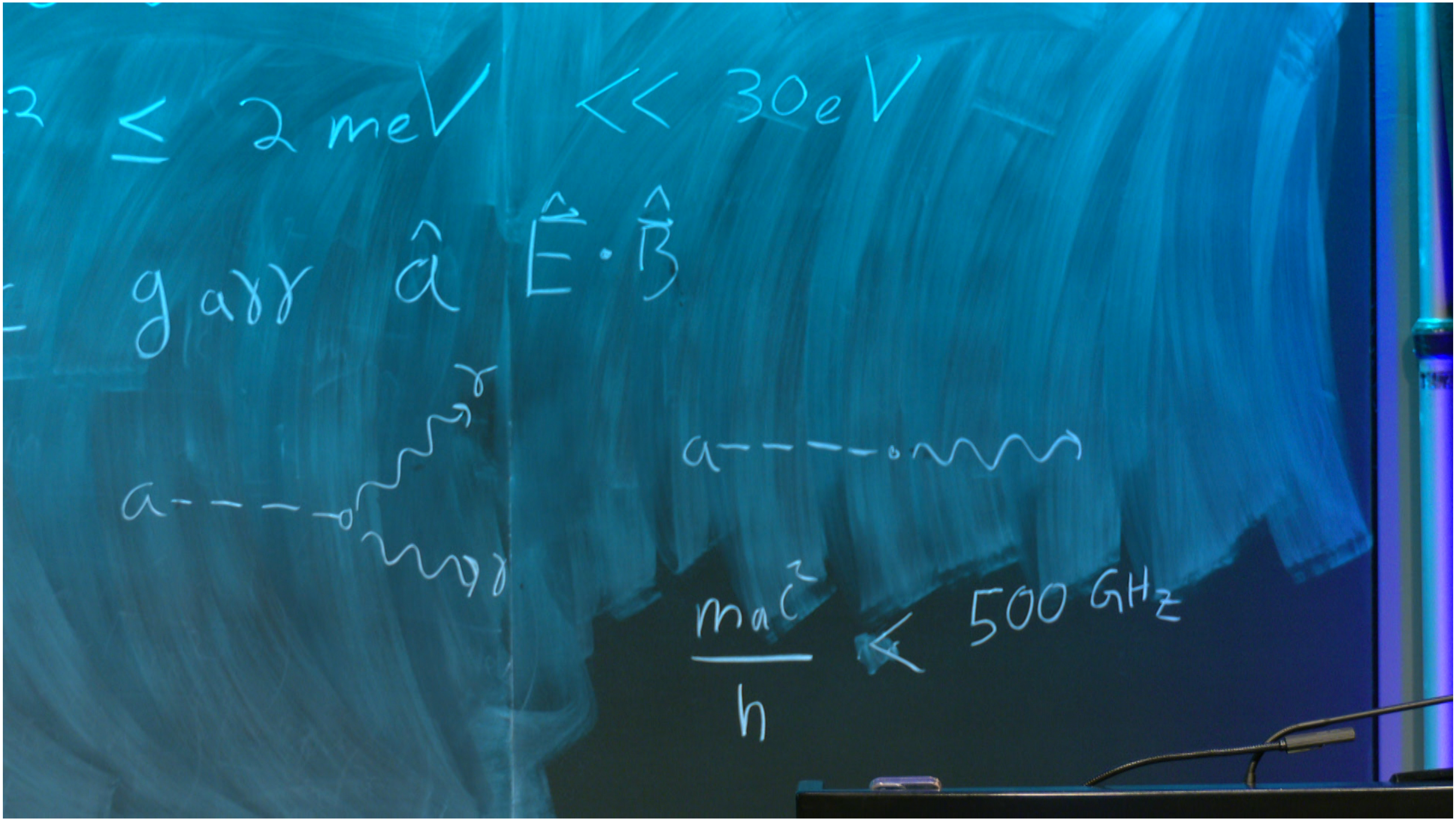
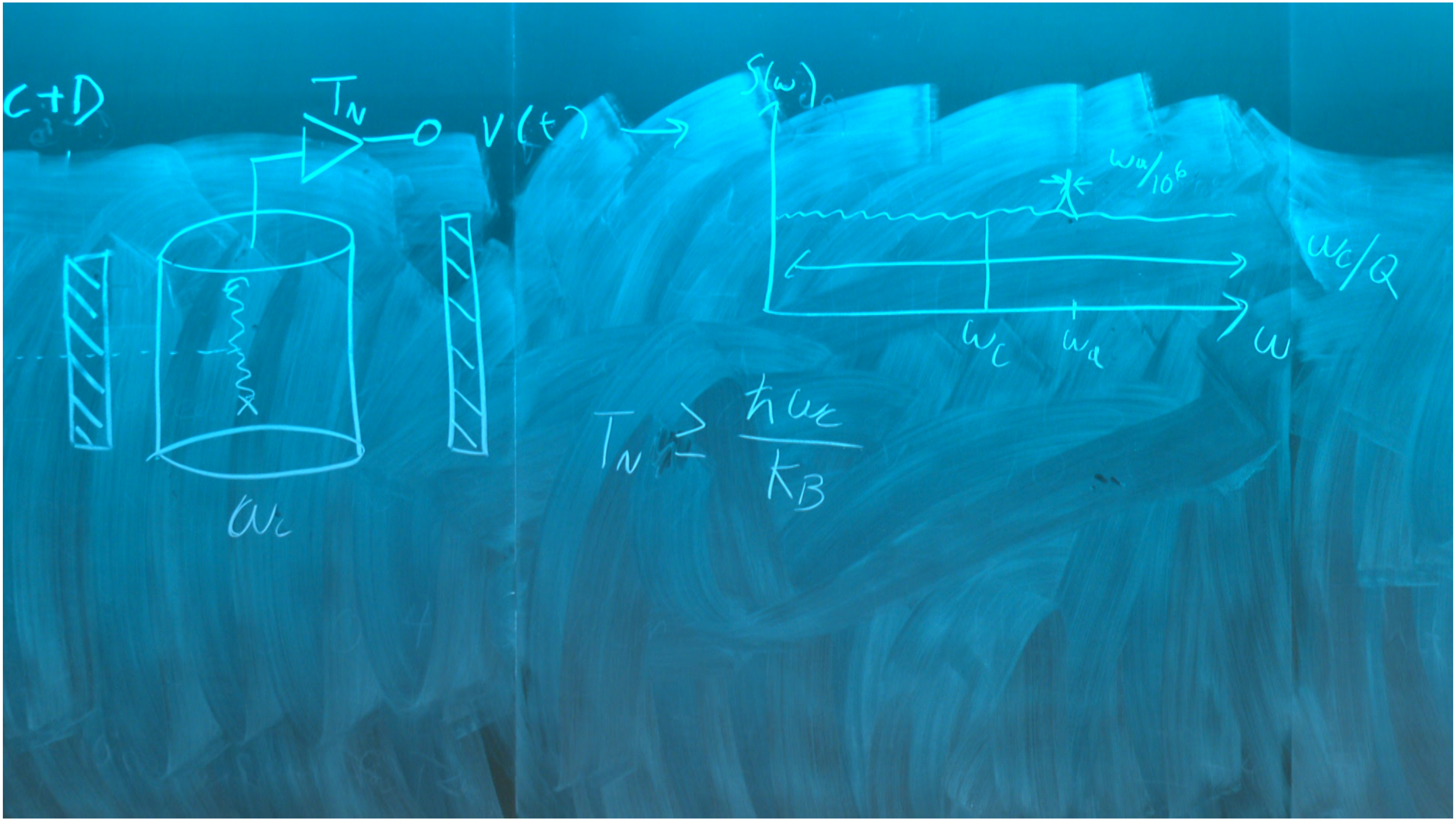
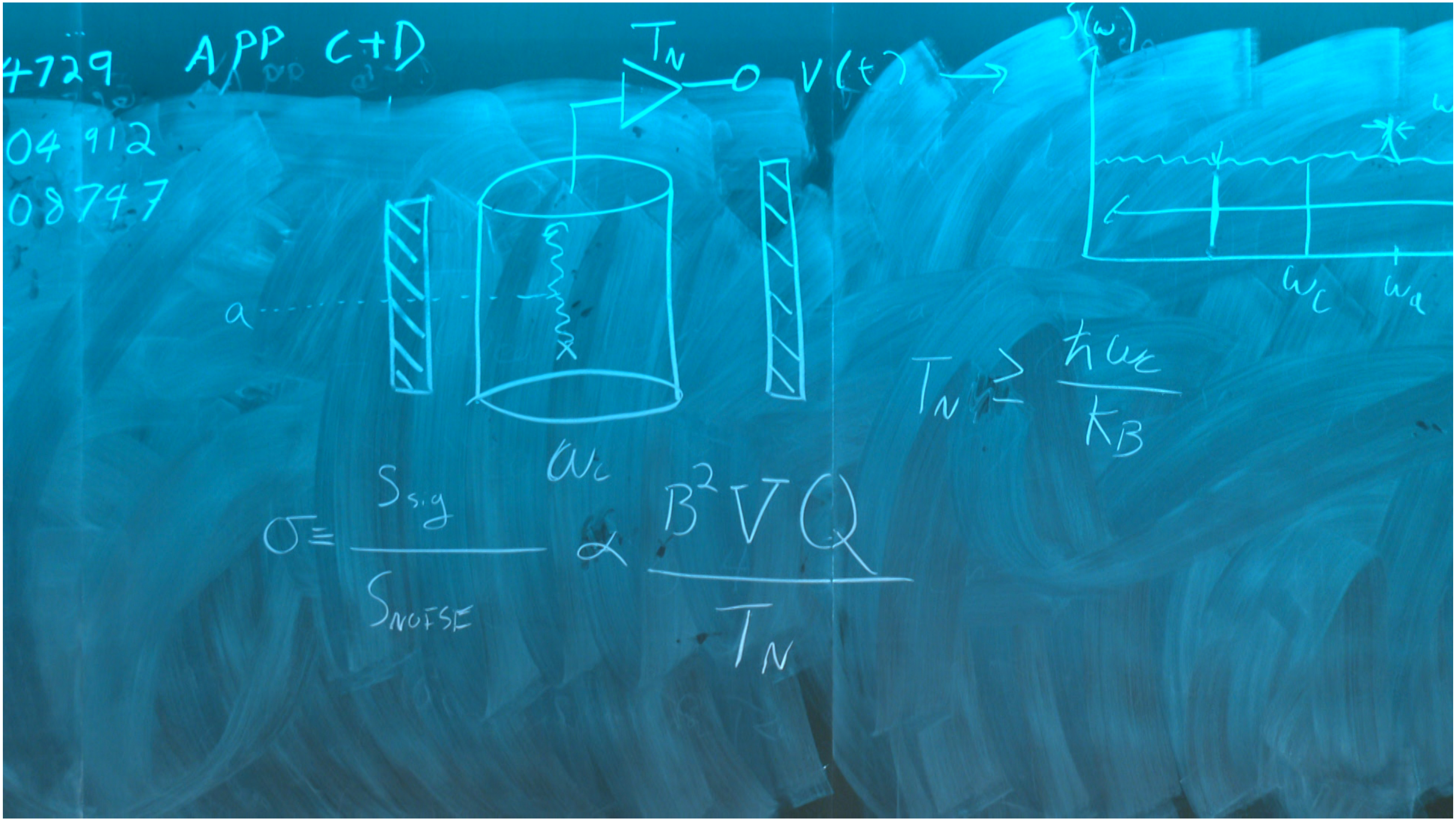

DM
1. Weakly interacting
2. "cold" ~ 300 km/s
$\frac{v}{c} \sim 10^{-3}$
3. $\rho_a \sim 0.4$ GeV/cm^3


For QCD axion
$m_a c^2 \le 2\,\mathrm{meV} \ll 30\,\mathrm{eV}$
$\mathcal{L} \subset g_{a\gamma\gamma}\, \hat{a}\, \hat{E}\cdot\hat{B}$
a
γ
γ
a


≤ 2 meV << 30eV
gaγγ â Ê·B̂
a γ γ
a
$m_a c^2$ / h << 500 GHz


C+D
T_N
V(t)
ω_c
S(ω)
$\omega_a/10^6$
ω_c/Q
ω_c
ω_a
ω
$T_N \gtrsim \frac{\hbar\omega_c}{k_B}$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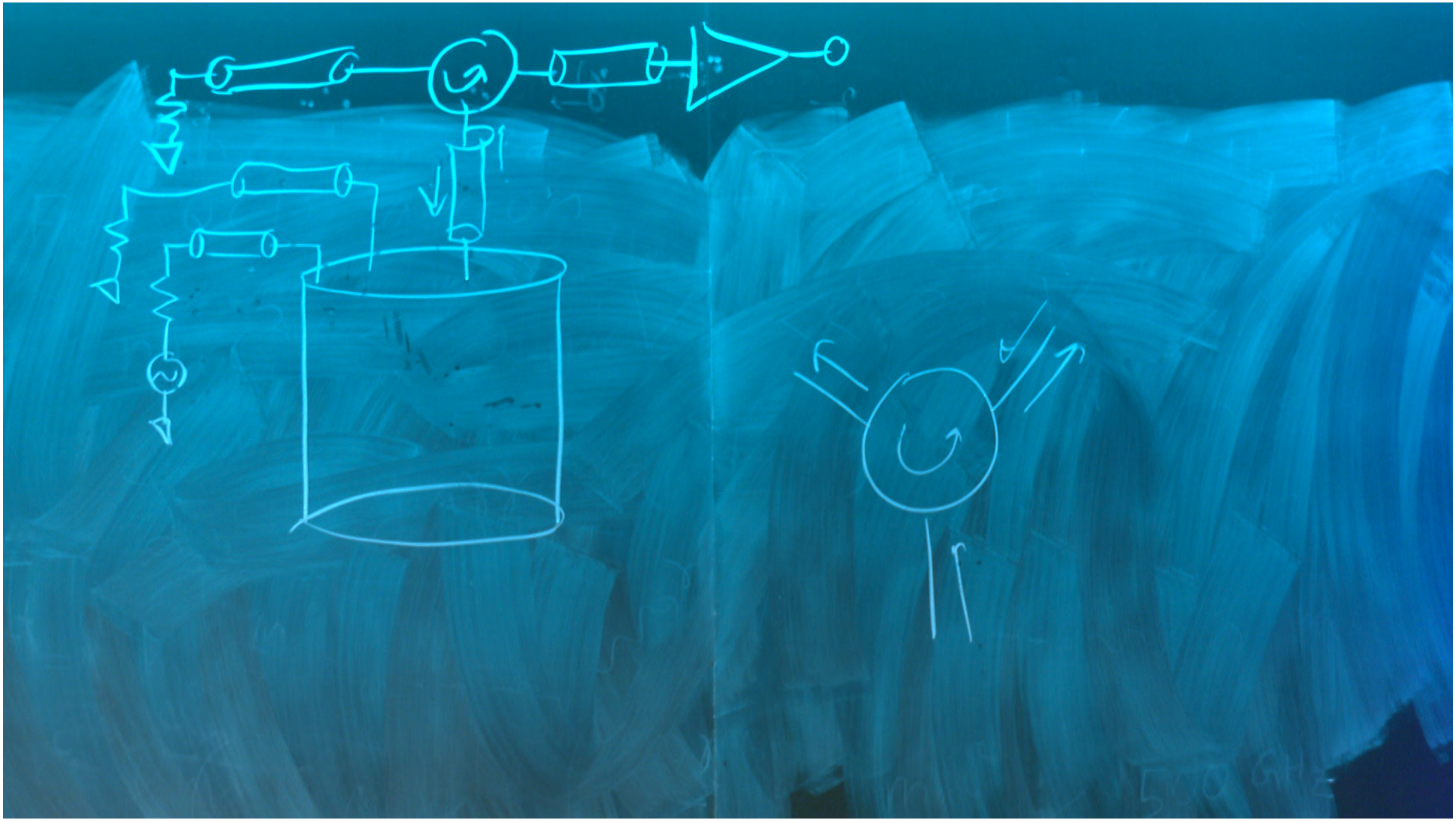
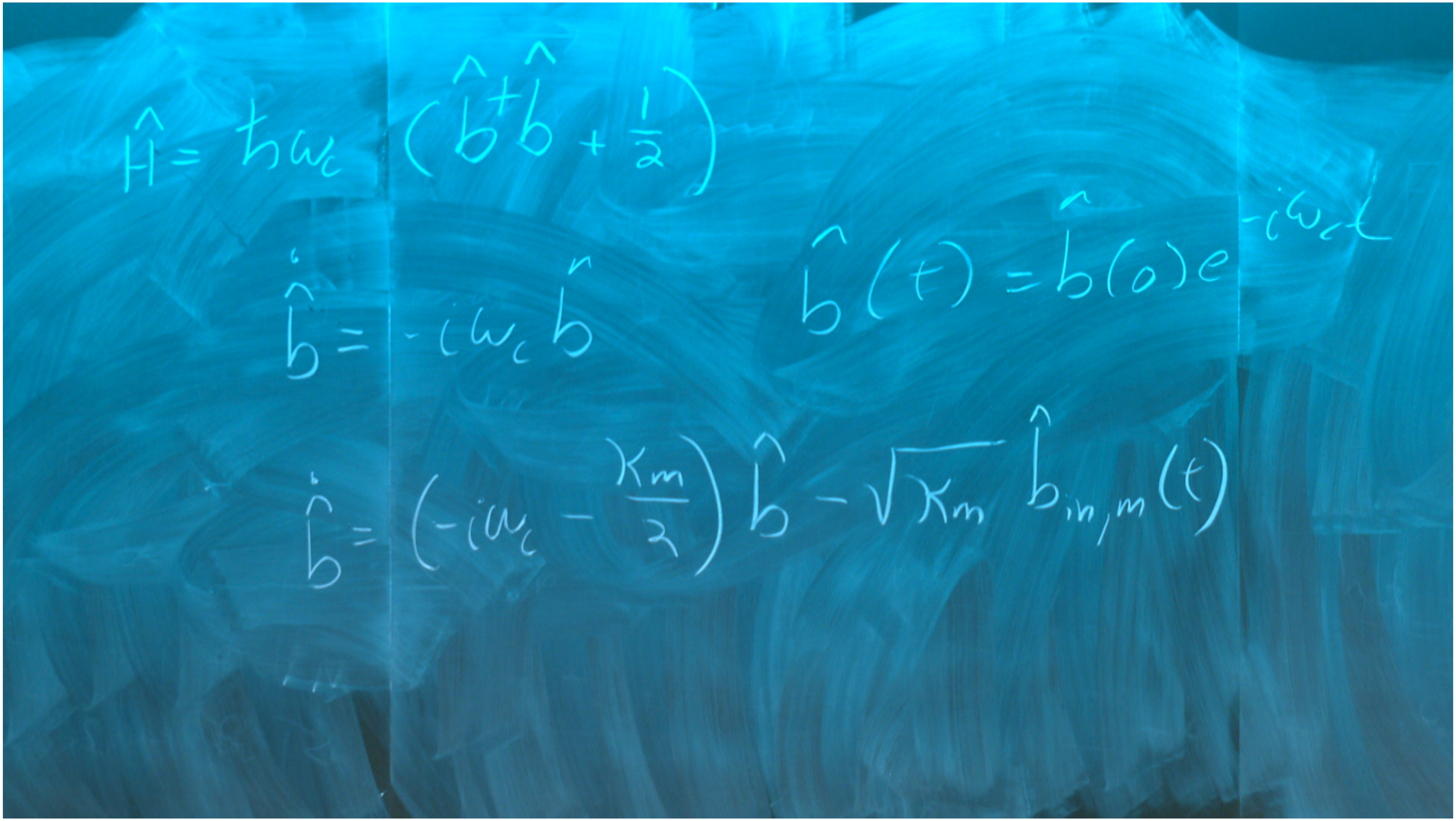
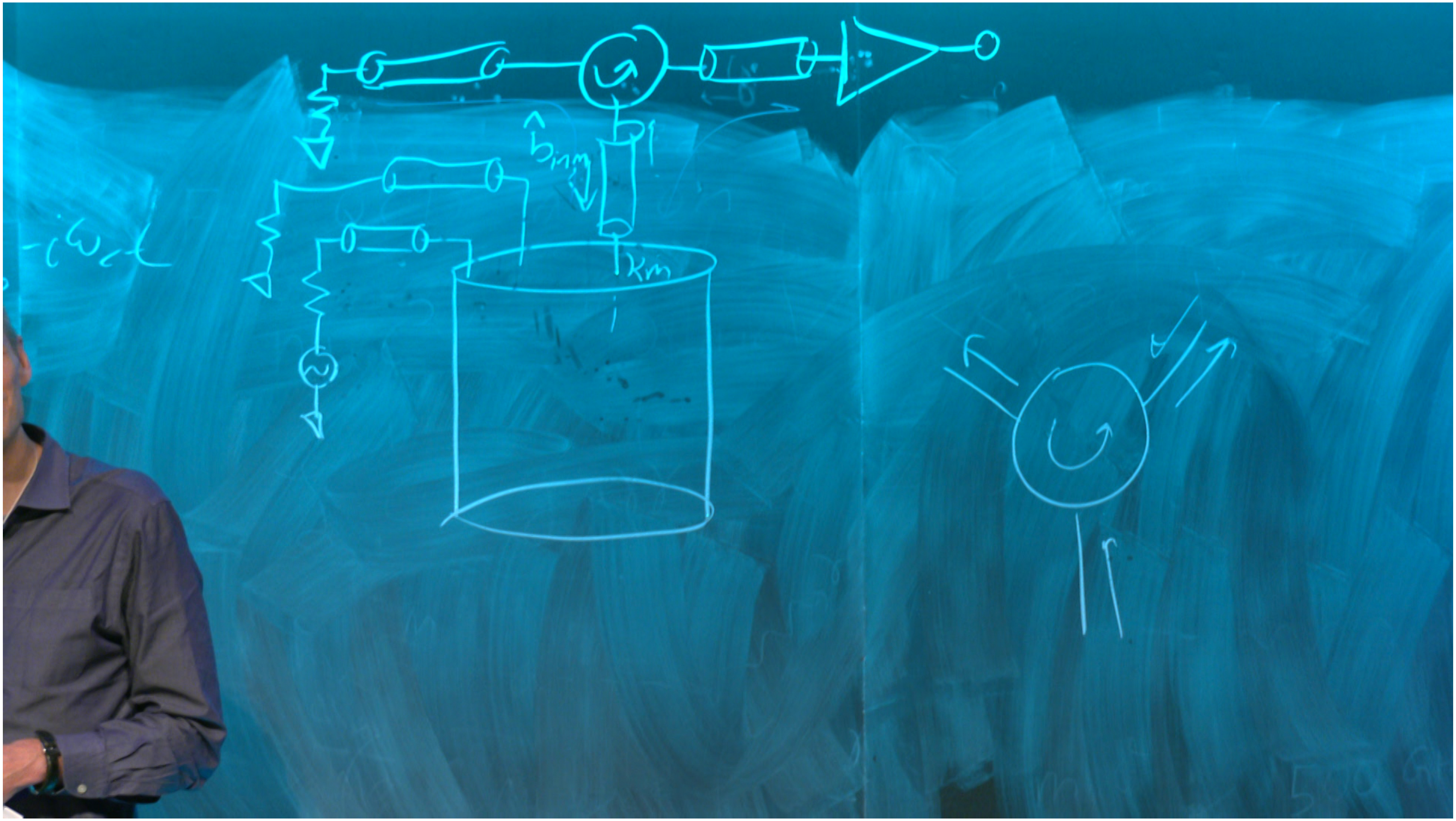
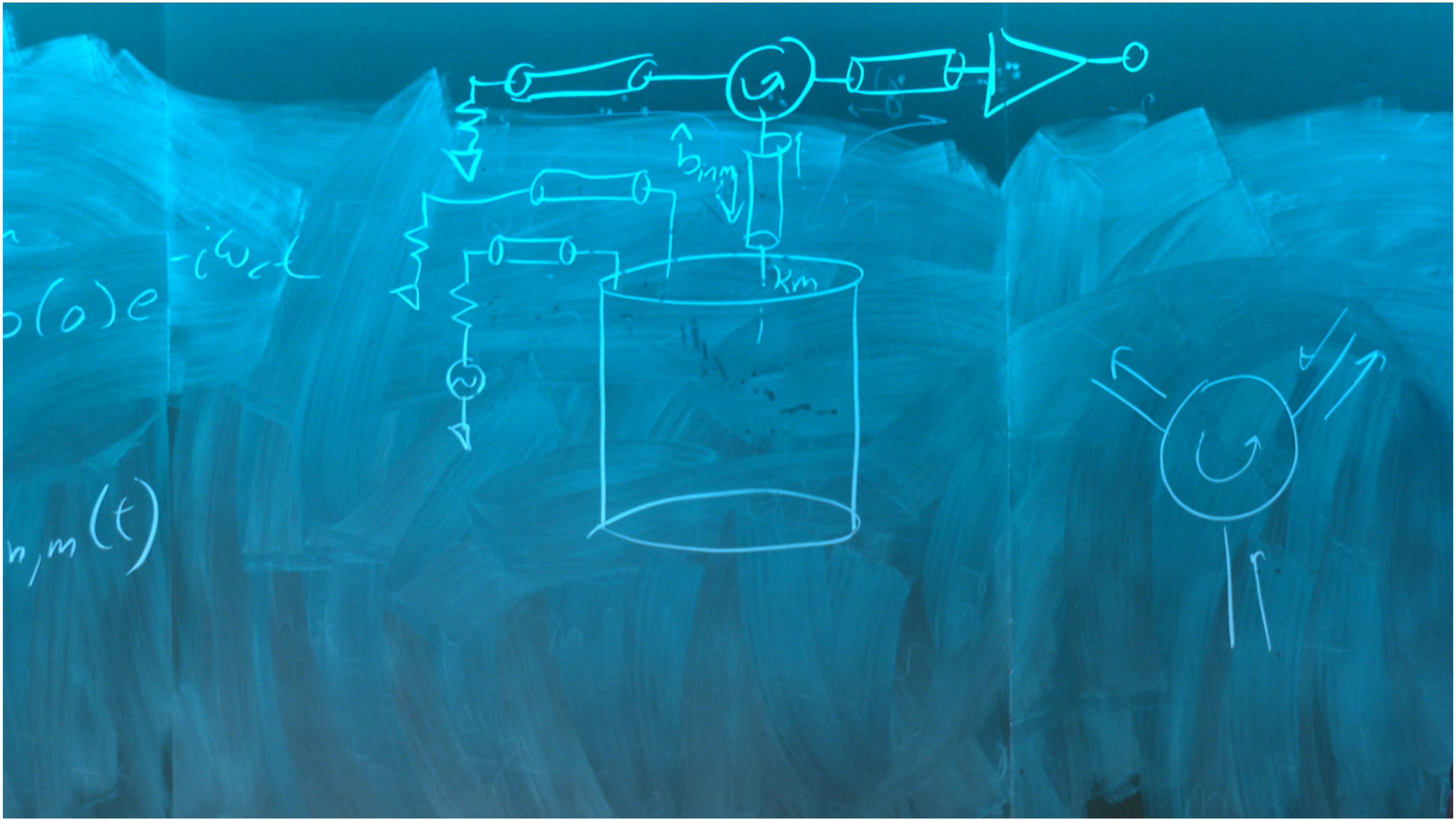
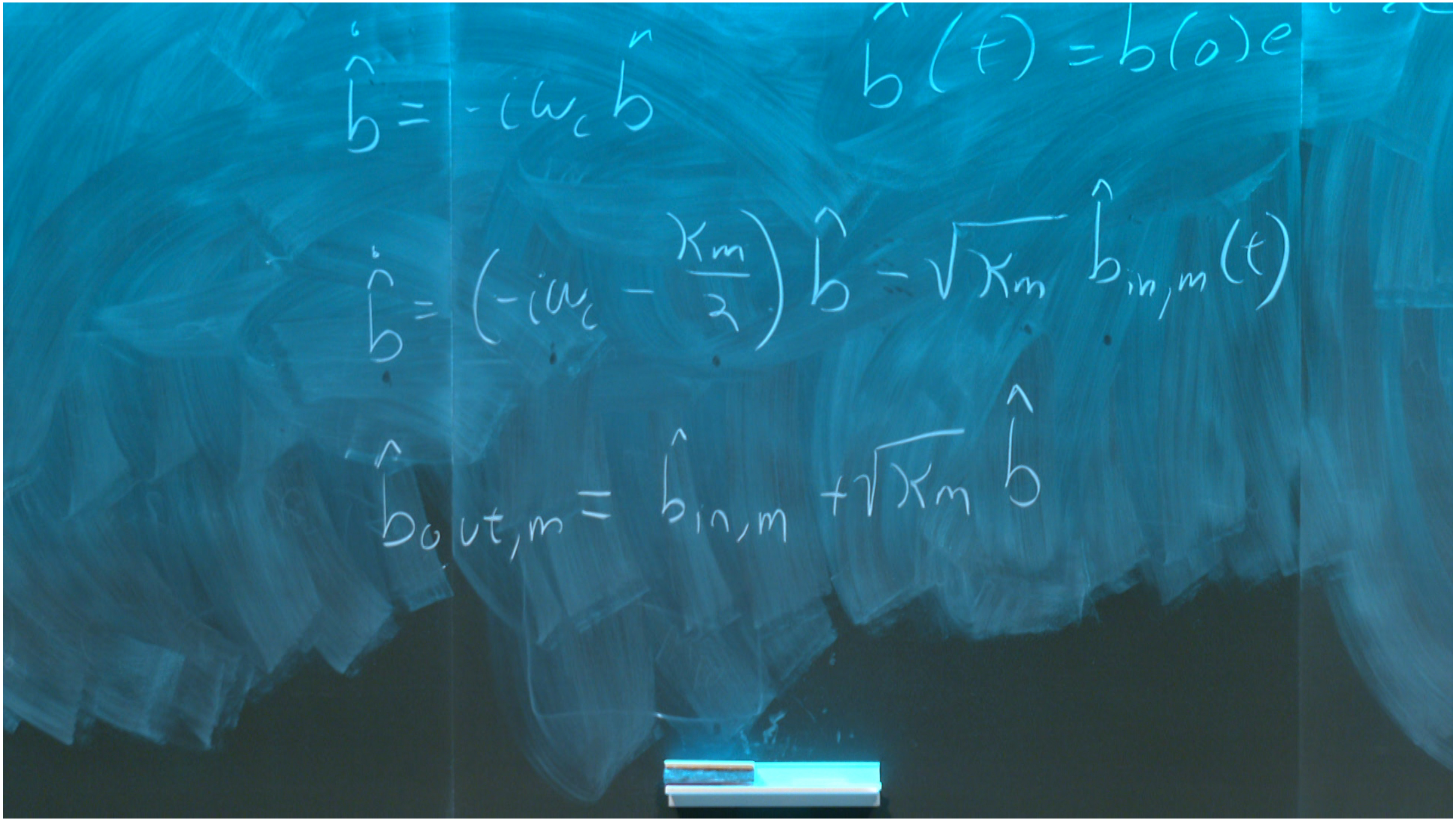
T_N
V(t)
S(ω)
a
ω_c
ω_c
ω_a
T_N ≳ ħω_c / K_B
σ ≡ S_sig / S_NOISE ∝ B²VQ / T_N

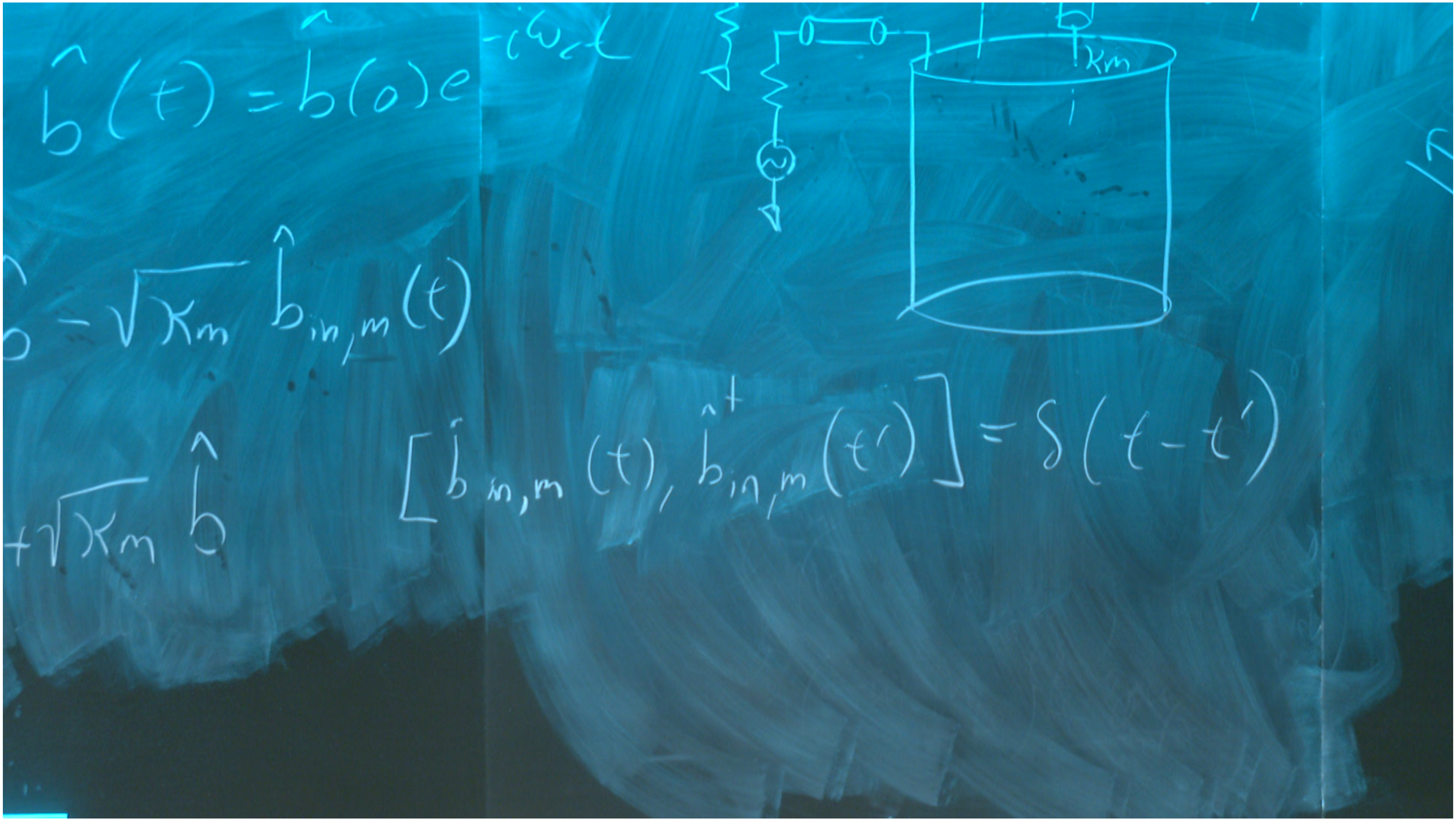


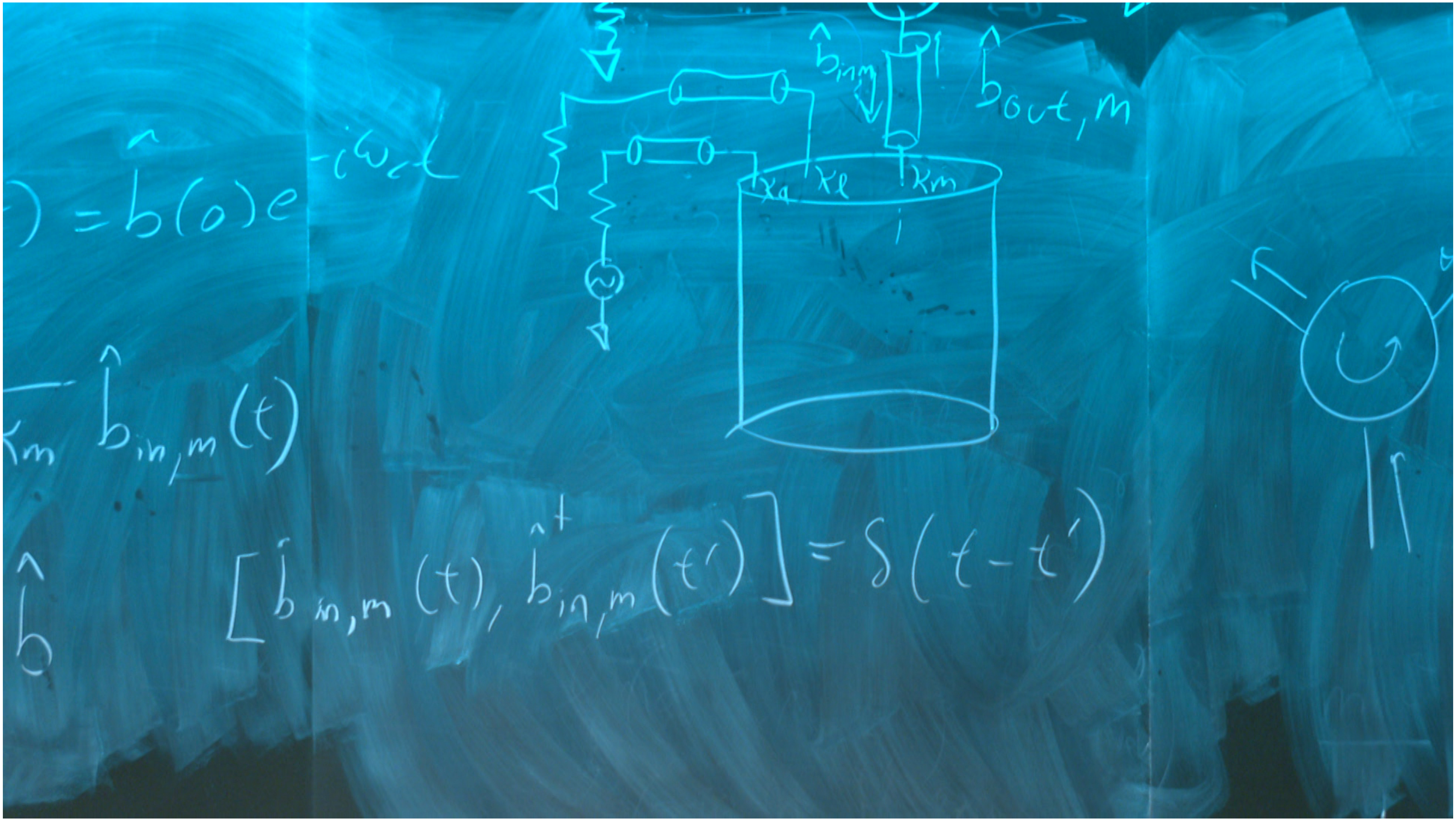

$\hat{H} = \hbar\omega_c\left(\hat{b}^\dagger\hat{b} + \frac{1}{2}\right)$
$\dot{\hat{b}} = -i\omega_c\hat{b}$
$\hat{b}(t) = \hat{b}(0)e^{-i\omega_c t}$
$\dot{\hat{b}} = \left(-i\omega_c - \frac{\kappa_m}{2}\right)\hat{b} - \sqrt{\kappa_m}\,\hat{b}_{in,m}(t)$


$-i\omega_c t$
$\hat{b}_{in m}$
k_m

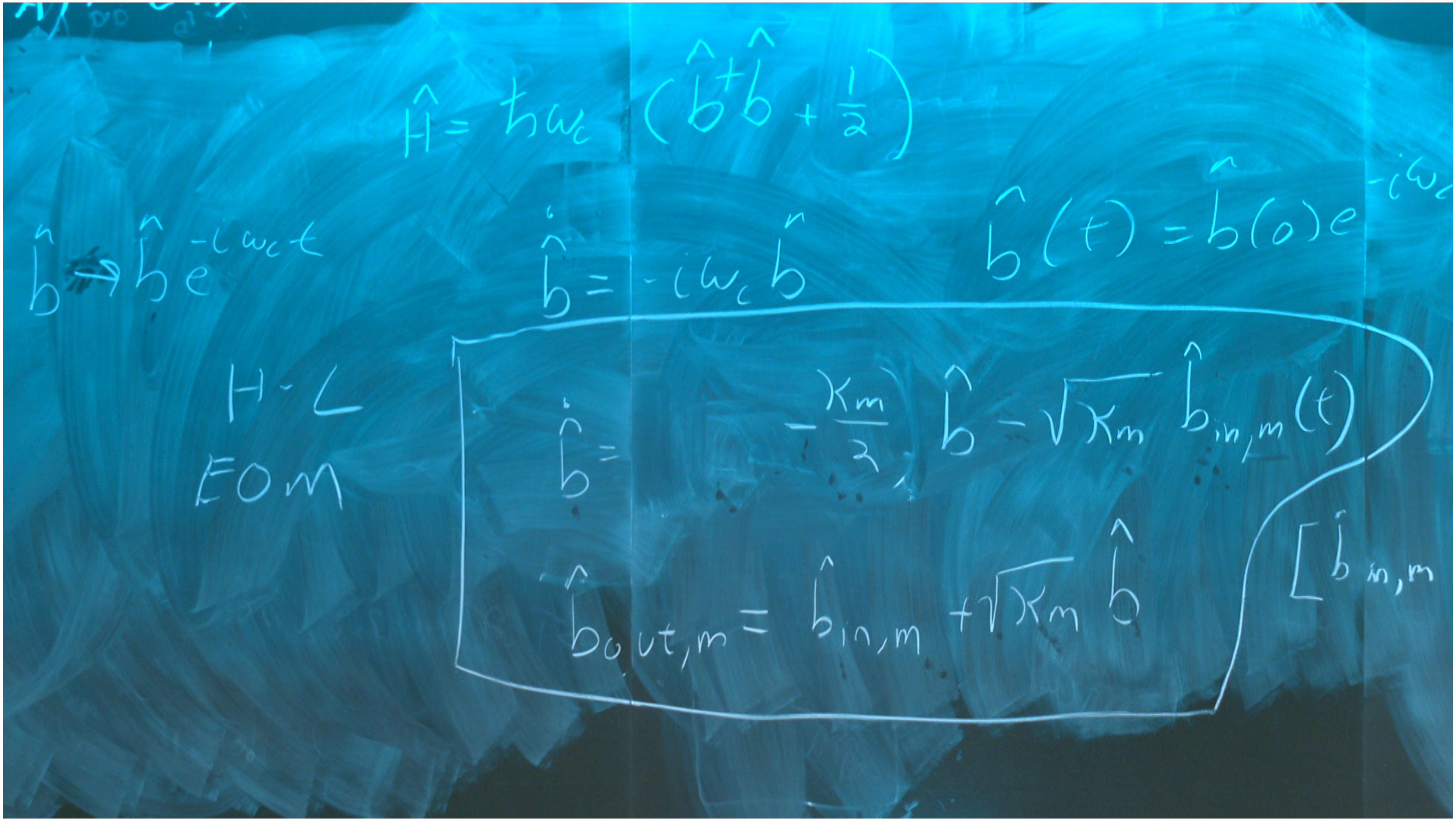

b̂inm
κm


$\dot{\hat{b}} = -i\omega_c \hat{b}$
$\hat{b}(t) = b(0)e$
$\dot{\hat{b}} = \left(-i\omega_c - \frac{\kappa_m}{2}\right)\hat{b} - \sqrt{\kappa_m}\,\hat{b}_{in,m}(t)$
$\hat{b}_{out,m} = \hat{b}_{in,m} + \sqrt{\kappa_m}\,\hat{b}$


$\hat{b}(t) = \hat{b}(0)e^{-i\omega_c t}$
κ_m
$\hat{b} = \sqrt{\kappa_m}\,\hat{b}_{in,m}(t)$
$+\sqrt{\kappa_m}\,\hat{b}$
$[\hat{b}_{in,m}(t), \hat{b}^{\dagger}_{in,m}(t')] = \delta(t-t')$



b_in,m
b_out,m
x_a
x_l
x_m
) = b(0)e^{-iω_c t}
b_in,m(t)
[b_in,m(t), b†_in,m(t′)] = δ(t − t′)


Ĥ = ħω_c (b̂†b̂ + 1/2)
b̂ → b̂ e^{-iω_c t}
ḃ̂ = -iω_c b̂
b̂(t) = b̂(0)e^{-iω_c
H - L
EOM
ḃ̂ = -κ_m/2 b̂ - √κ_m b̂_{in,m}(t)
b̂_{out,m} = b̂_{in,m} + √κ_m b̂
[b̂ in,m