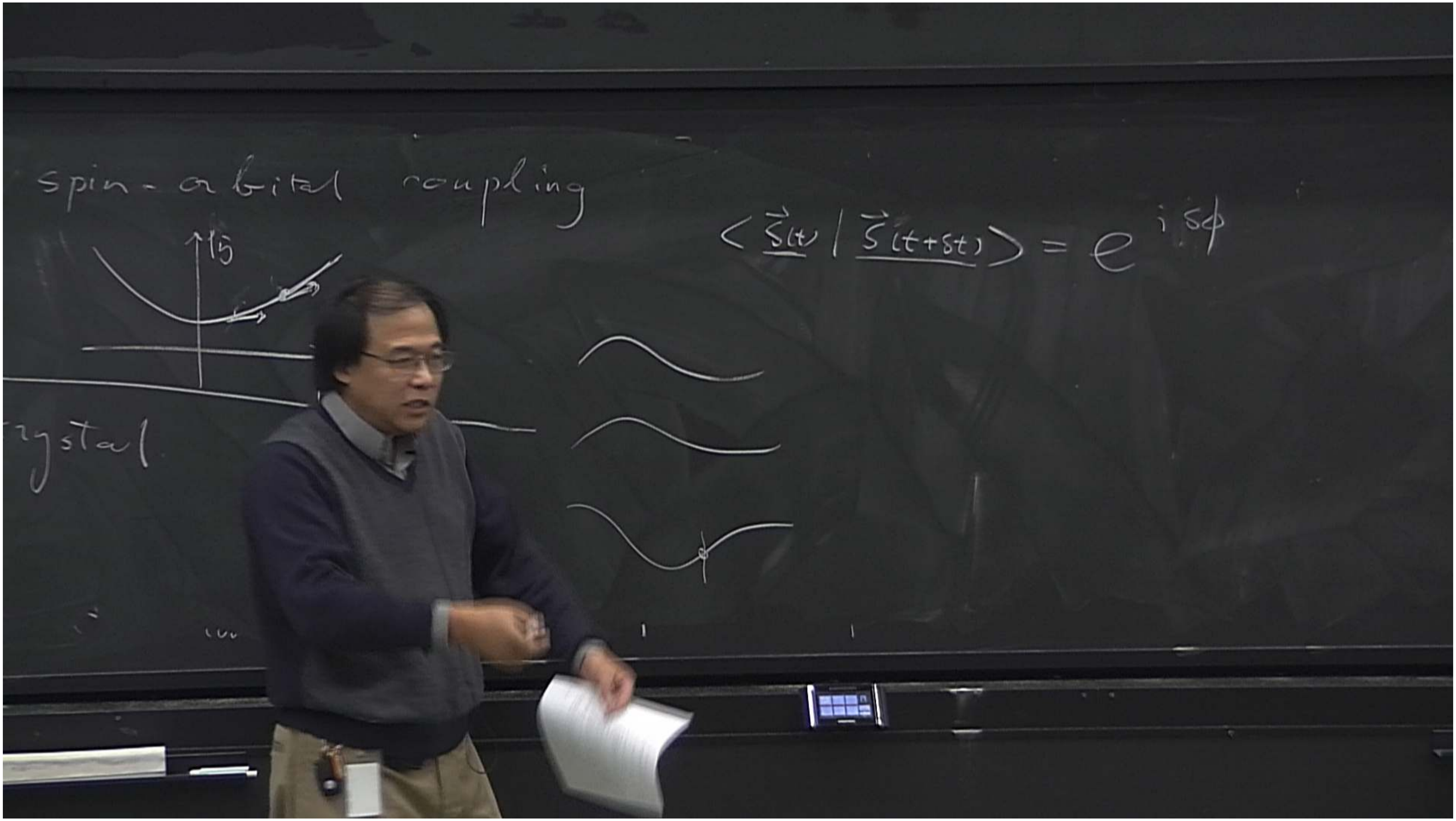
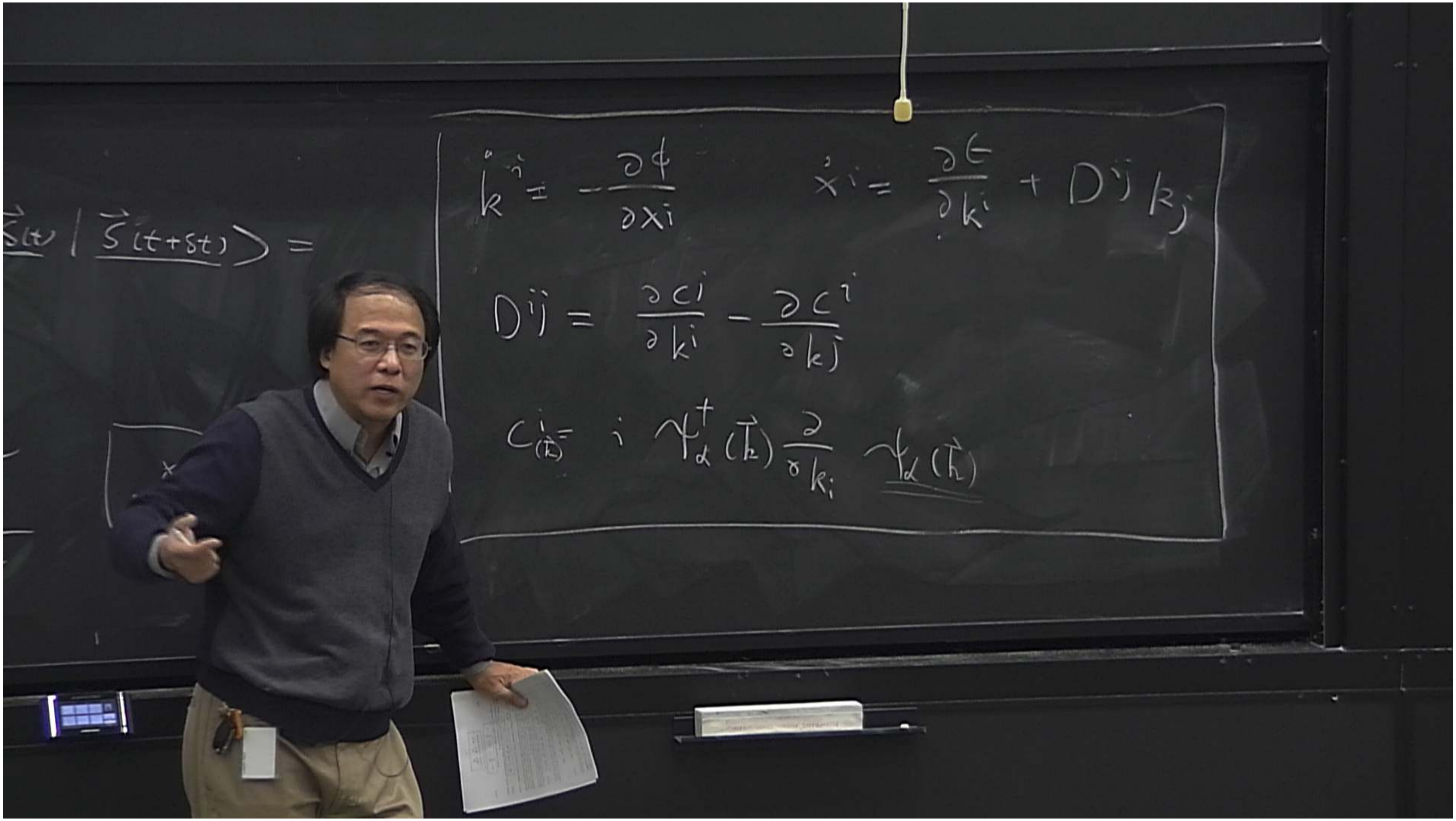
Title: 13/14 PSI - Condensed Matter - Lecture 9

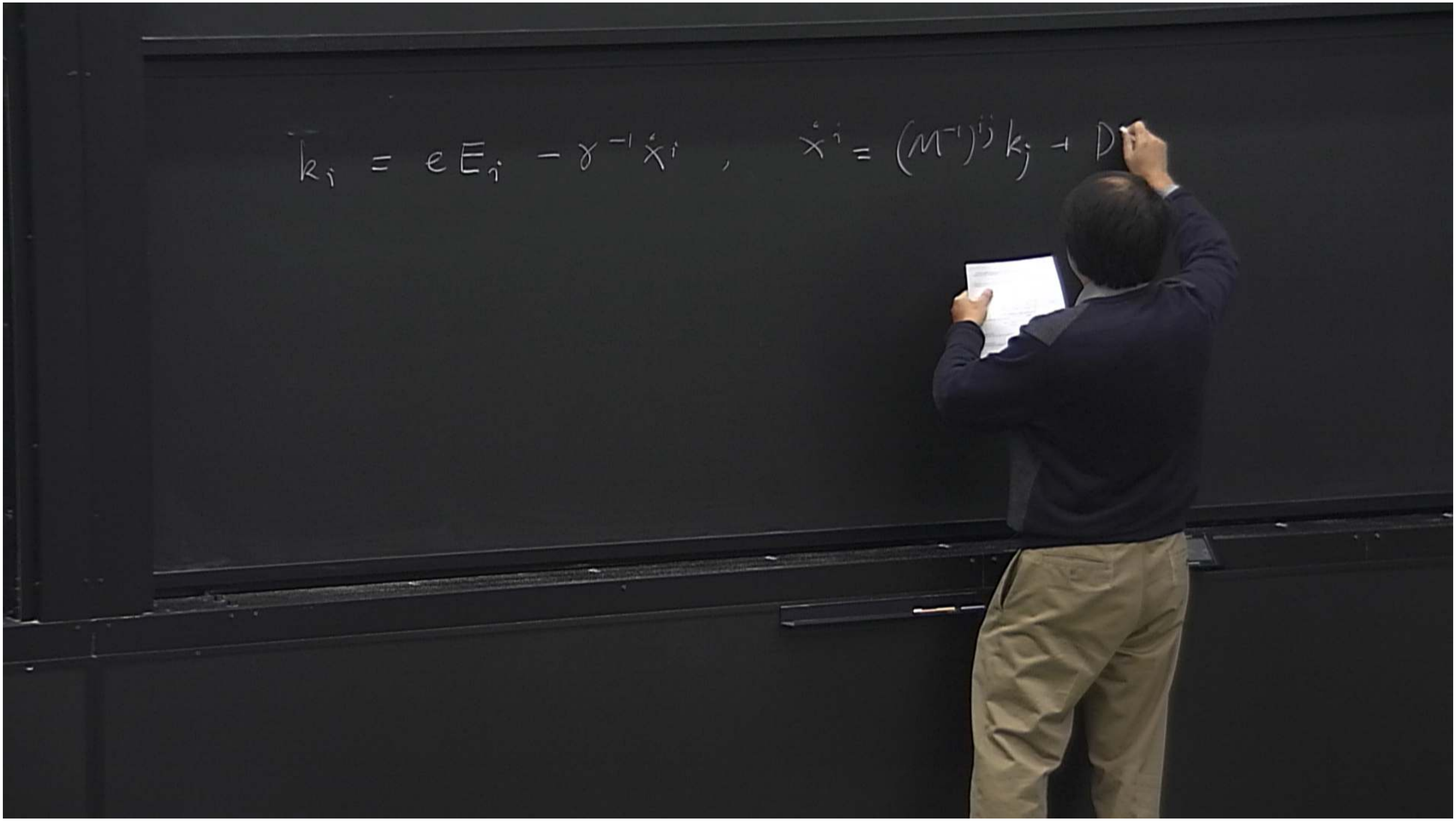
Date: Nov 21, 2013 10:45 AM

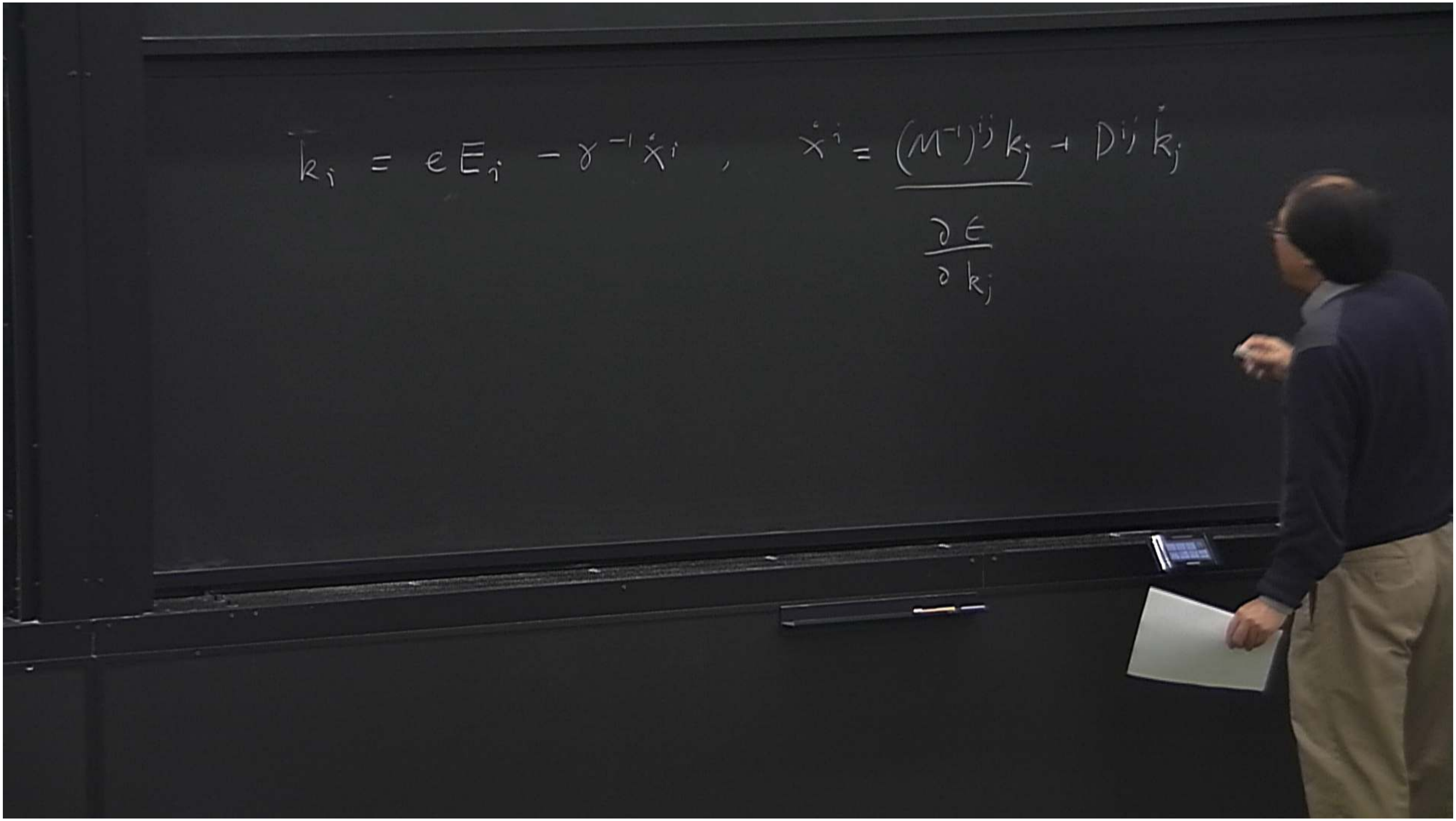
URL: http://pirsa.org/13110037

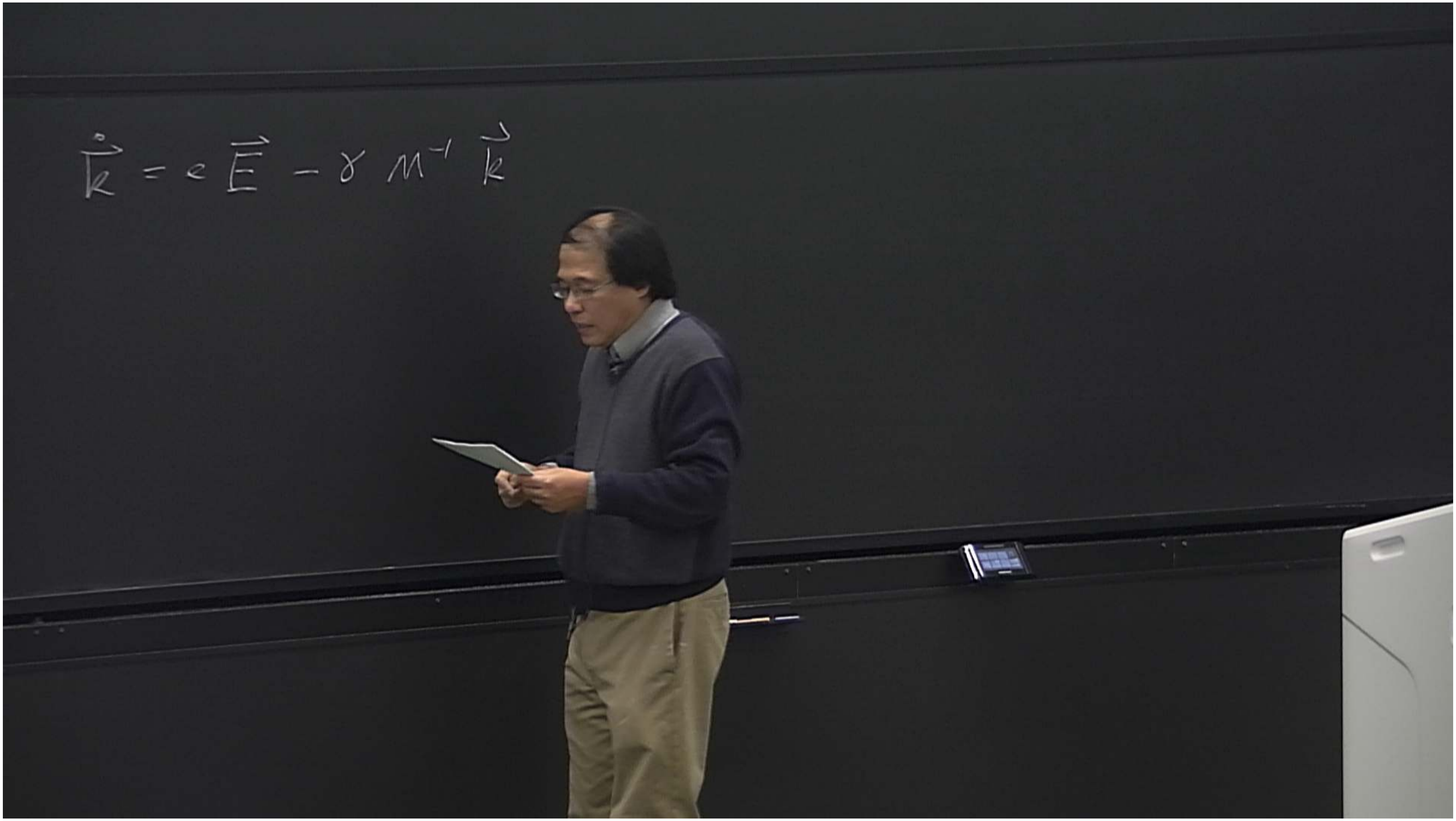
Abstract:

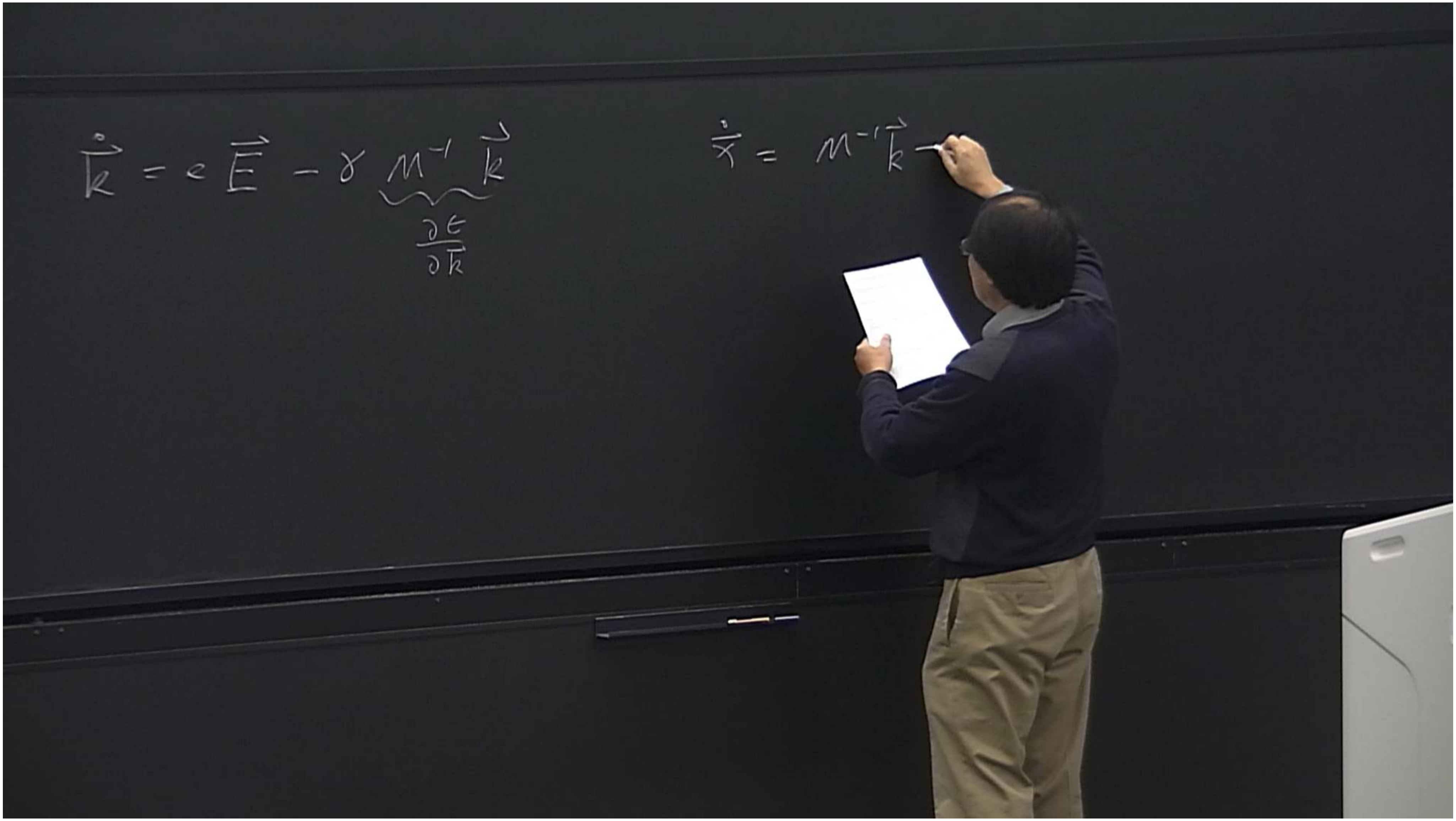

spin-orbital coupling
rystal
$\langle \vec{S}(t) | \vec{S}(t+\delta t) \rangle = e^{i\delta\phi}$

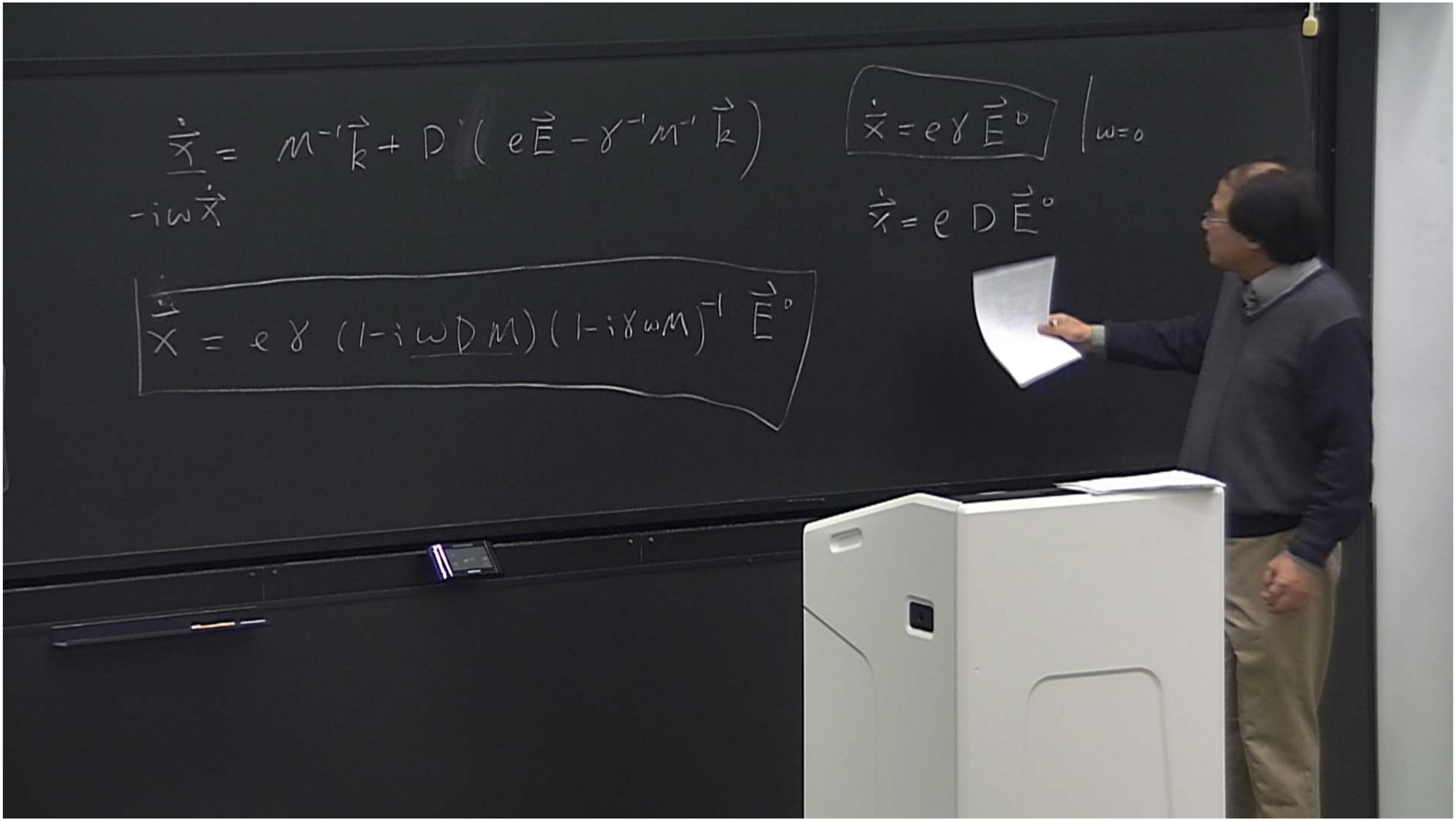

$\dot{k}^i = -\frac{\partial\phi}{\partial x^i}$
$\dot{x}^i = \frac{\partial\epsilon}{\partial k^i} + D^{ij} k_j$
$D^{ij} = \frac{\partial c^j}{\partial k^i} - \frac{\partial c^i}{\partial k^j}$
$c^i_{(\vec{k})} = i\,\psi^\dagger_\alpha(\vec{k}) \frac{\partial}{\partial k_i} \psi_\alpha(\vec{k})$
$\vec{S}(t) | \vec{S}(t+\delta t) \rangle =$

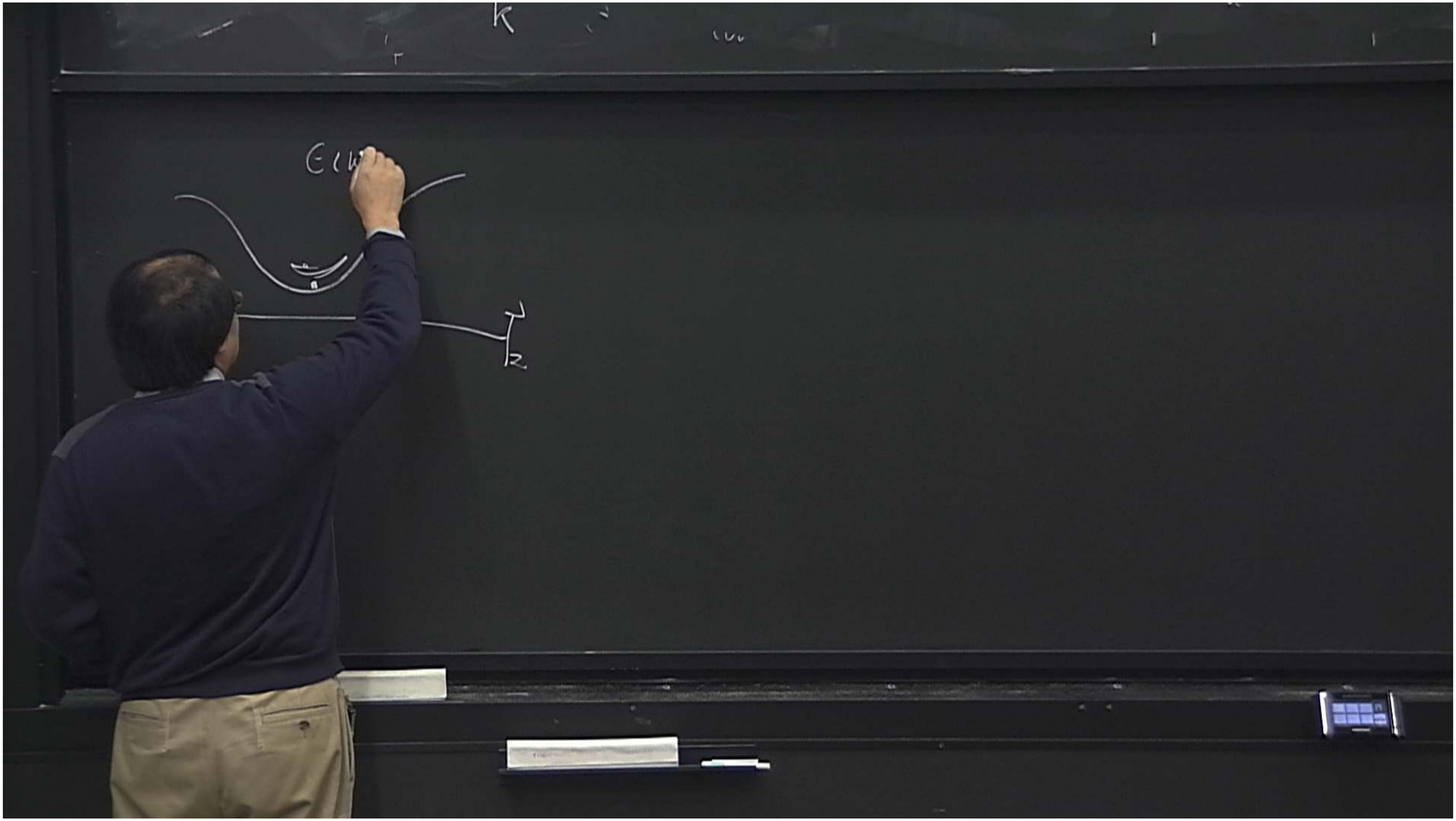

k_i = eE_i − γ^{-1} x^i , x^i = (M^{-1})^{ij} k_j + D

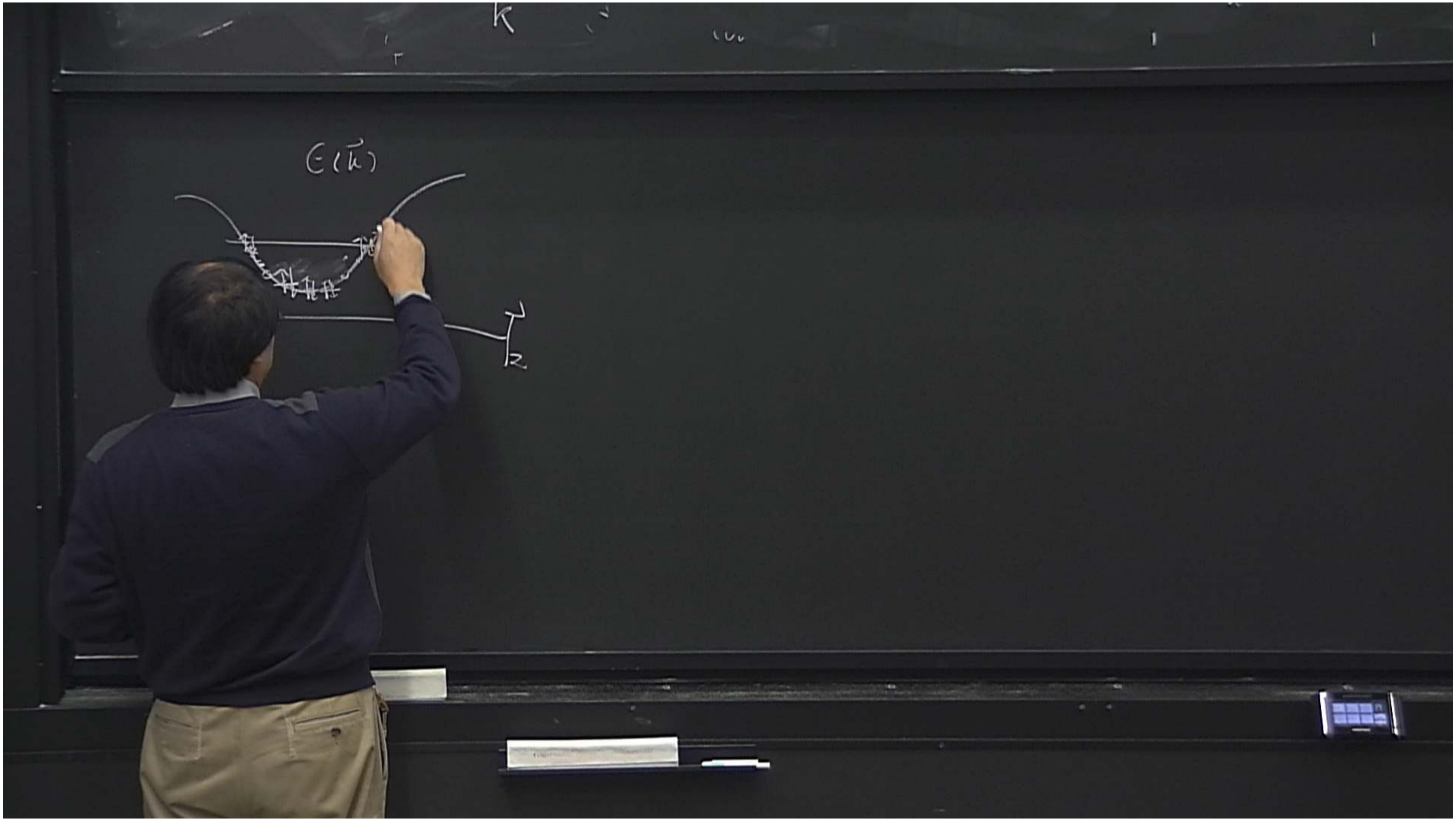

$\dot{k}_i = eE_i - \gamma^{-1}\dot{x}^i$,
$\dot{x}^i = (M^{-1})^{ij} k_j + D^{ij}\dot{k}_j$
$\frac{\partial \epsilon}{\partial k_j}$


$\dot{\vec{k}} = e\vec{E} - \gamma m^{-1}\vec{k}$

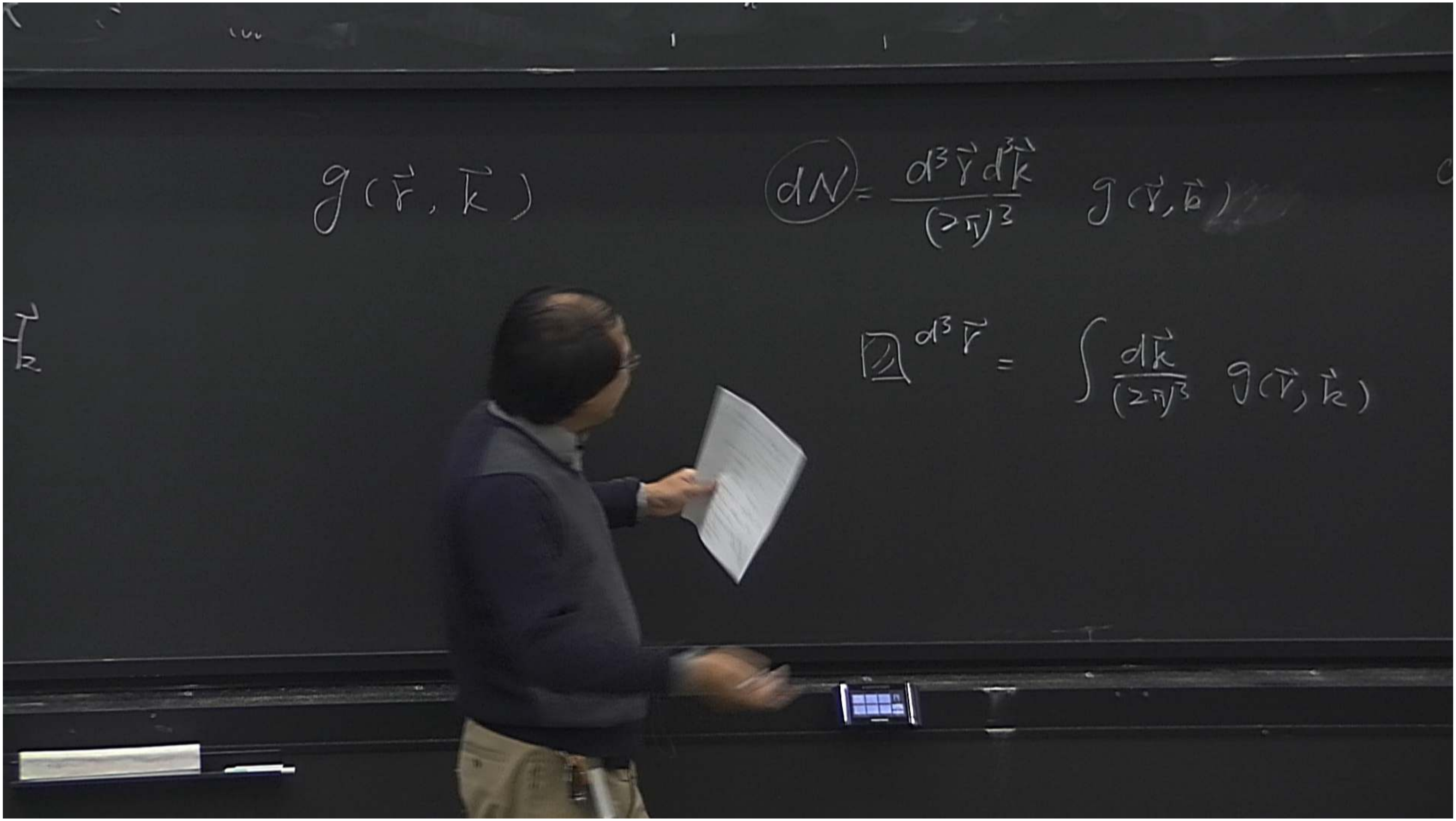

$\dot{\vec{k}} = e\vec{E} - \gamma\, m^{-1}\vec{k}$
$\frac{\partial \epsilon}{\partial \vec{k}}$
$\dot{\vec{x}} = m^{-1}\vec{k} -$

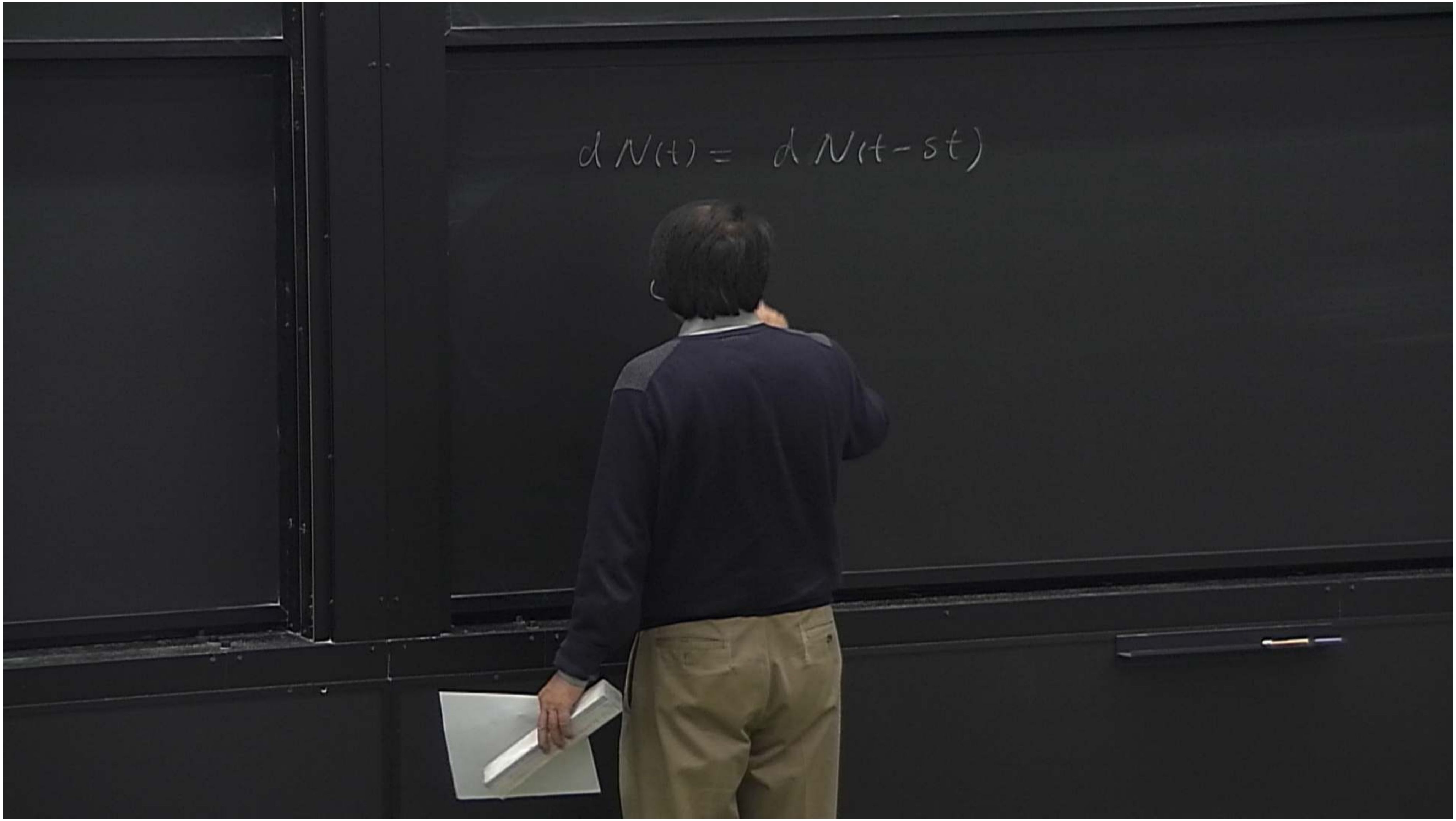

$\dot{\vec{x}} = m^{-1}\vec{k} + D(e\vec{E} - \gamma^{-1}m^{-1}\vec{k})$
$-i\omega\dot{\vec{x}}$
$\dot{\vec{x}} = e\gamma\vec{E}^0$
$|_{\omega=0}$
$\dot{\vec{x}} = eD\vec{E}^0$
$\dot{X} = e\gamma(1-i\omega DM)(1-i\gamma\omega M)^{-1}\vec{E}^0$

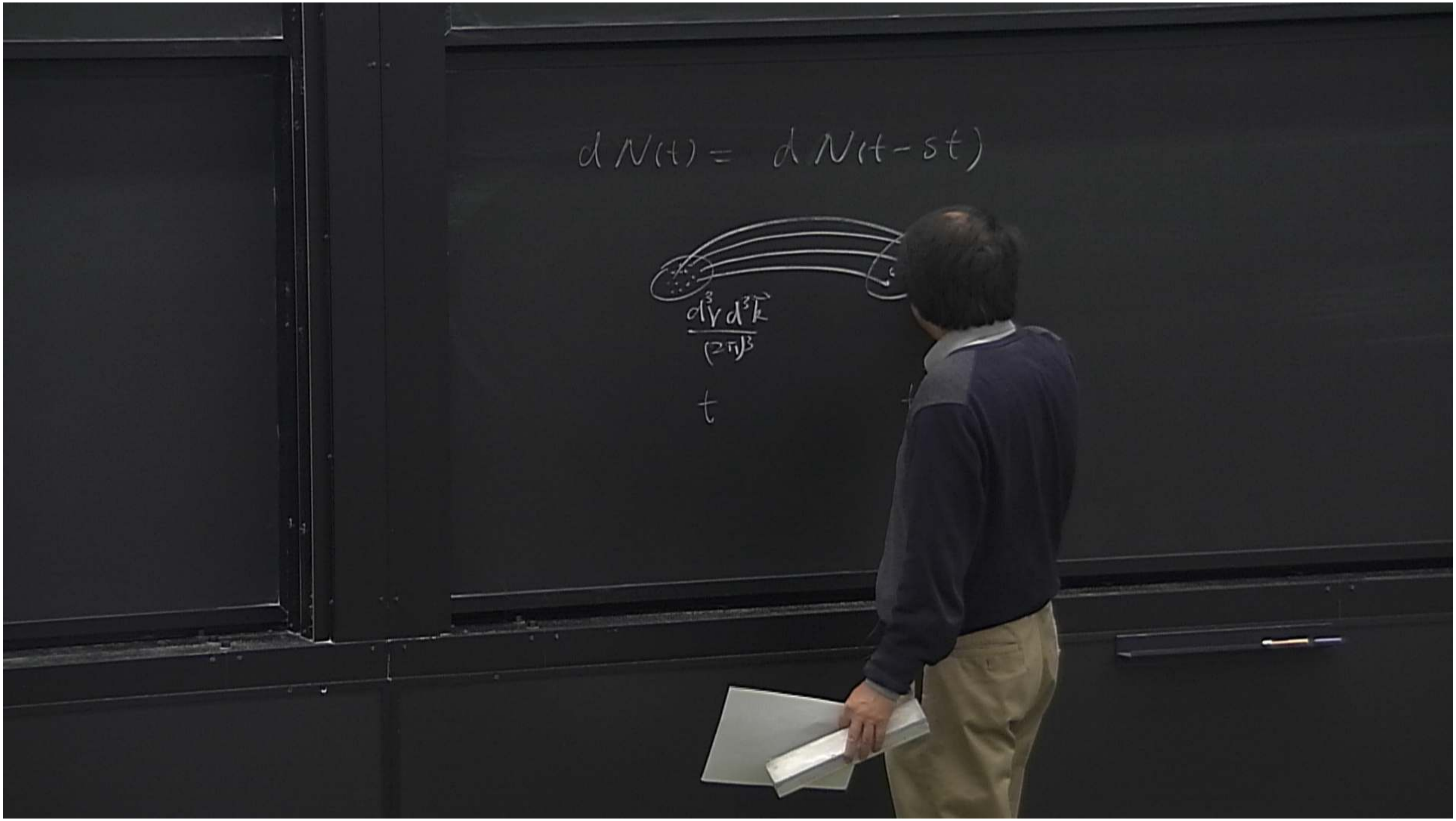


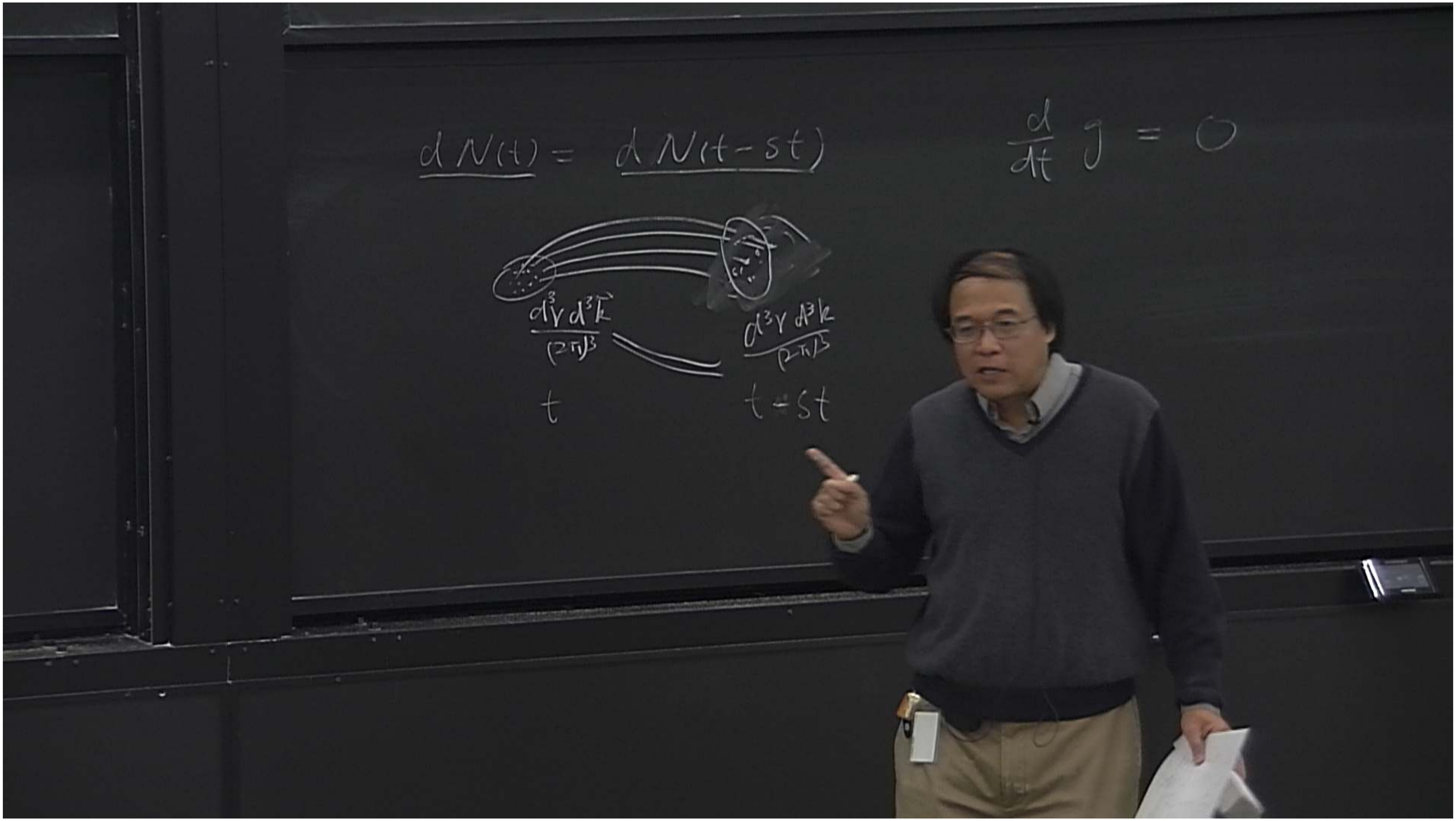


ε(k⃗)

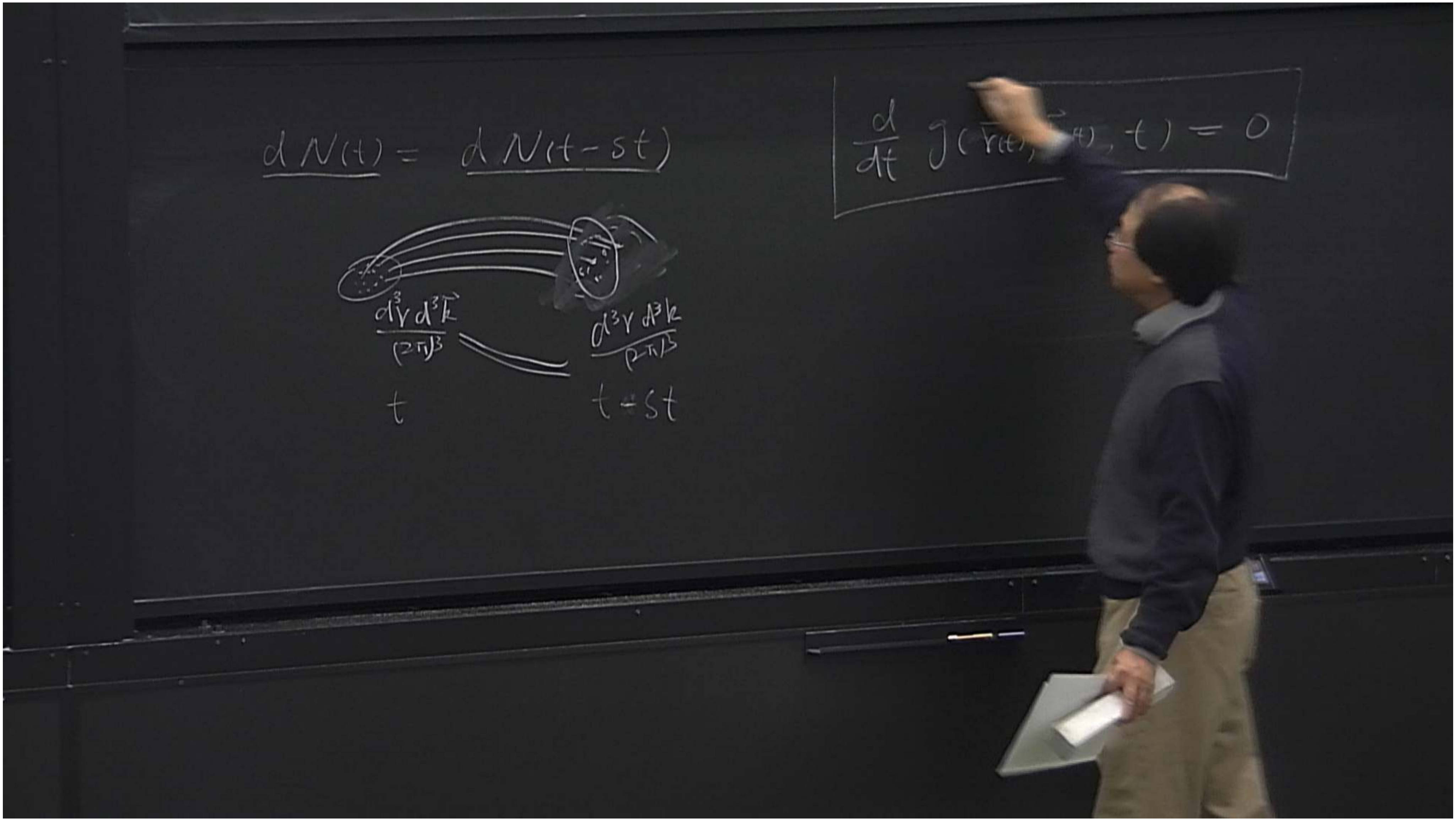

g(r, k)
dN = d^3r d^3k / (2π)^3 g(r, k)
d^3r = ∫ dk / (2π)^3 g(r, k)


dN(t) = dN(t-st)

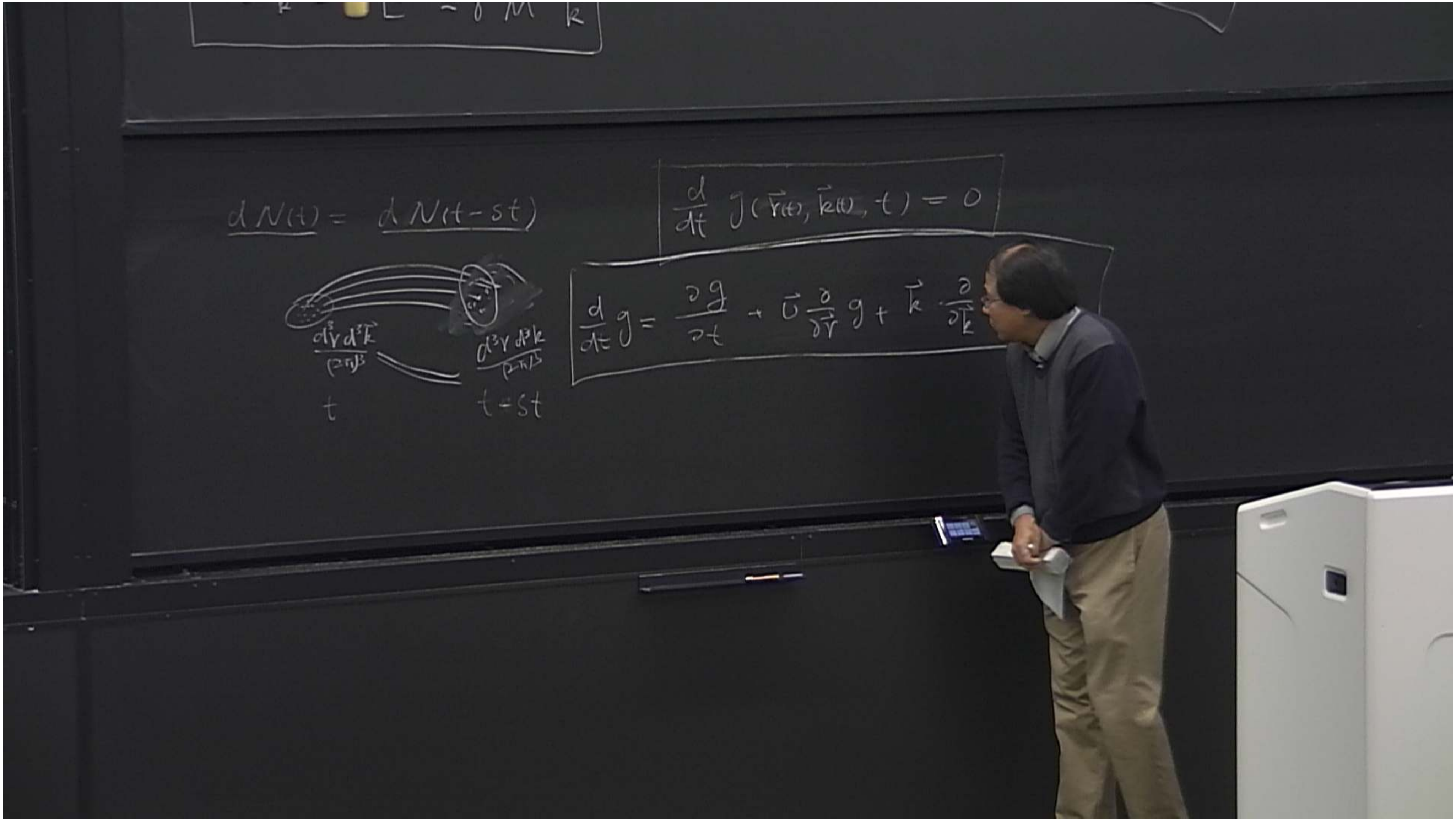

dN(t) = dN(t - δt)
d³r d³k / (2π)³
t

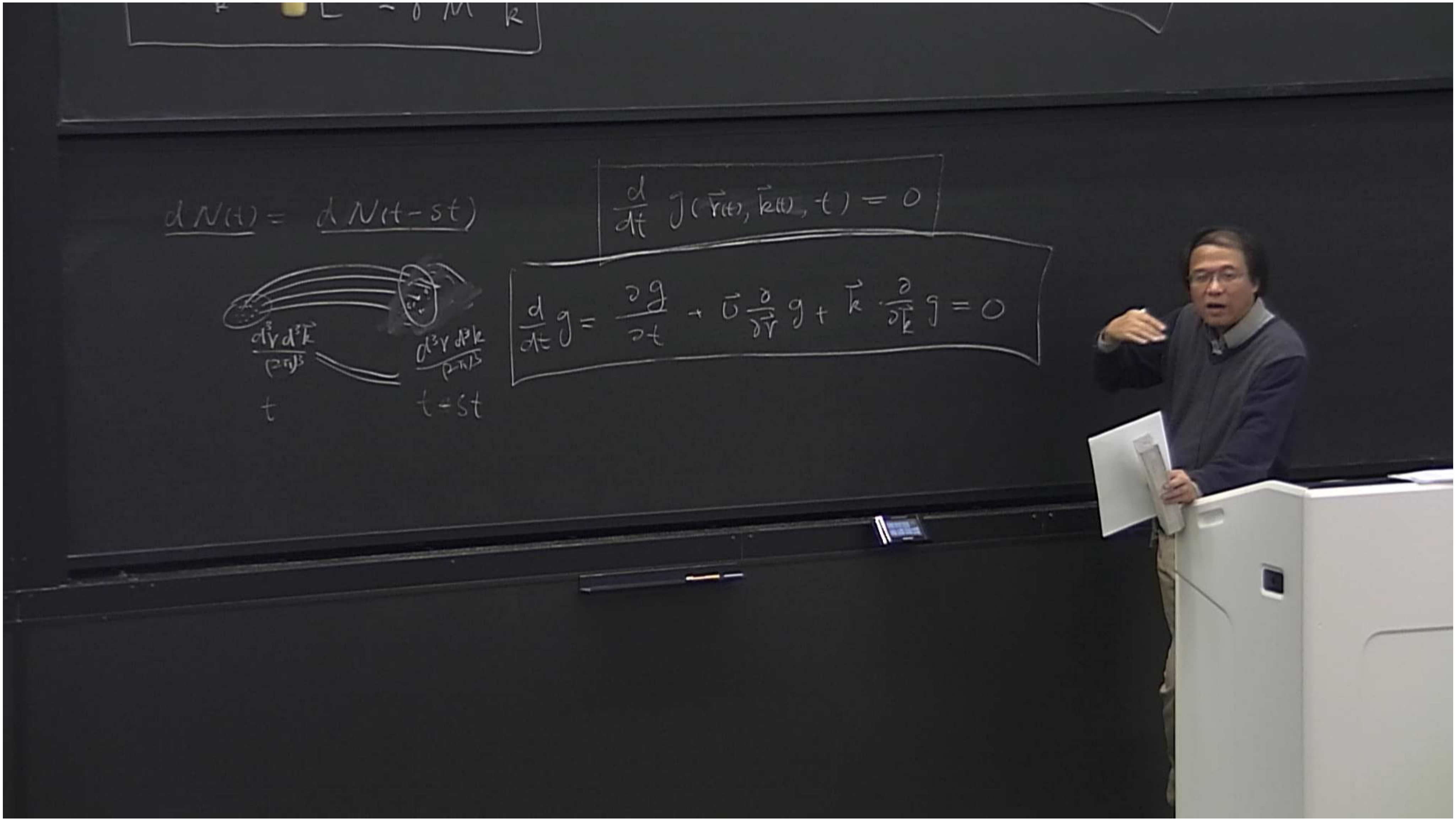


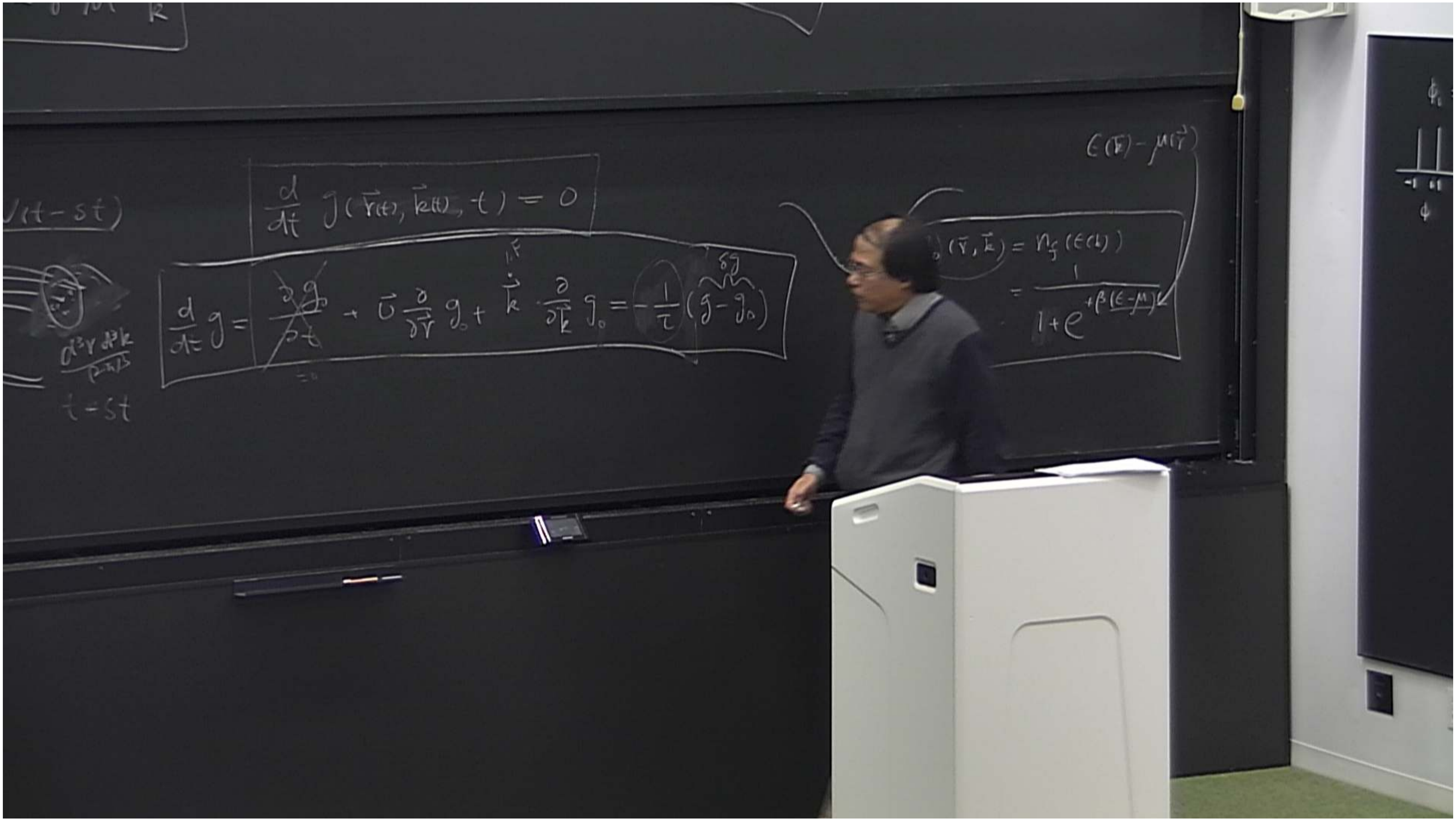
d N(t) = d N(t − δt)
d/dt g = 0
d³r d³k / (2π)³
d³r d³k / (2π)³
t
t + δt

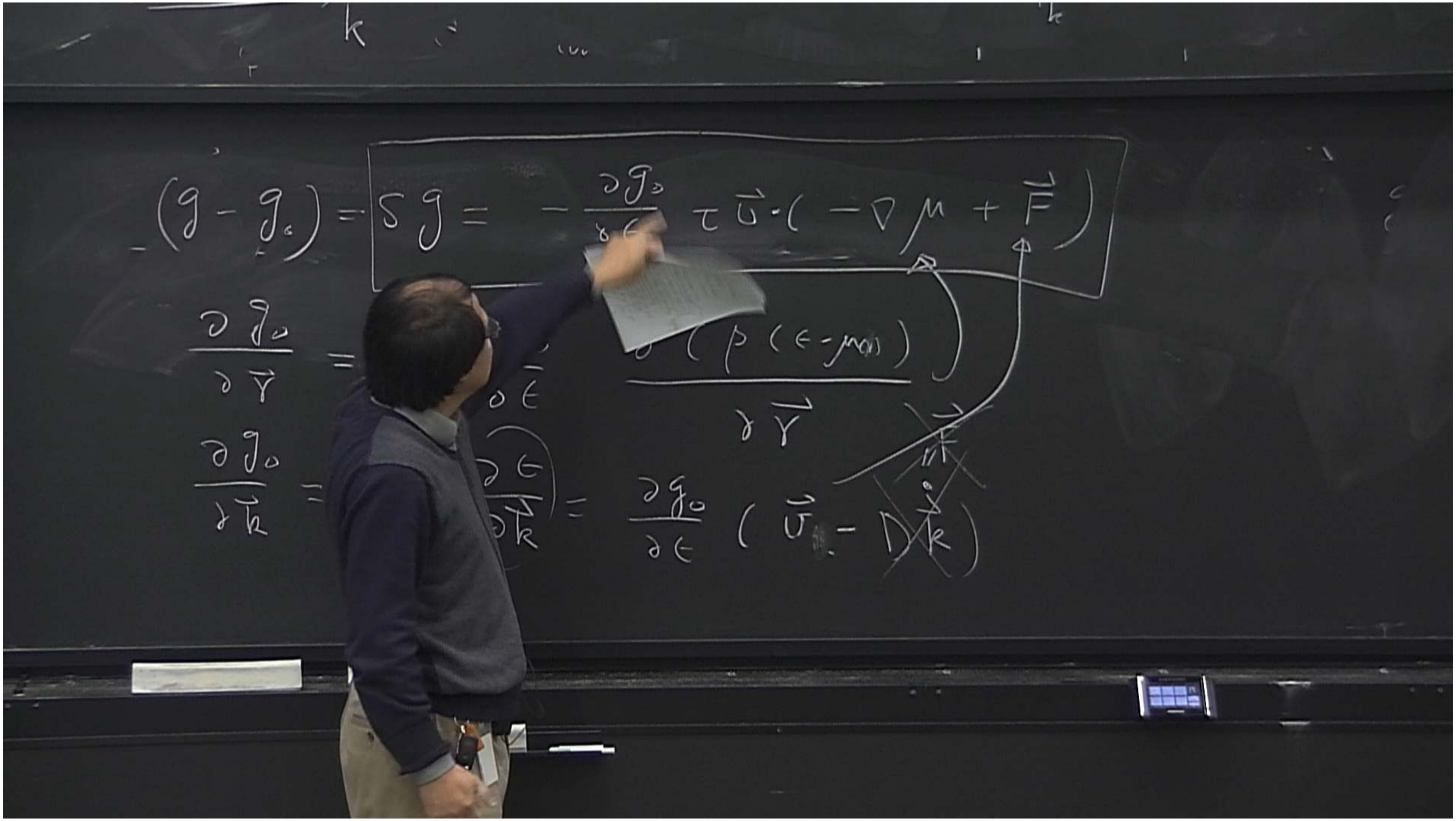


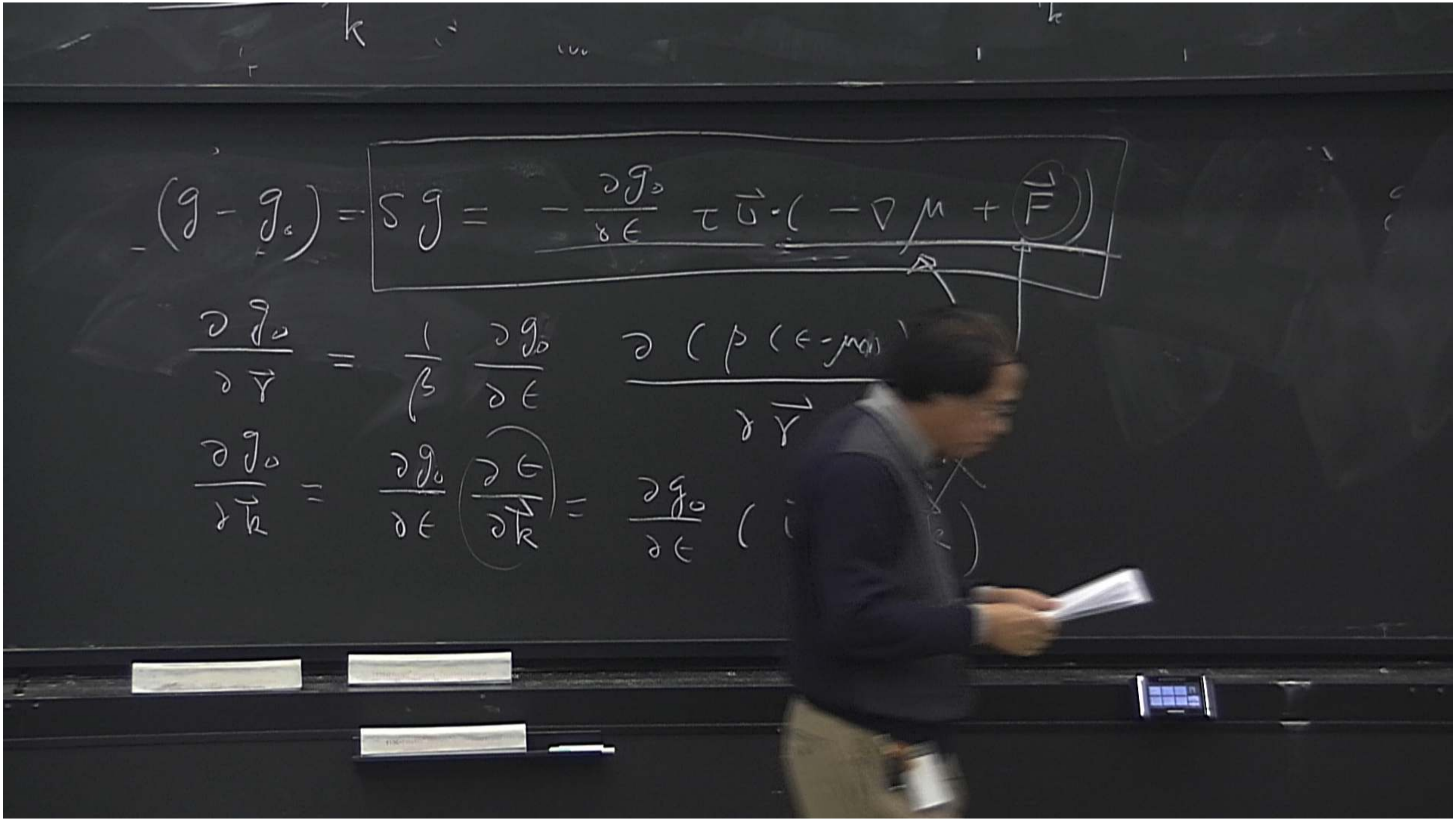
d N(t) = d N(t-δt)
d/dt g(r(t), k(t), t) = 0
d³r d³k / (2π)³
d³r d³k / (2π)³
t
t+δt

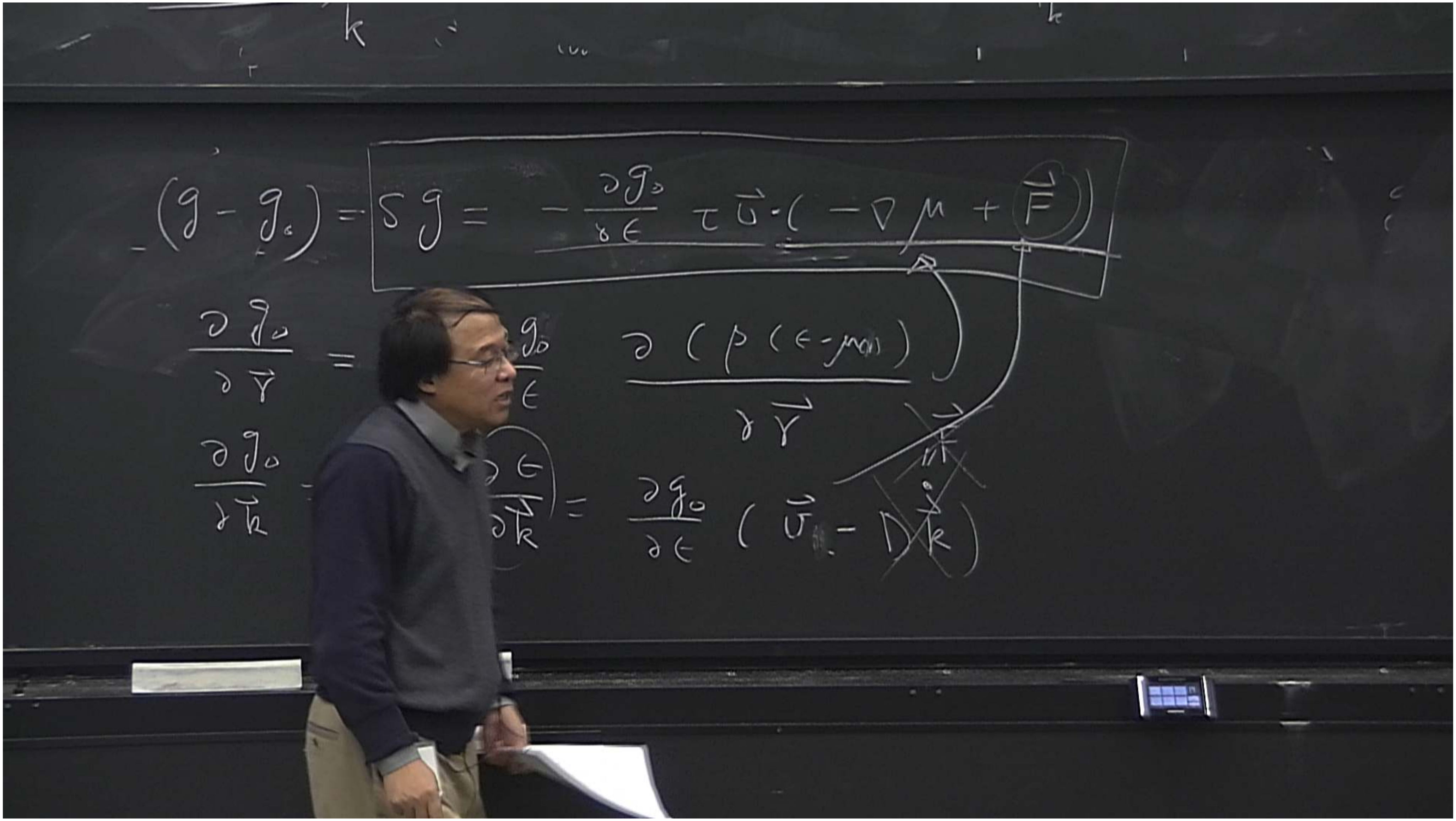

dN(t) = dN(t - δt)
d/dt g(r(t), k(t), t) = 0
d/dt g = ∂g/∂t + v ∂/∂r g + k · ∂/∂k
t
t - δt

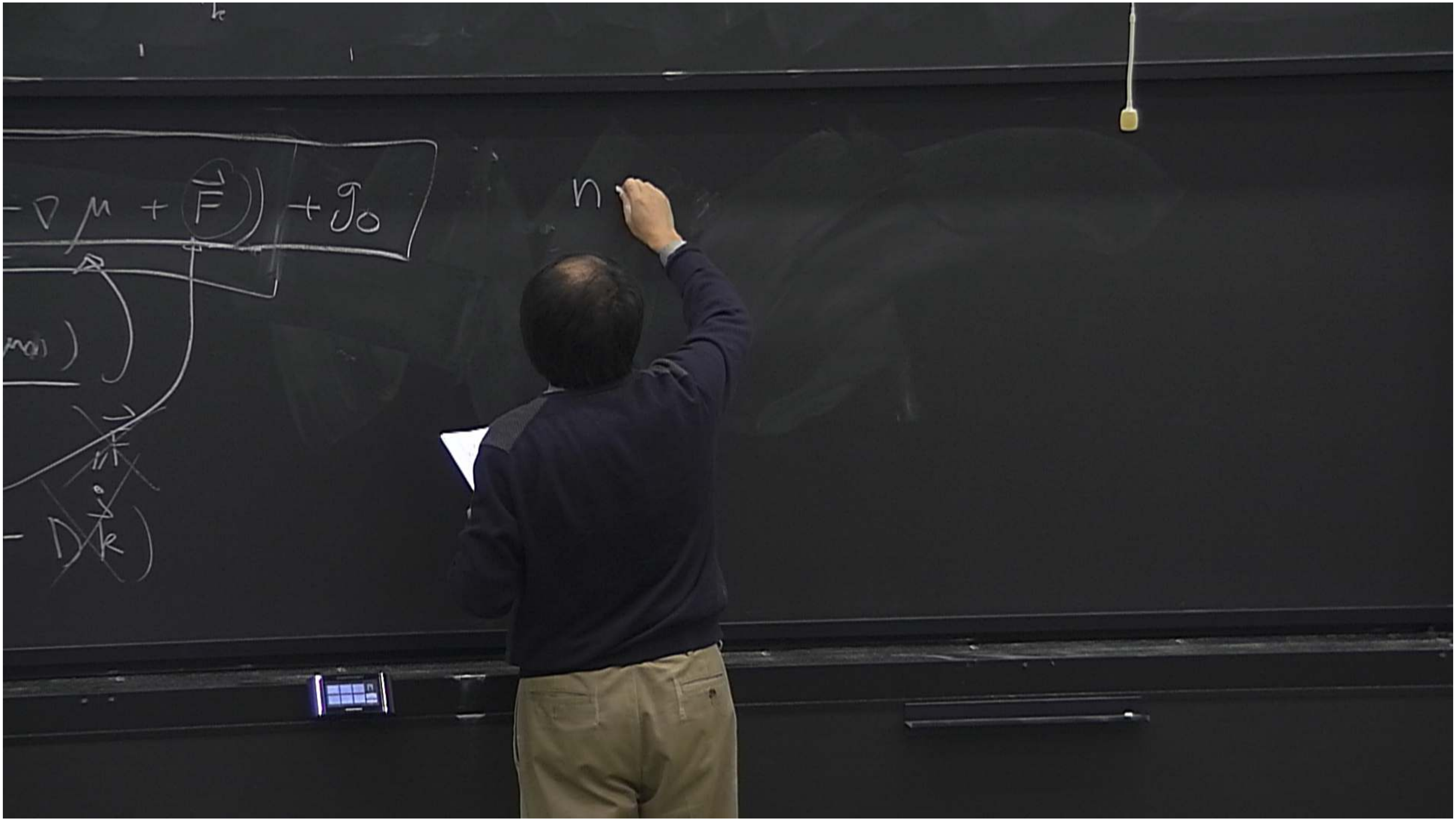

dN(t) = dN(t−δt)
d/dt g(r(t), k(t), t) = 0
d/dt g = ∂g/∂t + v ∂/∂r g + k · ∂/∂k g = 0
d³r d³k / (2π)³
d³r d³k / (2π)³
t
t+δt

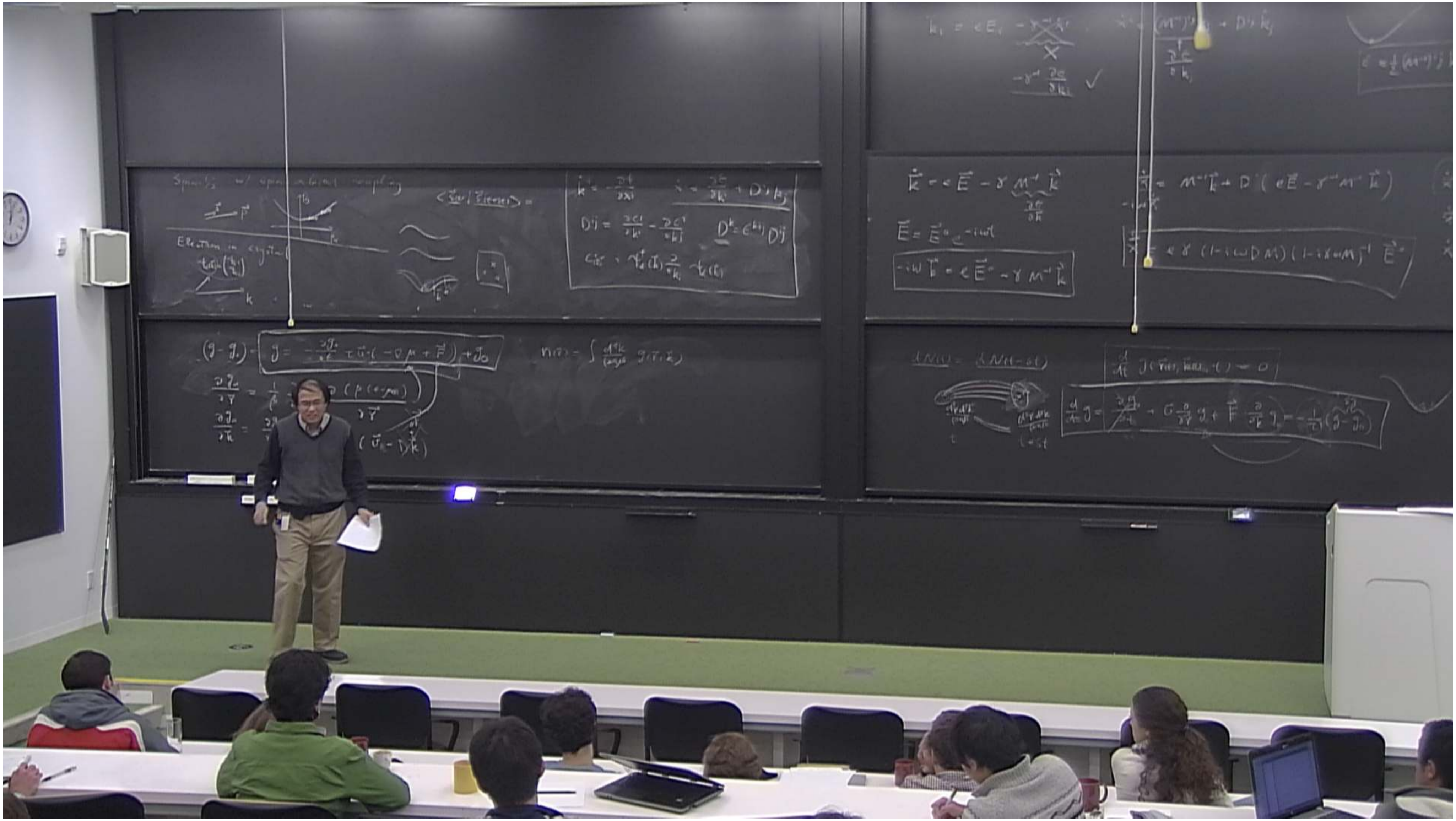


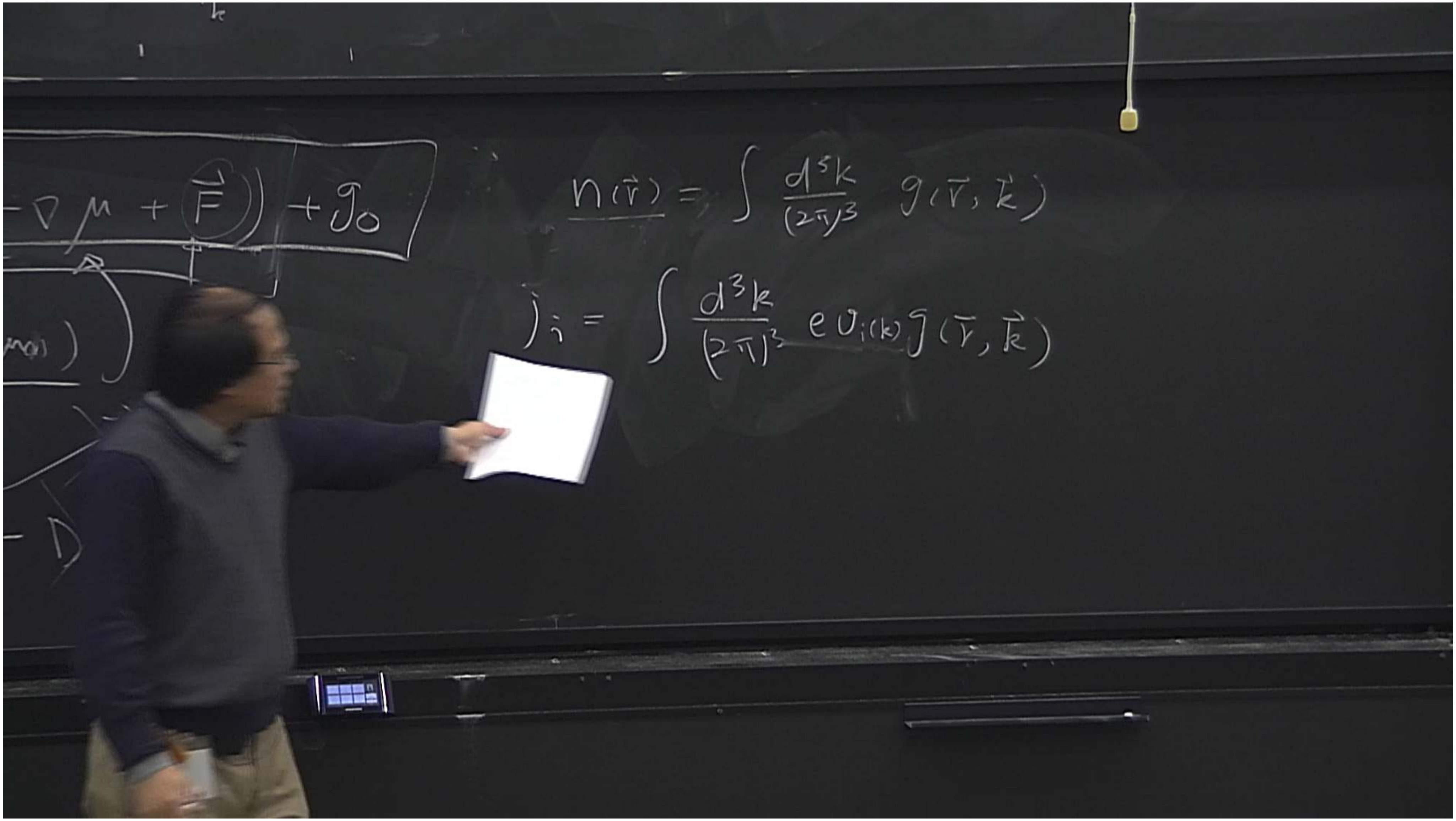

(g - g₀) = δg = - ∂g₀/∂ε τ v·(-∇μ + F)

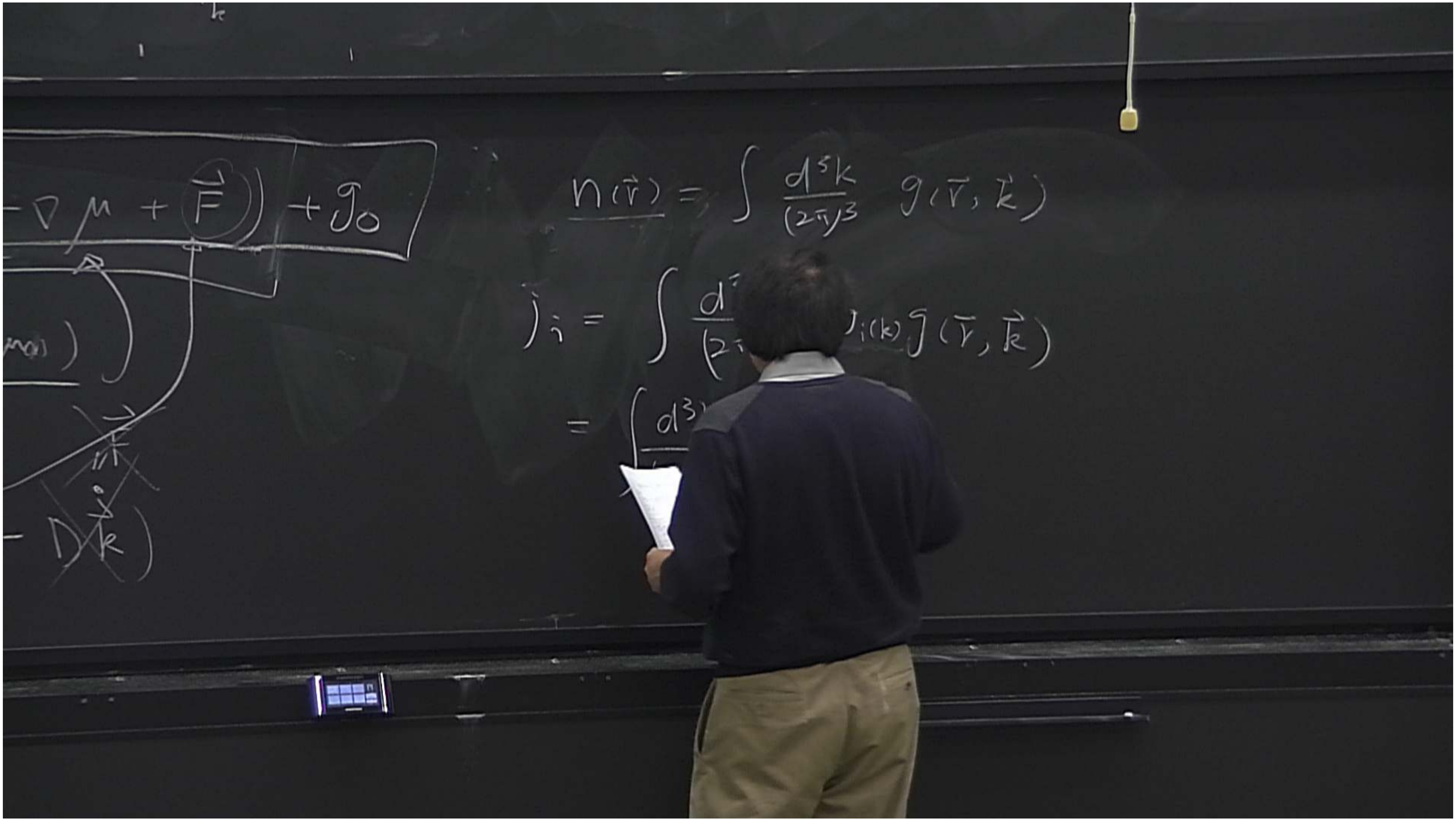


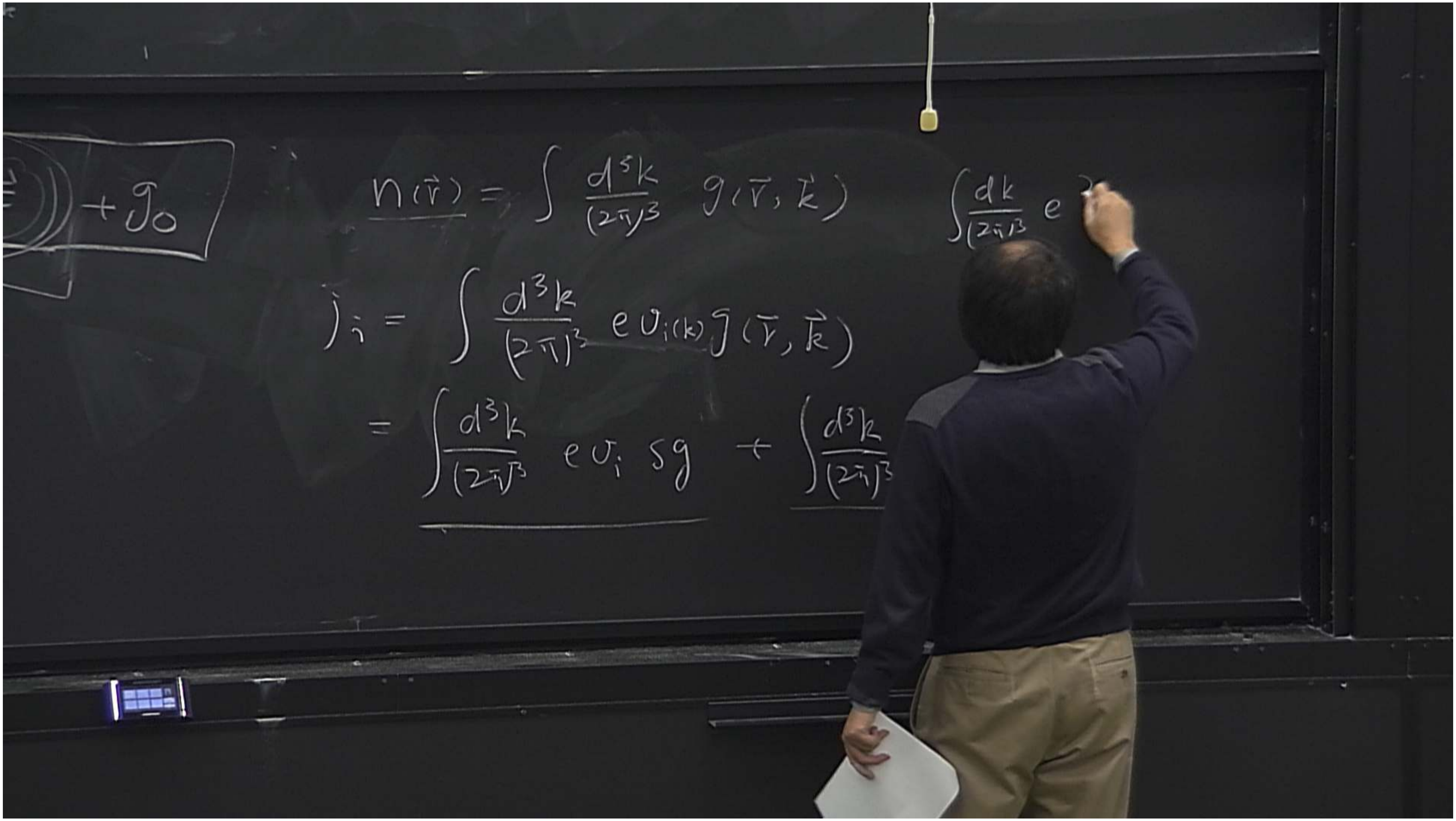

(g - g₀) = δg = - ∂g₀/∂ε τ v · (- ∇μ + F)

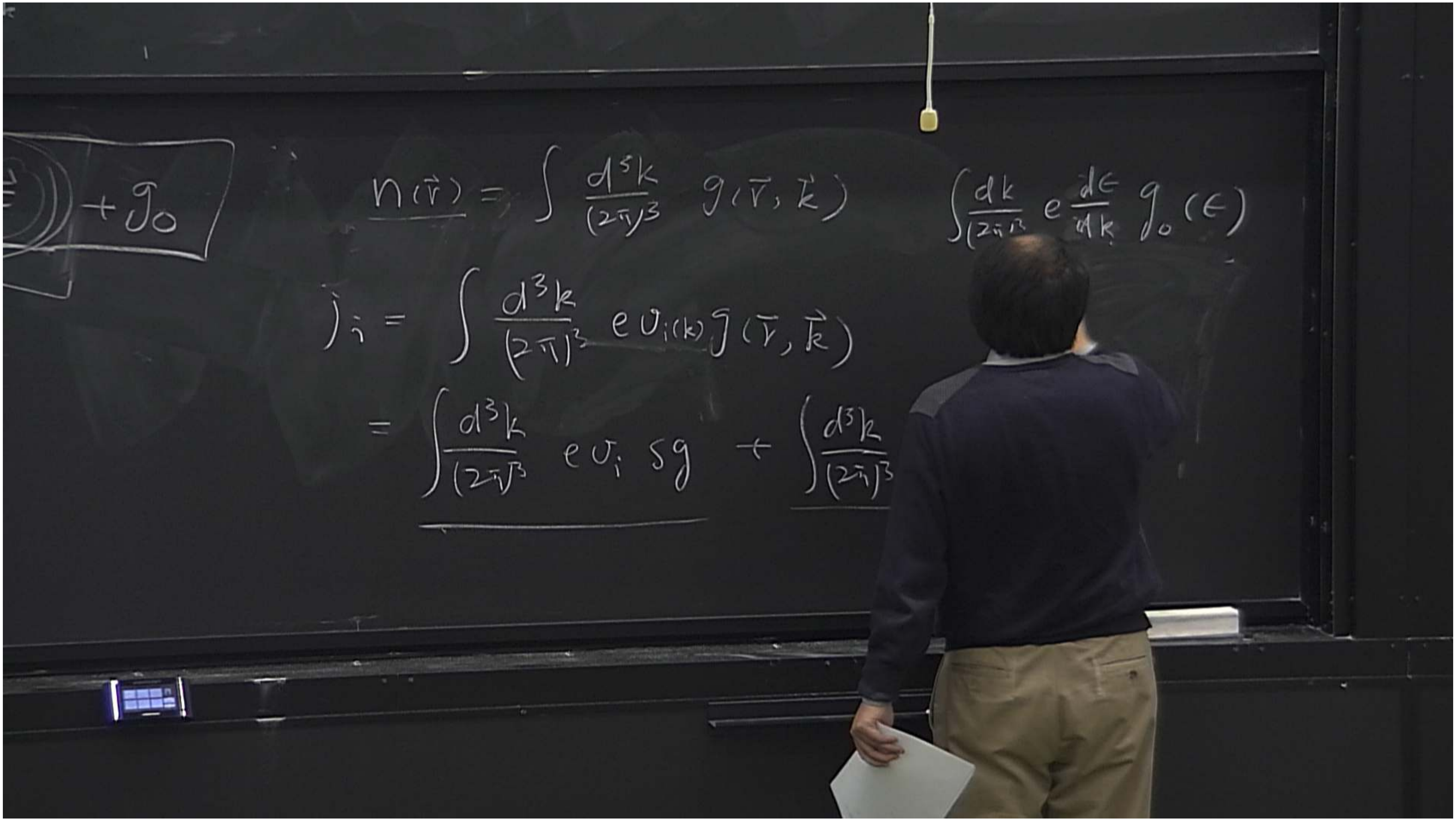


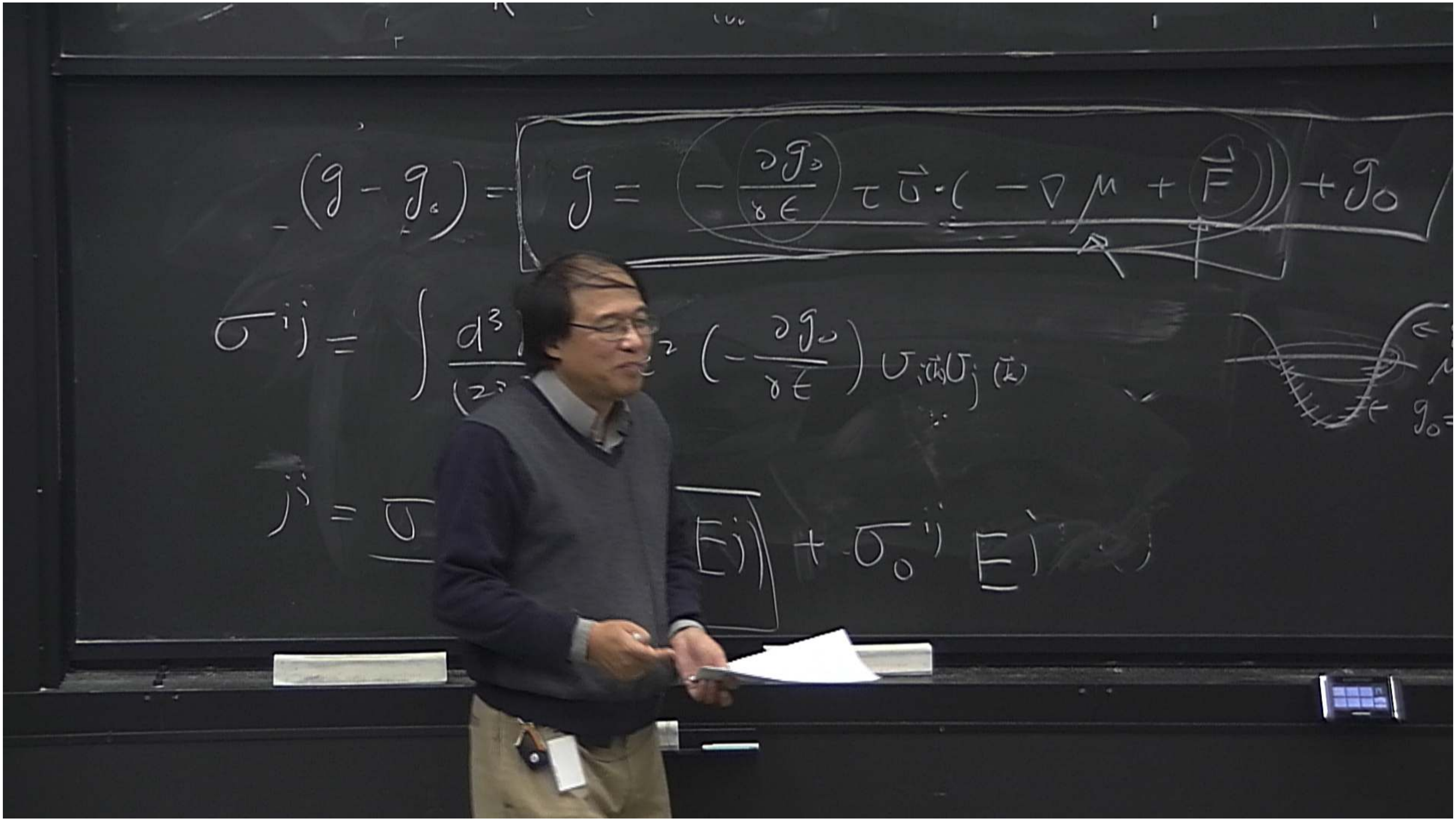



$n(\vec{r}) = \int \frac{d^3k}{(2\pi)^3} g(\vec{r}, \vec{k})$
$j_i = \int \frac{d^3k}{(2\pi)^3} e v_i(k) g(\vec{r}, \vec{k})$

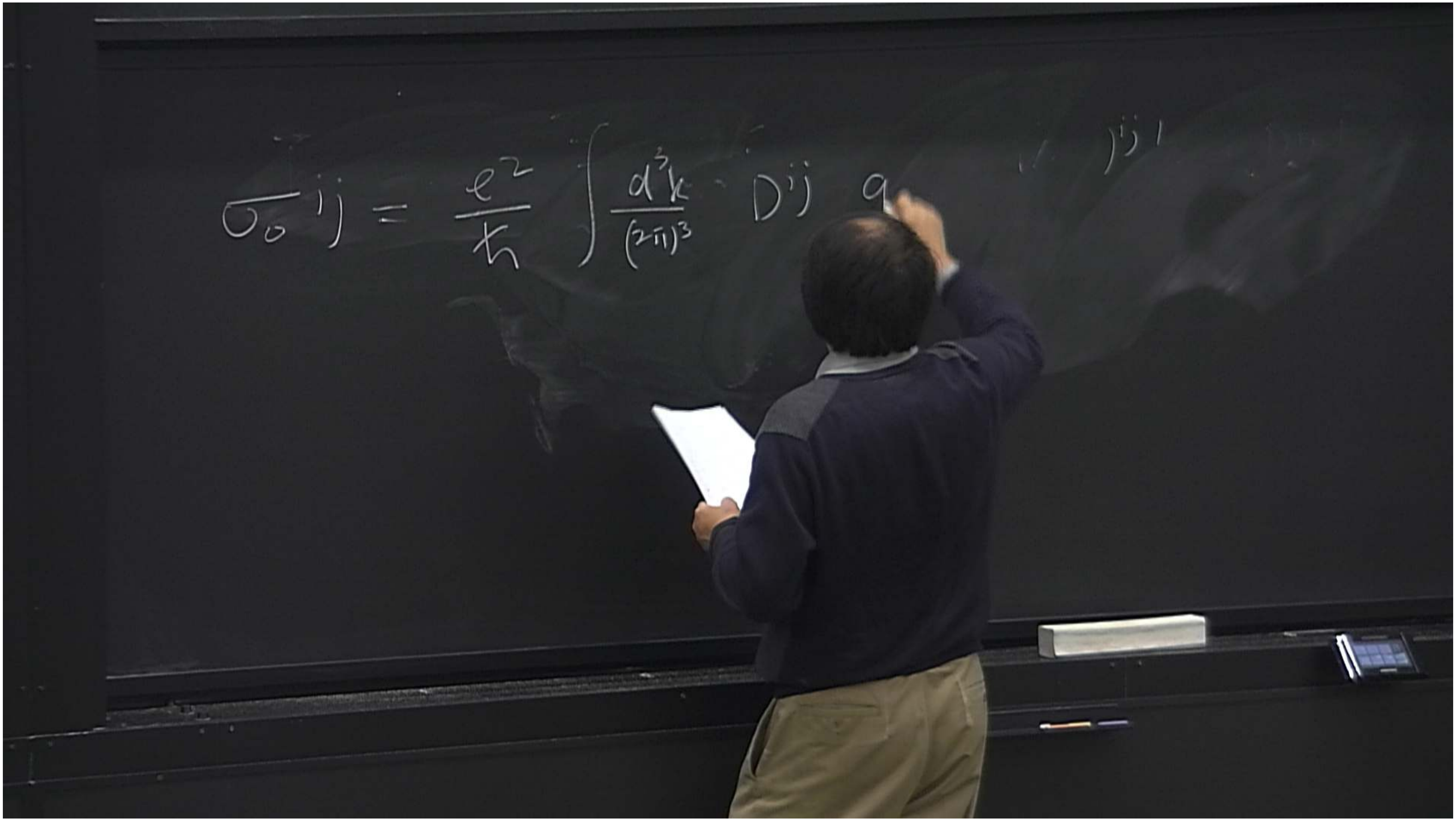

n(r) = ∫ d³k/(2π)³ g(r, k)

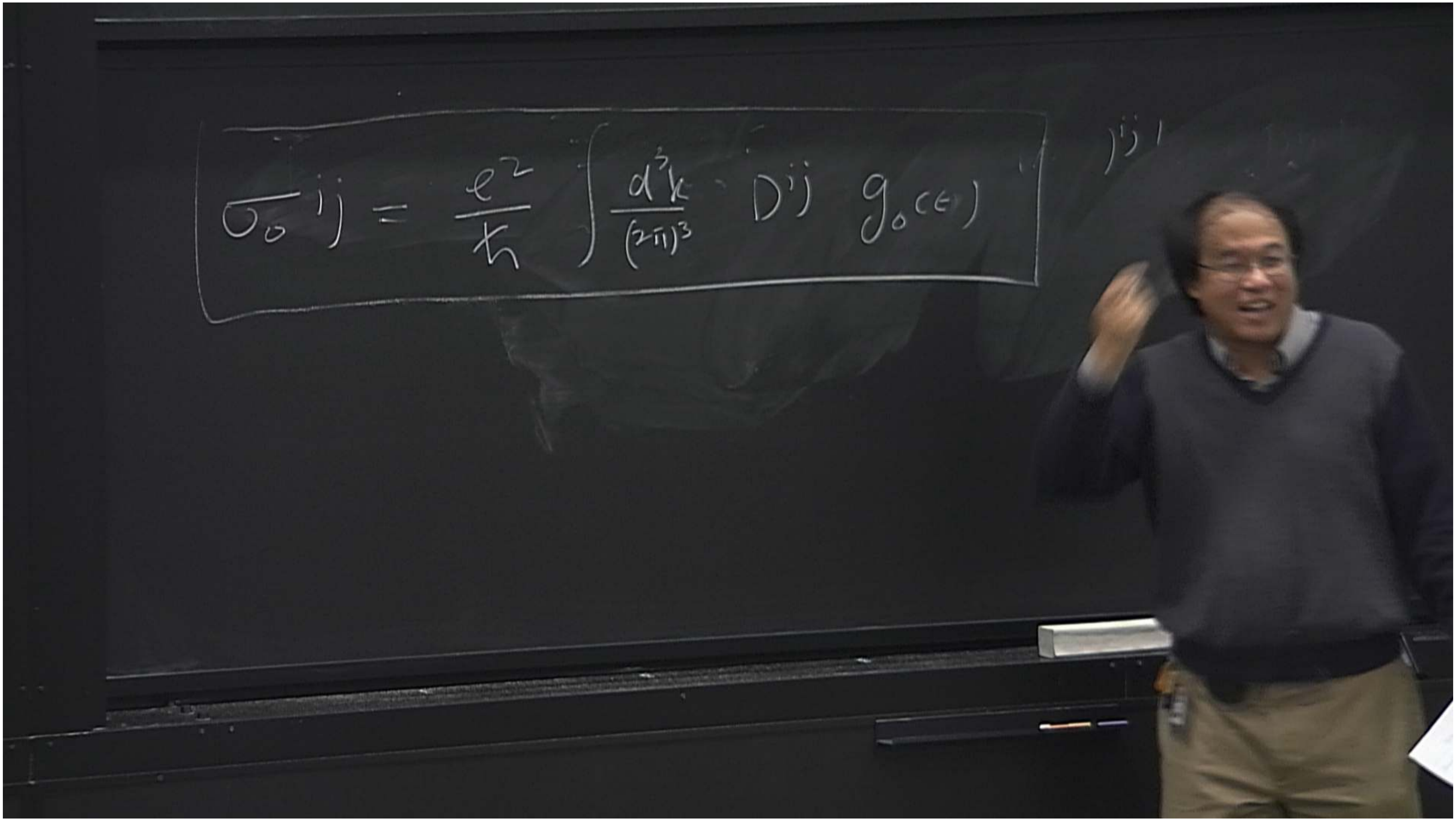

+ g_0
$n(\vec{r}) = \int \frac{d^3k}{(2\pi)^3} g(\vec{r}, \vec{k})$
$\int \frac{dk}{(2\pi)^3} e$
$j_i = \int \frac{d^3k}{(2\pi)^3} e v_i(k) g(\vec{r}, \vec{k})$
$= \int \frac{d^3k}{(2\pi)^3} e v_i \delta g + \int \frac{d^3k}{(2\pi)^3}$


+ g_0
n(r⃗) = ∫ d³k/(2π)³ g(r⃗, k⃗)
∫ dk/(2π)³ e dε/dk g_0(ε)
j_i = ∫ d³k/(2π)³ e v_i(k) g(r⃗, k⃗)
= ∫ d³k/(2π)³ e v_i δg + ∫ d³k/(2π)³



$(g - g_0) =$
$g = \left(-\frac{\partial g_0}{\partial \epsilon}\right) \tau \vec{v} \cdot (-\nabla \mu + \vec{F}) + g_0$
$\sigma^{ij} =$
$g_0 =$




$\sigma_0^{ij} = \frac{e^2}{\hbar} \int \frac{d^3k}{(2\pi)^3} D^{ij} \, g_0(\epsilon)$