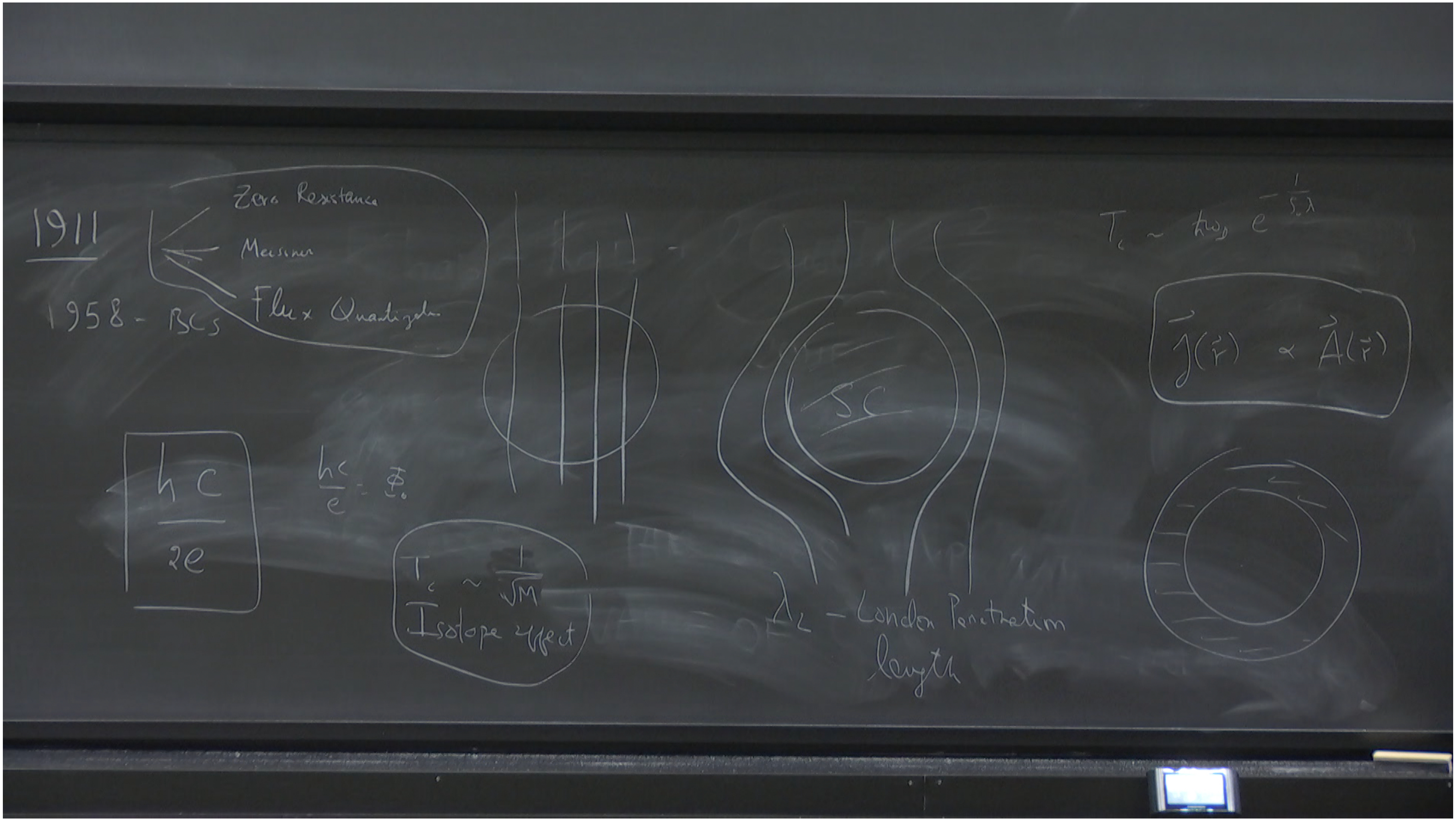
Title: Quantum Matter Lecture (230412)

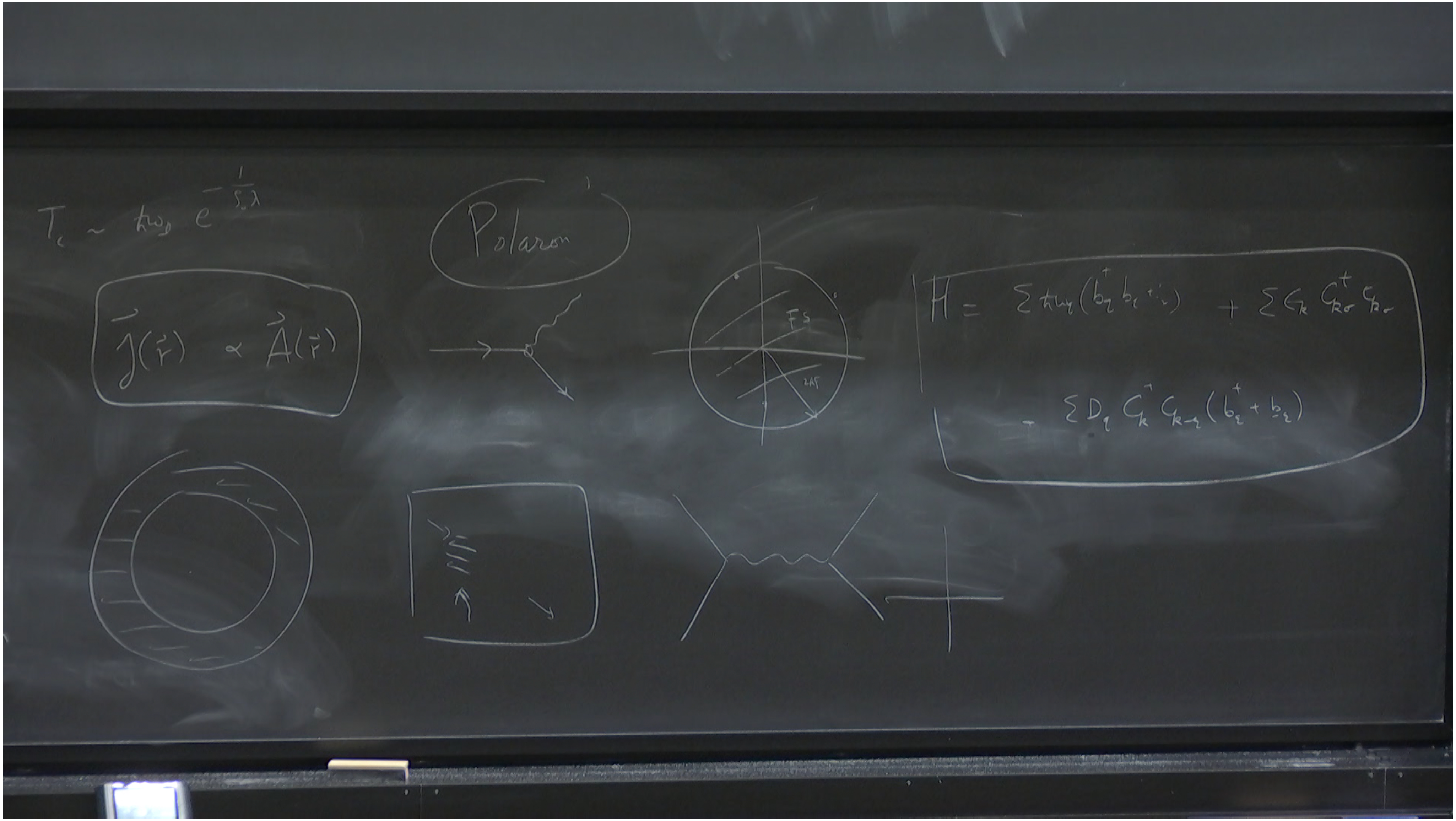
Speakers: Ganapathy Baskaran

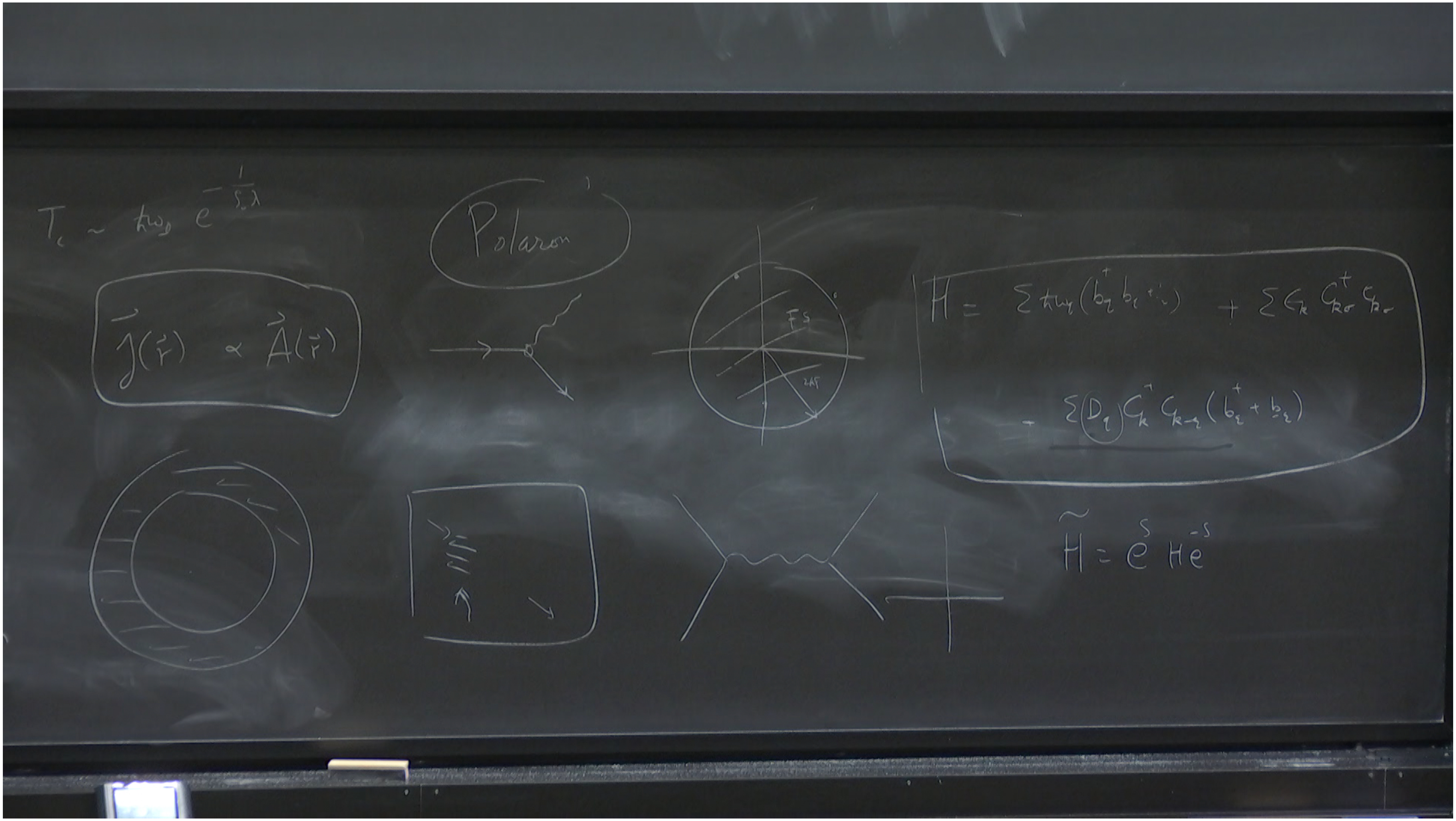
Collection: Quantum Matter (2022/2023)

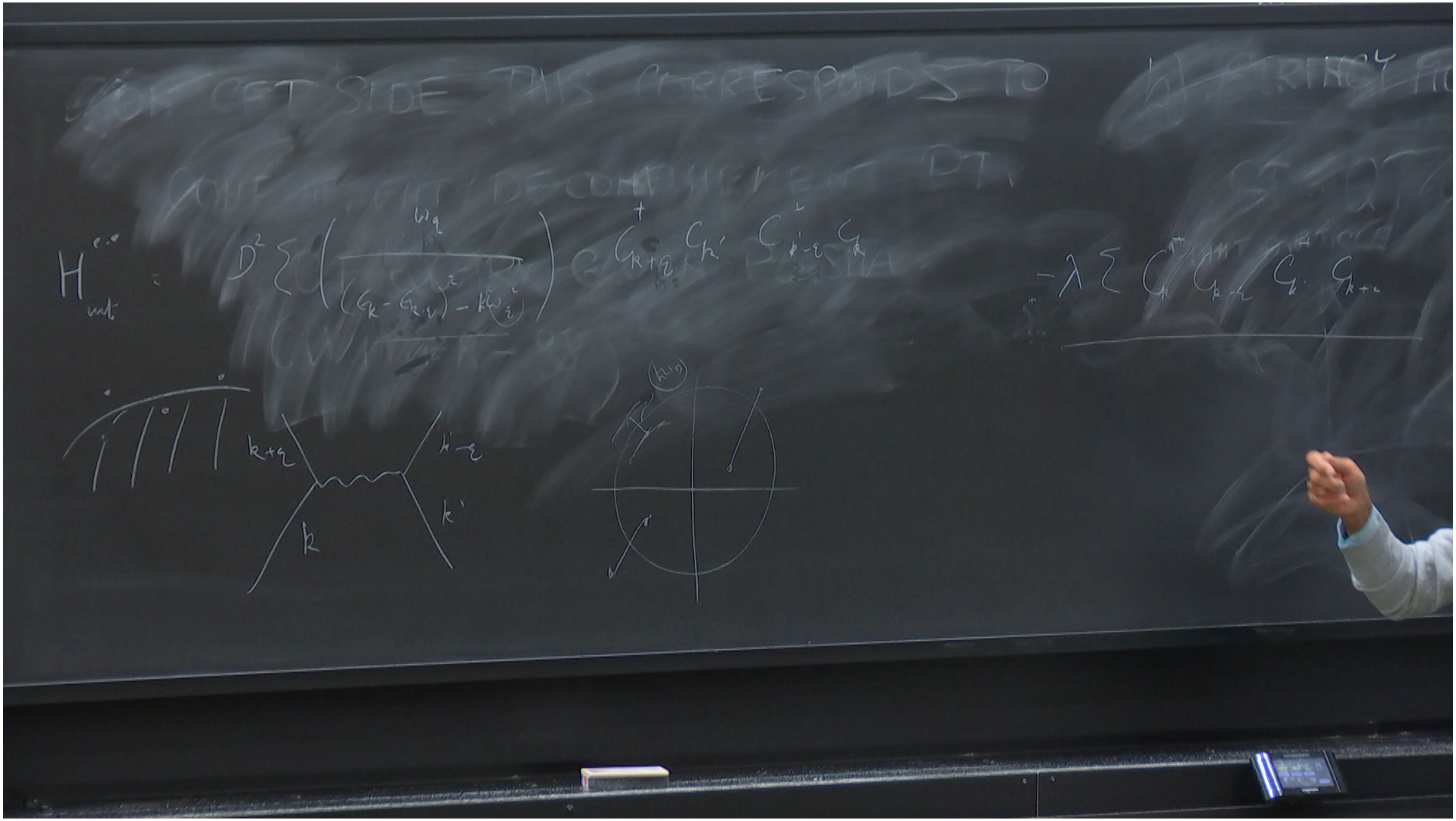
Date: April 12, 2023 - 10:15 AM

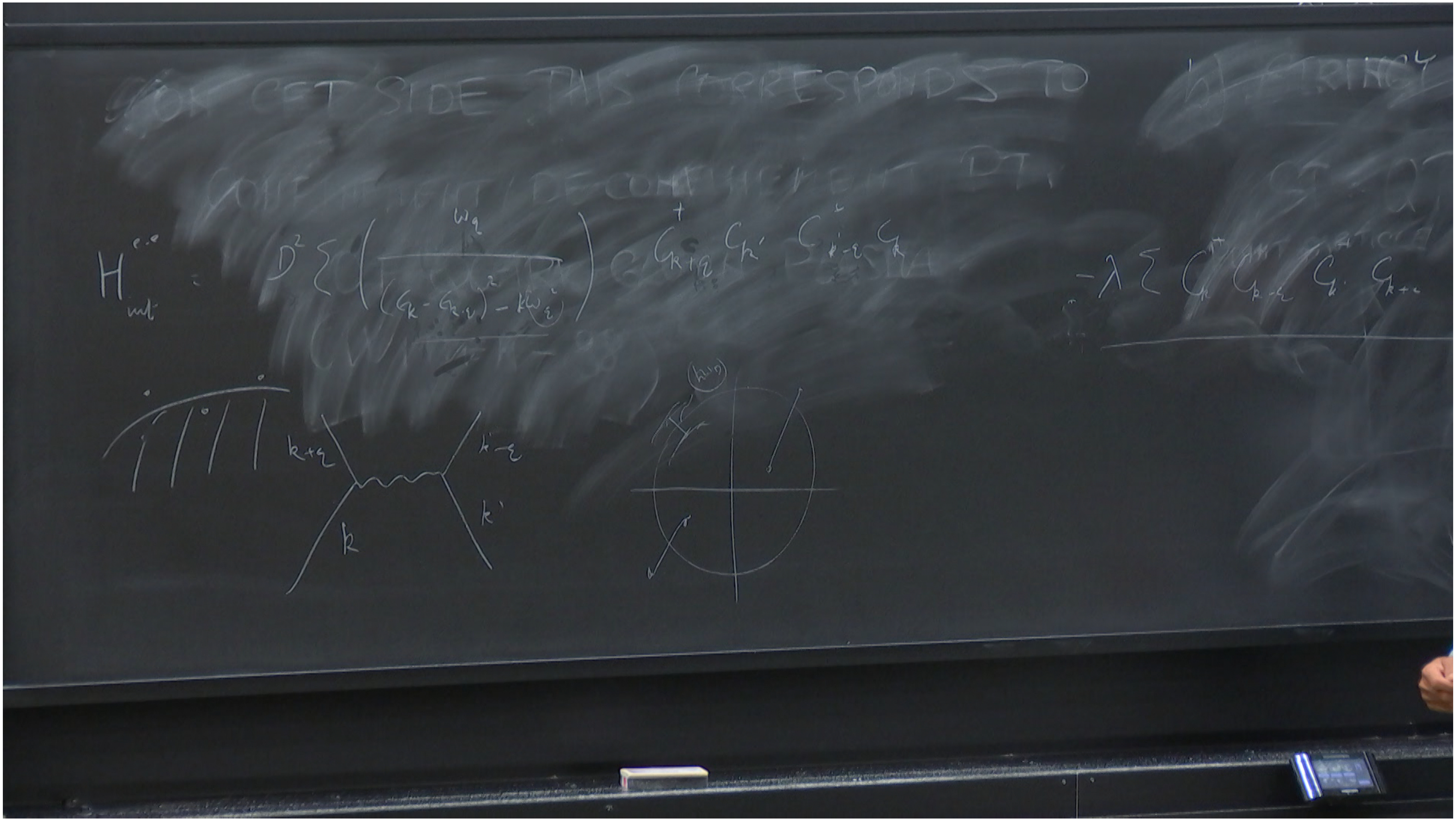
URL: https://pirsa.org/23040010

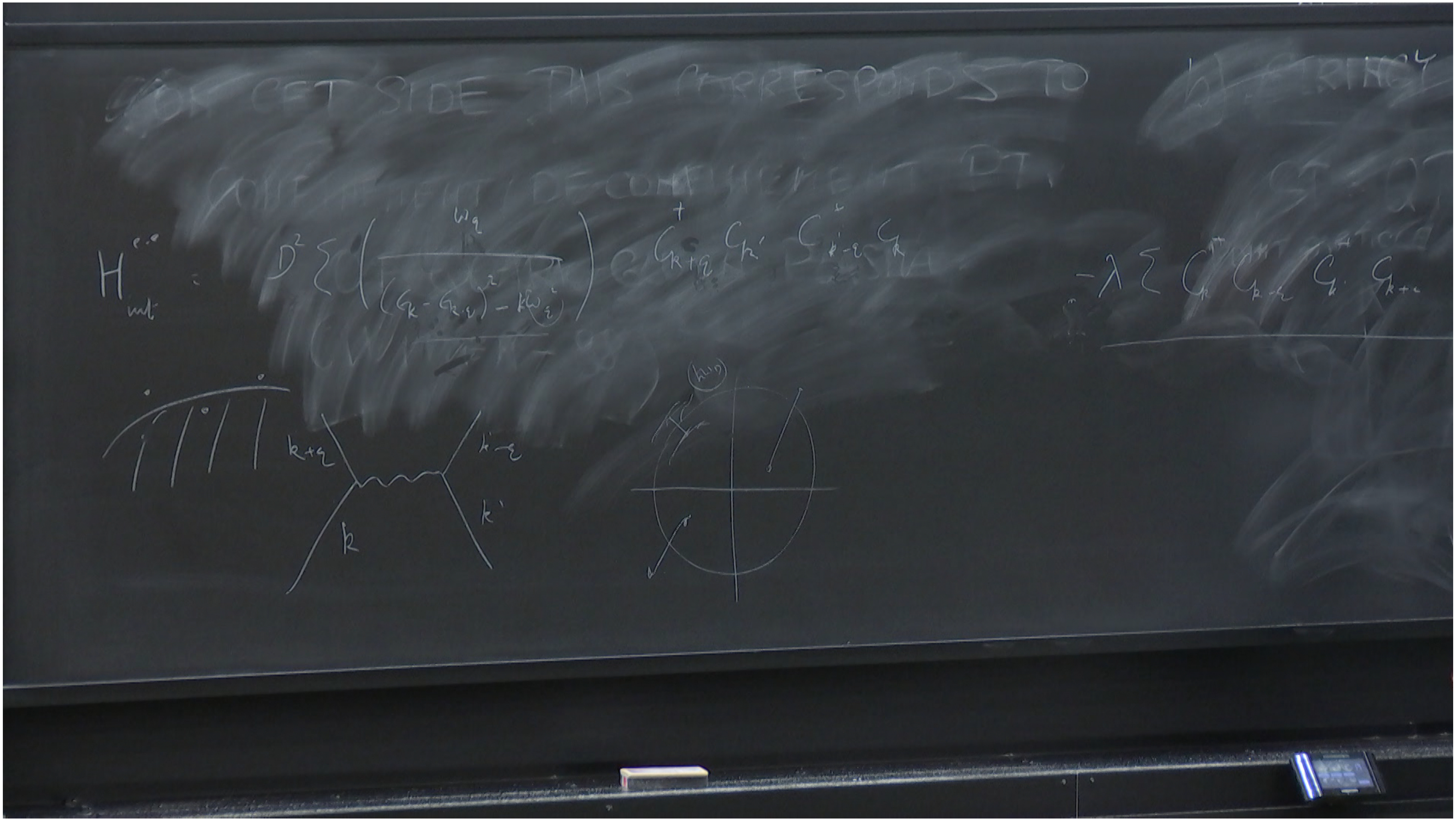

1911
Zero Resistance
Meissner
Flux Quantization
1958 - BCS
hc/2e
hc/e = Φ0
Tc ~ 1/√M
Isotope effect
SC
λL - London Penetration length
Tc ~ ħωD e^(-1/(g0λ))
J(r) ∝ A(r)

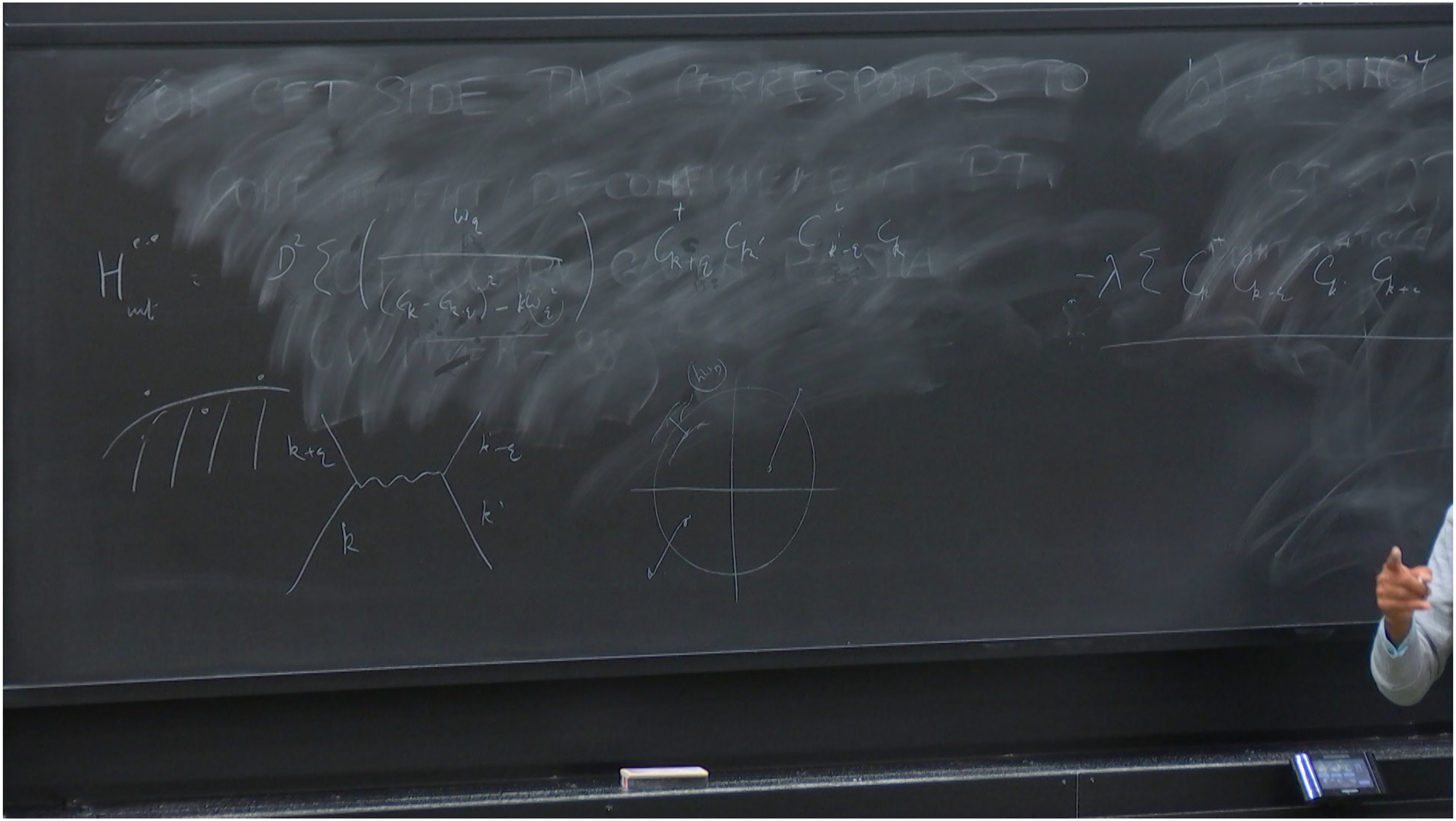

$T_c \sim \hbar\omega_D \, e^{-\frac{1}{g_0 \lambda}}$
Polaron
$\vec{J}(\vec{r}) \propto \vec{A}(\vec{r})$
FS
$H = \sum \hbar\omega_q (b_q^\dagger b_q + \tfrac{1}{2}) + \sum \epsilon_k c_{k\sigma}^\dagger c_{k\sigma}$
$- \sum D_q c_k^\dagger c_{k-q} (b_q^\dagger + b_{-q})$


$T_c \sim \hbar\omega_D \, e^{-\frac{1}{g_0\lambda}}$
Polaron
$\vec{J}(\vec{r}) \propto \vec{A}(\vec{r})$
FS
$2k_F$
$H = \sum \hbar\omega_q (b_q^\dagger b_q + \tfrac{1}{2}) + \sum \epsilon_k c_{k\sigma}^\dagger c_{k\sigma}$
$+ \sum D_q c_k^\dagger c_{k-q} (b_q^\dagger + b_q)$
$\tilde{H} = e^{S} H e^{-S}$

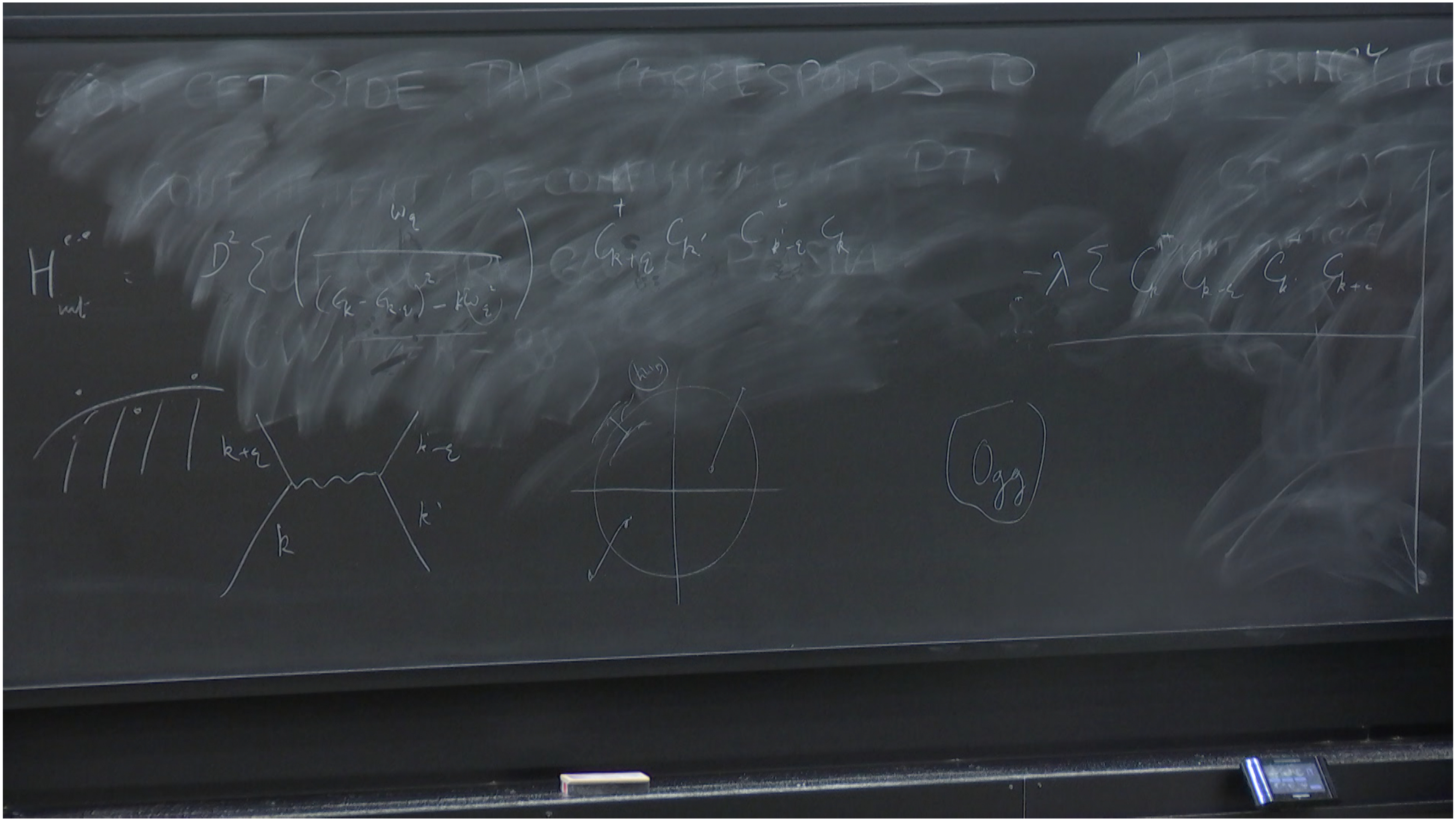

k+q
k'-q
k
k'

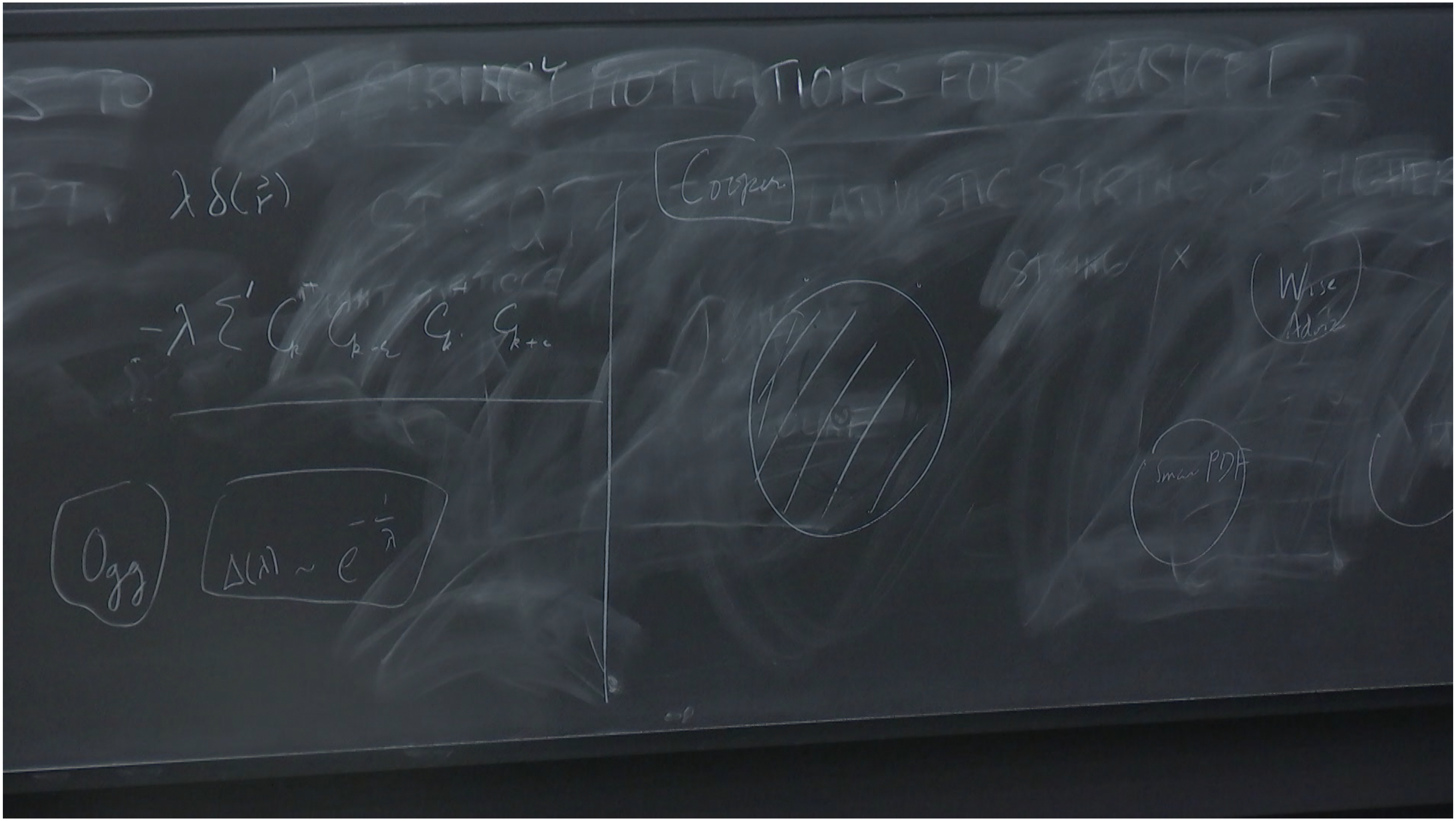

ON CFT SIDE THIS CORRESPONDS TO
CONFINEMENT / DE-CONFINEMENT PT
$H^{e.e}_{int} = D^2 \sum \left(\frac{\omega_q}{(\varepsilon_k - \varepsilon_{k+q})^2 - \omega_q^2} \right) c^\dagger_{k+q} c_{k'} c^\dagger_{k'-q} c_k$
$- \lambda \sum c^\dagger_k c^\dagger_{k-q} c_{k'} c_{k+q}$
k+q
k'-q
k
k'

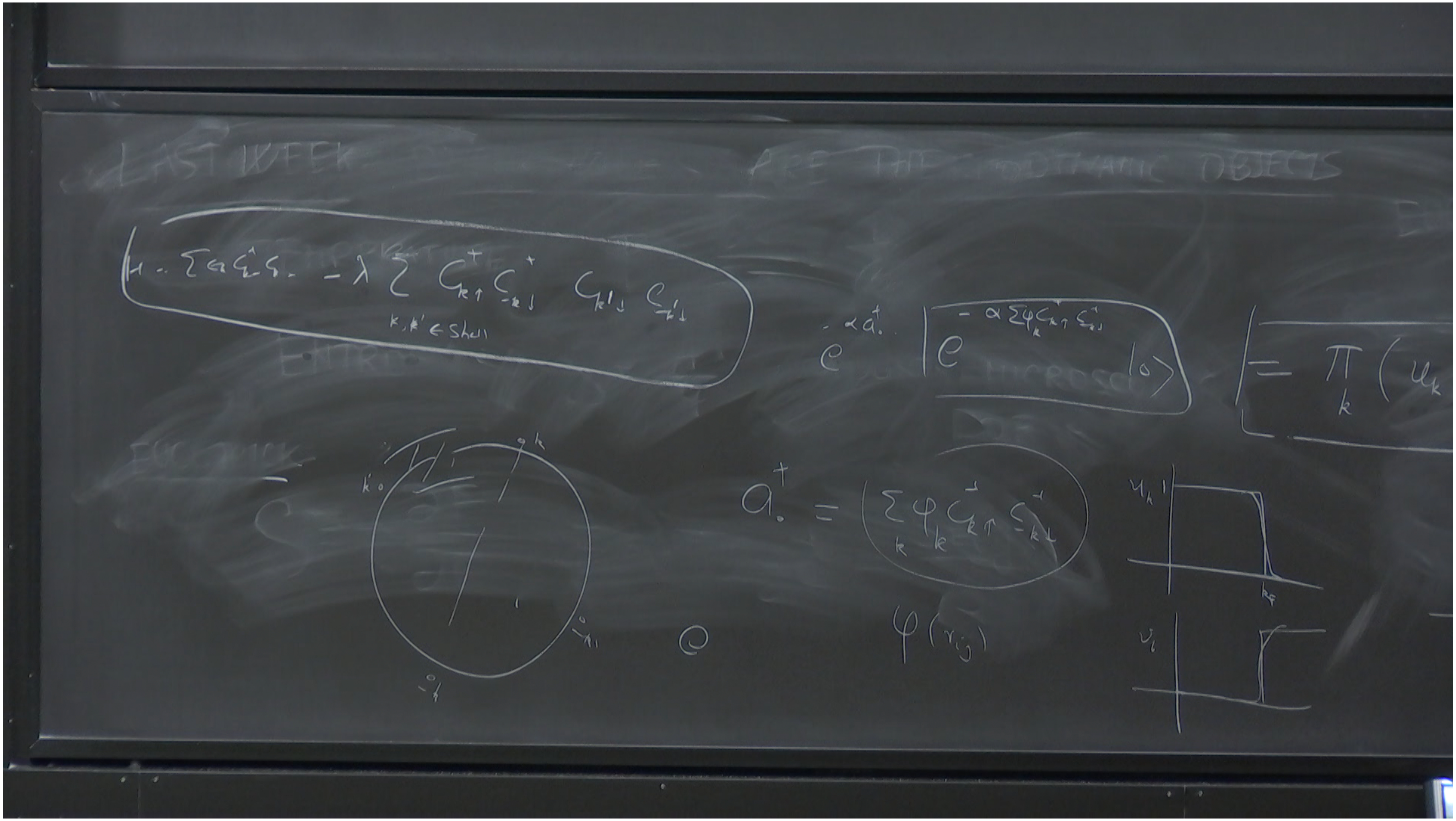

k+q
k-q
k'
k

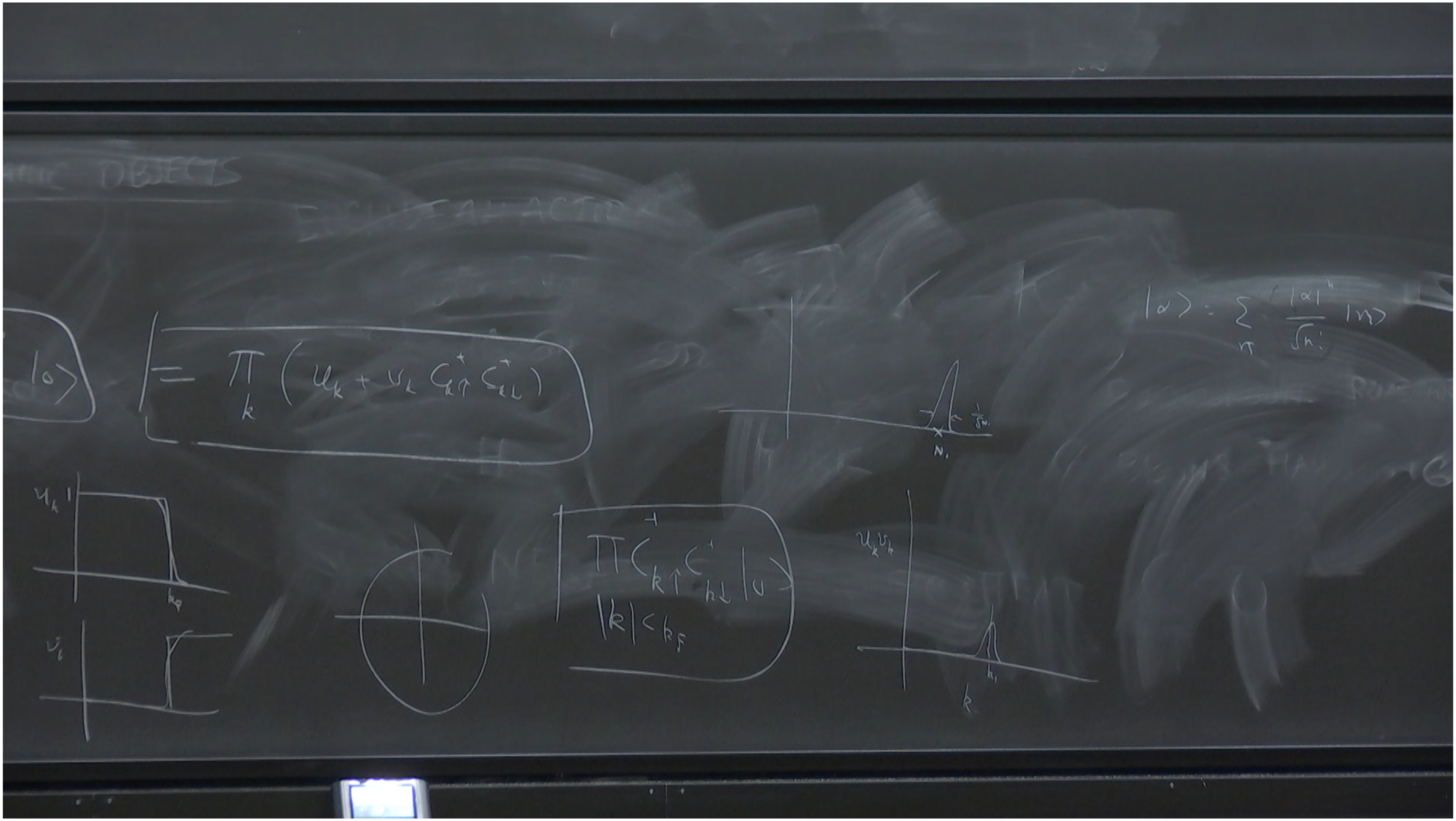


k+q
k-q
k
k'




MOTIVATIONS FOR
λδ(r)
Cooper
Ogg
Δ(λ) ~ e^{-1/λ}


$H = \sum \epsilon_k c_k^\dagger c_k - \lambda \sum_{k,k' \in \text{shell}} c_{k\uparrow}^\dagger c_{-k\downarrow}^\dagger c_{k'\downarrow} c_{-k'\downarrow}$
$e^{-\alpha a_0^\dagger}$
$e^{-\alpha \sum \varphi_k c_{k\uparrow}^\dagger c_{-k\downarrow}^\dagger} |0\rangle = \prod_k (u_k$
$a_0^\dagger = \sum_k \varphi_k c_{k\uparrow}^\dagger c_{-k\downarrow}^\dagger$
$\varphi(r_{ij})$
u_k
k_F
v_k


|0⟩ = ∏_k (u_k + v_k c†_{k↑} c†_{-k↓})
|α⟩ = Σ_n |α|^n / √n! |n⟩
|k| < k_F