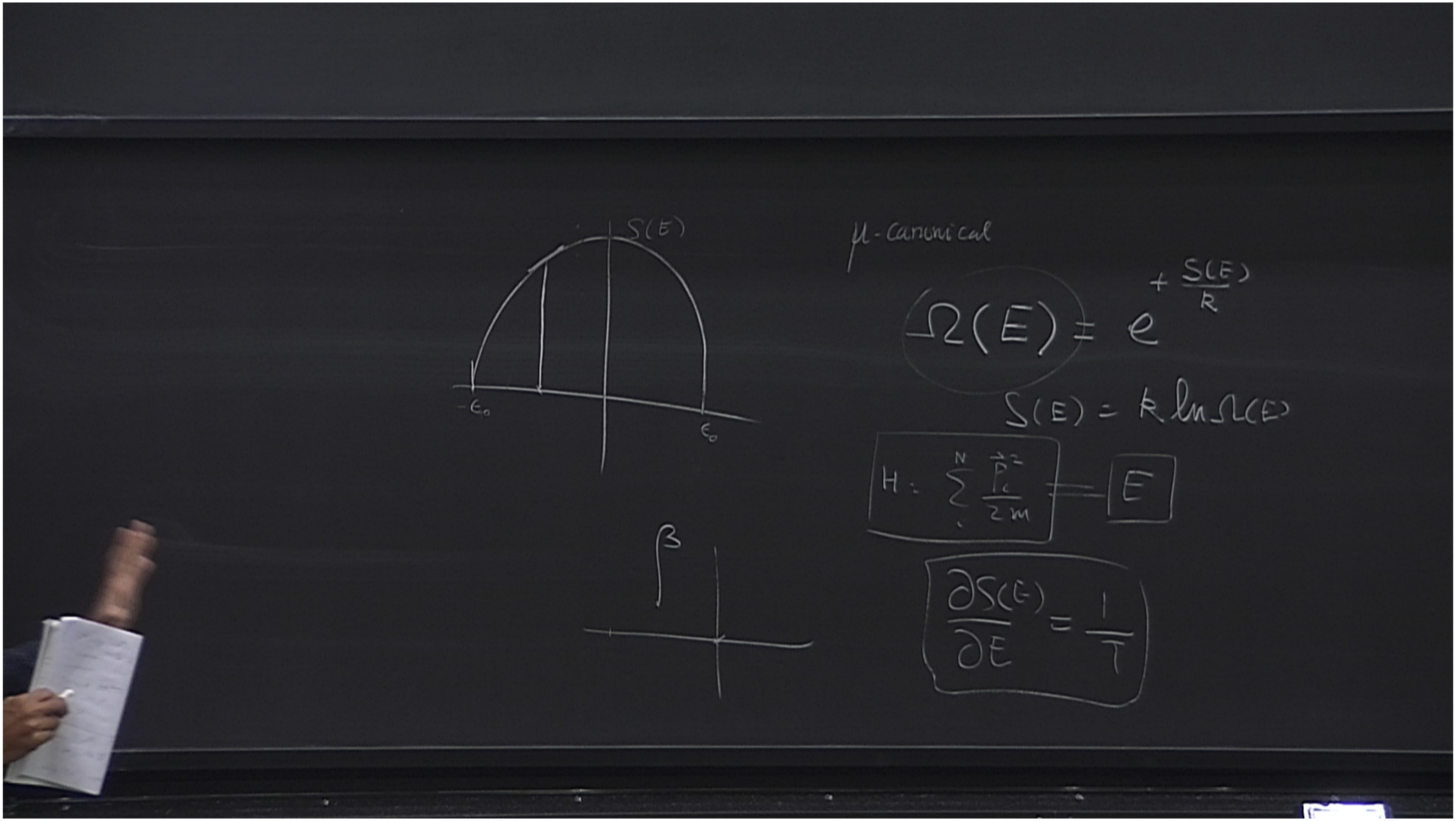
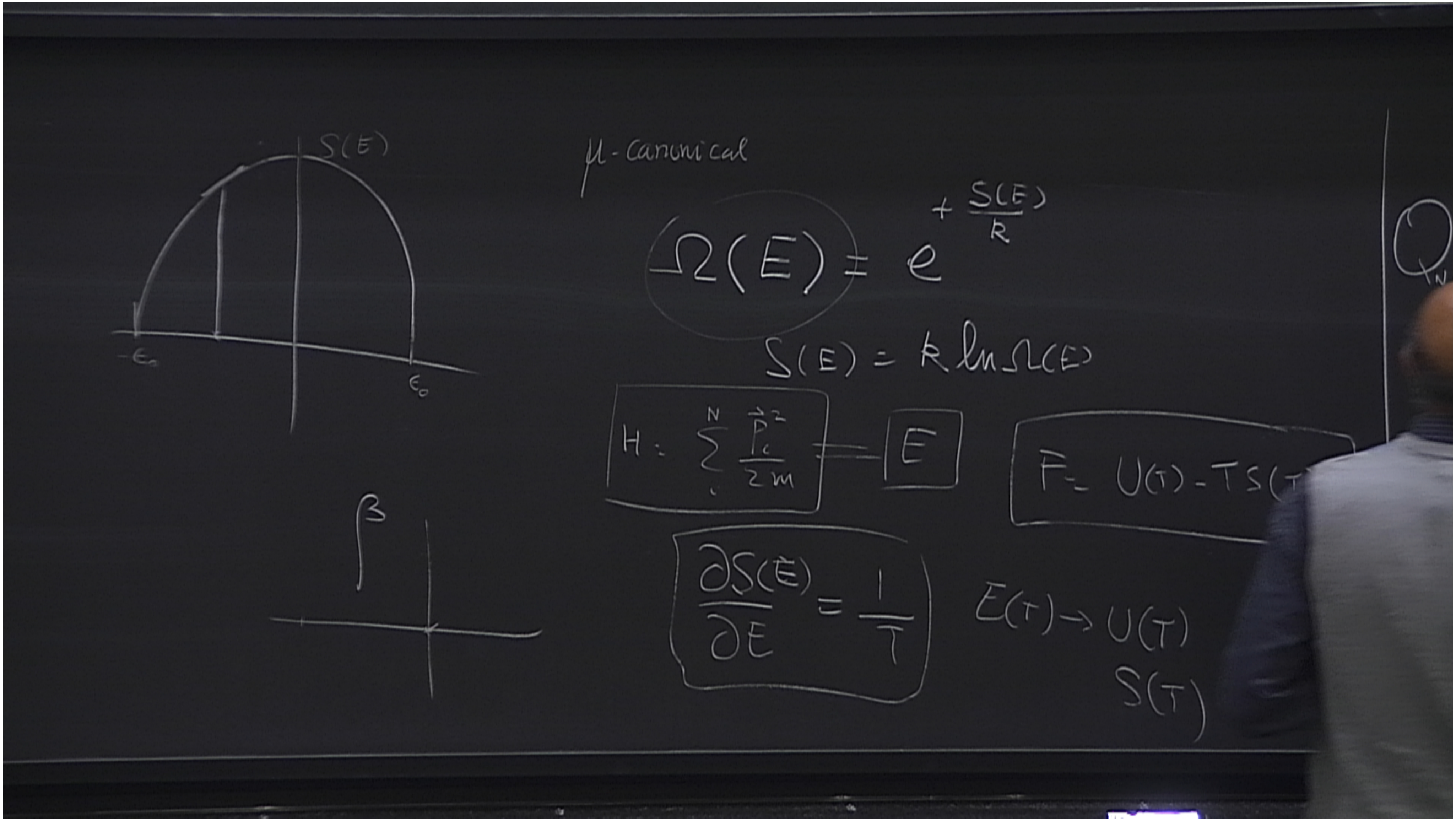
Title: PSI 2015/2016 Statistical Mechanics - G. Baskaran - Lecture 3

Date: Oct 15, 2015 10:45 AM

URL: http://pirsa.org/15100088

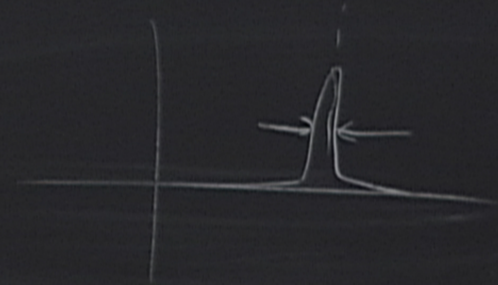
Abstract:


S(E)
-ε0
ε0
μ-canonical
Ω(E) = e^{+S(E)/k}
S(E) = k ln Ω(E)
H = Σ_i^N p_i^2 / 2m = E
β
∂S(E)/∂E = 1/T


S(E)
-E₀
E₀
β
μ-canonical
Ω(E) = e^{+S(E)/k}
S(E) = k ln Ω(E)
H = Σ_i^N p_i²/2m = E
F = U(T) - TS(T)
∂S(E)/∂E = 1/T
E(T) → U(T)
S(T)

$$Q_N(\beta) = \int e^{-\beta E}\, \Omega_N(E)\, dE$$

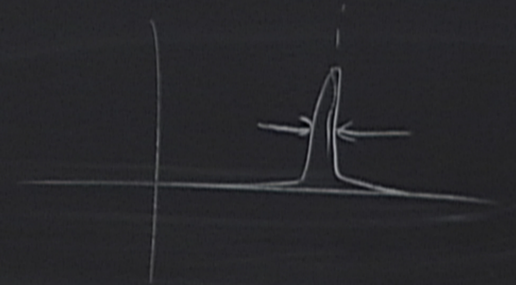
$$\Omega(E) = e^{N s(E)/k}$$



$$= \int e^{-\beta E} \left(\int \delta(E - H(p,q))\, dp\, dq \right)$$

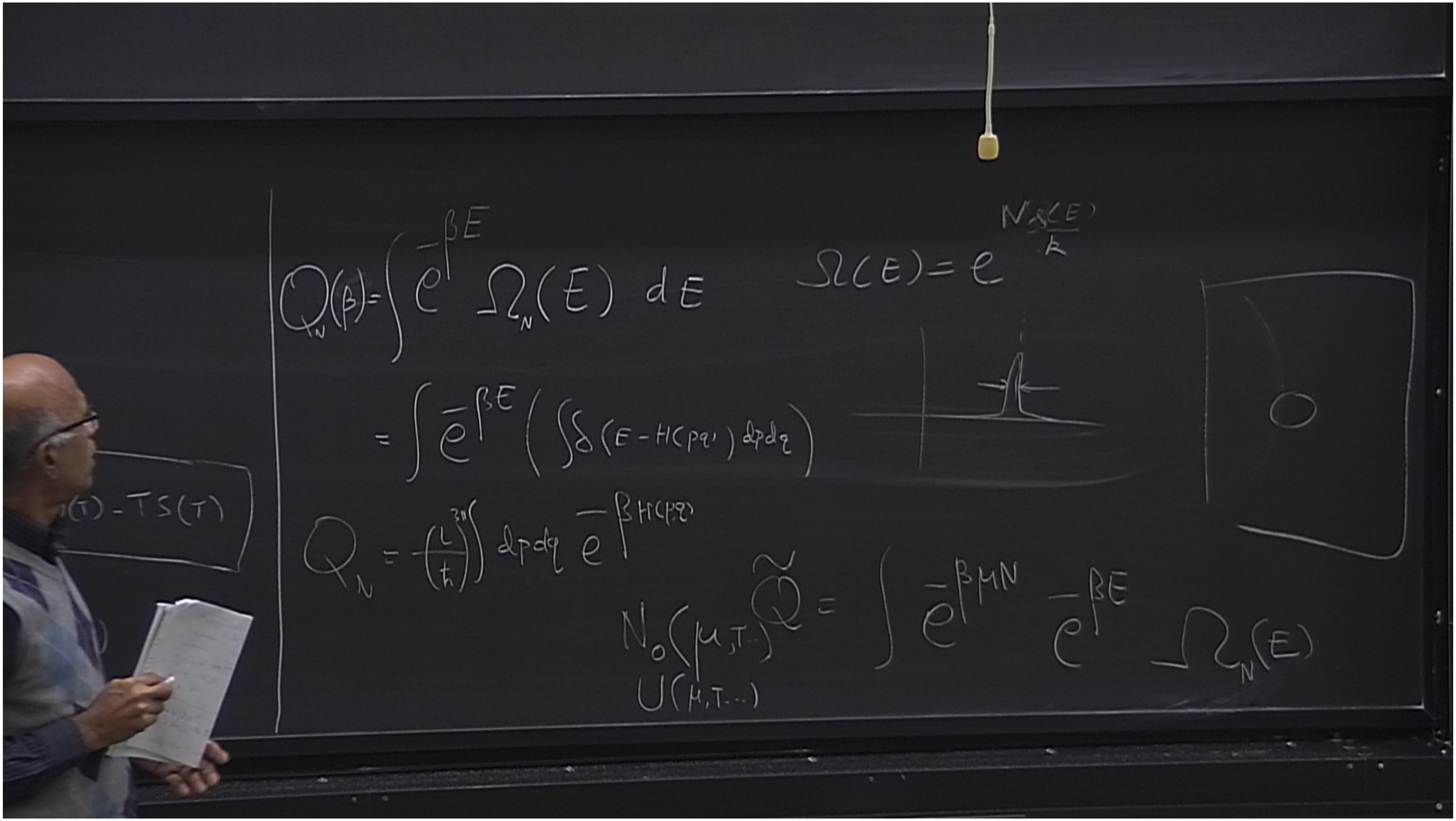
$$Q_N = \left(\frac{L}{h}\right)^{3N} \int dp\, dq\, e^{-\beta H(p,q)}$$

$$Q_N(\beta) = \int e^{-\beta E}\,\Omega_N(E)\,dE \qquad \Omega(E) = e^{N s(E)/k}$$



$$= \int e^{-\beta E}\left(\int \delta(E - H(p,q))\,dp\,dq\right)$$

$$Q_N = \left(\frac{L}{h}\right)^{3N}\int dp\,dq\; e^{-\beta H(p,q)}$$


$Q_N(\beta) = \int e^{-\beta E}\, \Omega_N(E)\, dE$
$\Omega(E) = e^{N s(E)/k}$
$= \int e^{-\beta E} \left(\iint \delta(E - H(pq))\, dp\, dq \right)$
$(T) - TS(T)$
$Q_N = \left(\frac{L}{h}\right)^{3N} \int dp\, dq\, e^{-\beta H(pq)}$
$N_0(\mu, T..)\ \tilde{Q} = \int e^{-\beta \mu N}\, e^{-\beta E}\, \Omega_N(E)$
$U(\mu, T...)$

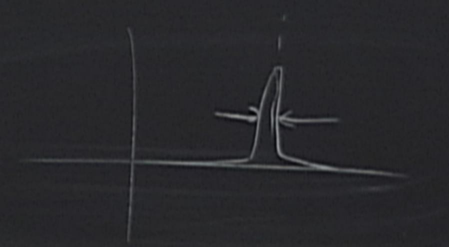
$e^{-\beta E_\alpha}$

$S(T)$

$$\boxed{\frac{e^{-\beta E_\alpha}}{Q}}$$

$$Q_N(\beta) = \int e^{-\beta E}\,\Omega_N(E)\,dE \qquad \Omega(E) = e^{N s(E)/k}$$

$$= \int e^{-\beta E}\left(\int\delta\big(E - H(pq)\big)\,dp\,dq\right)$$

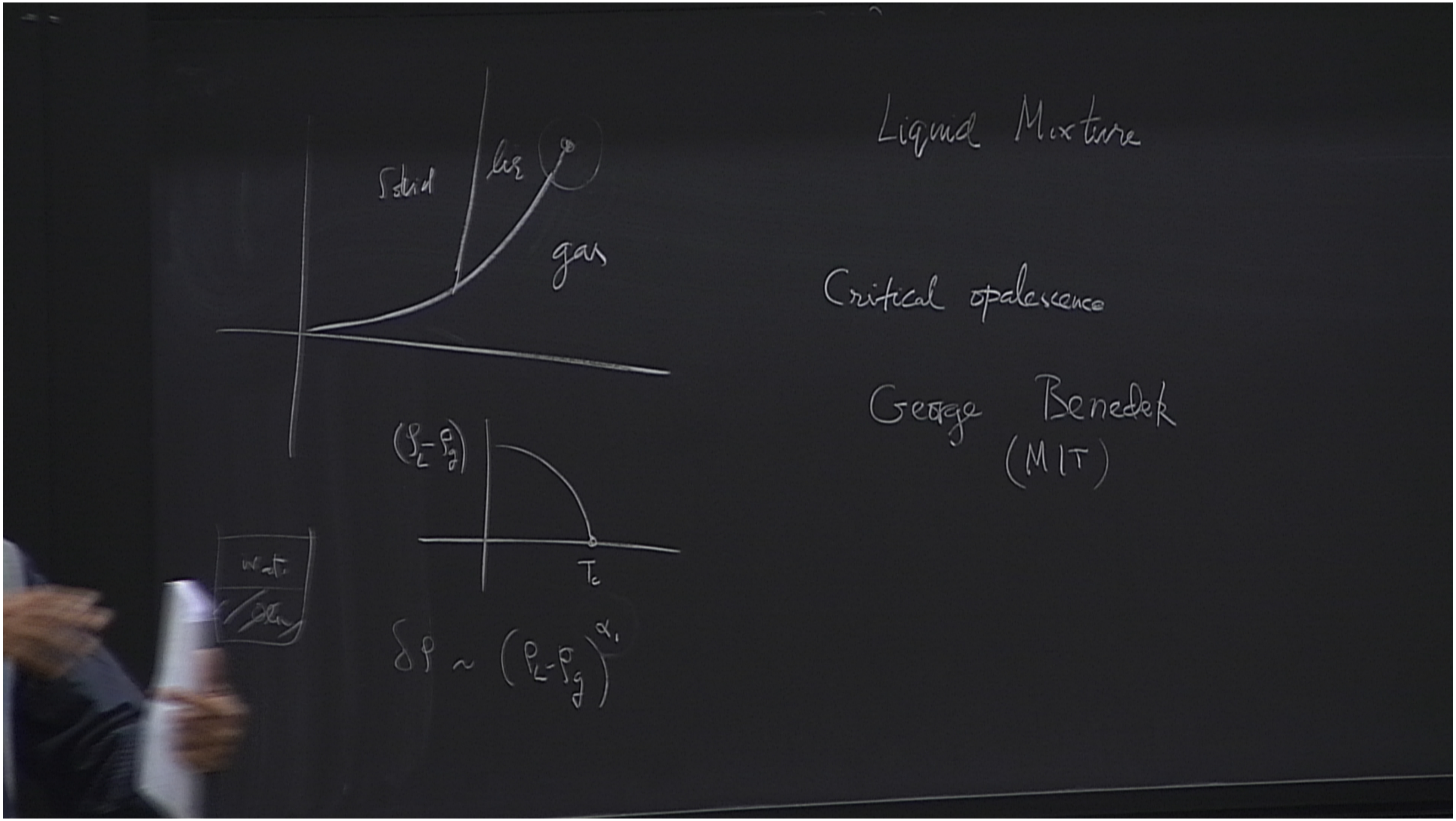


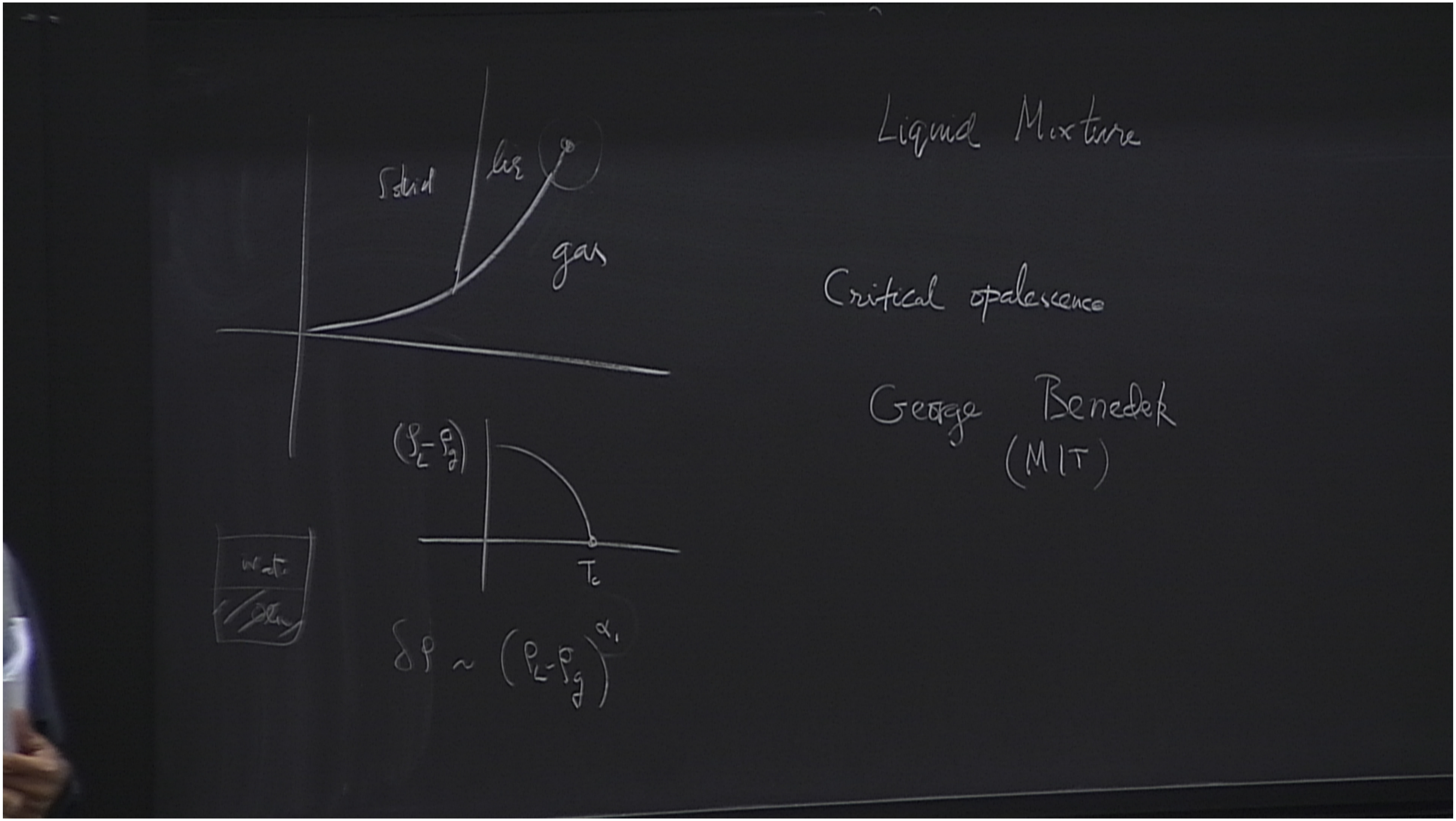
$$\boxed{Q_N = \left(\frac{L}{h}\right)^{3N}\int dp\,dq\; e^{-\beta H(p,q)}}$$

$$\tilde{Q} = \int e^{-\beta\mu N}\, e^{-\beta E}\,\Omega_N(E)$$

$N_0(\mu, T\ldots)$

$U(\mu, T\ldots)$


Liquid Mixture
Critical opalescence
George Benedek
(MIT)
solid
liq
gas
$(\rho_L - \rho_g)$
T_c
water
$\delta\rho \sim (\rho_L - \rho_g)^{\alpha_1}$


Solid
liq
gas
$(\rho_L - \rho_g)$
T_c
$\delta\rho \sim (\rho_L - \rho_g)^{\alpha}$
Liquid Mixture
Critical opalescence
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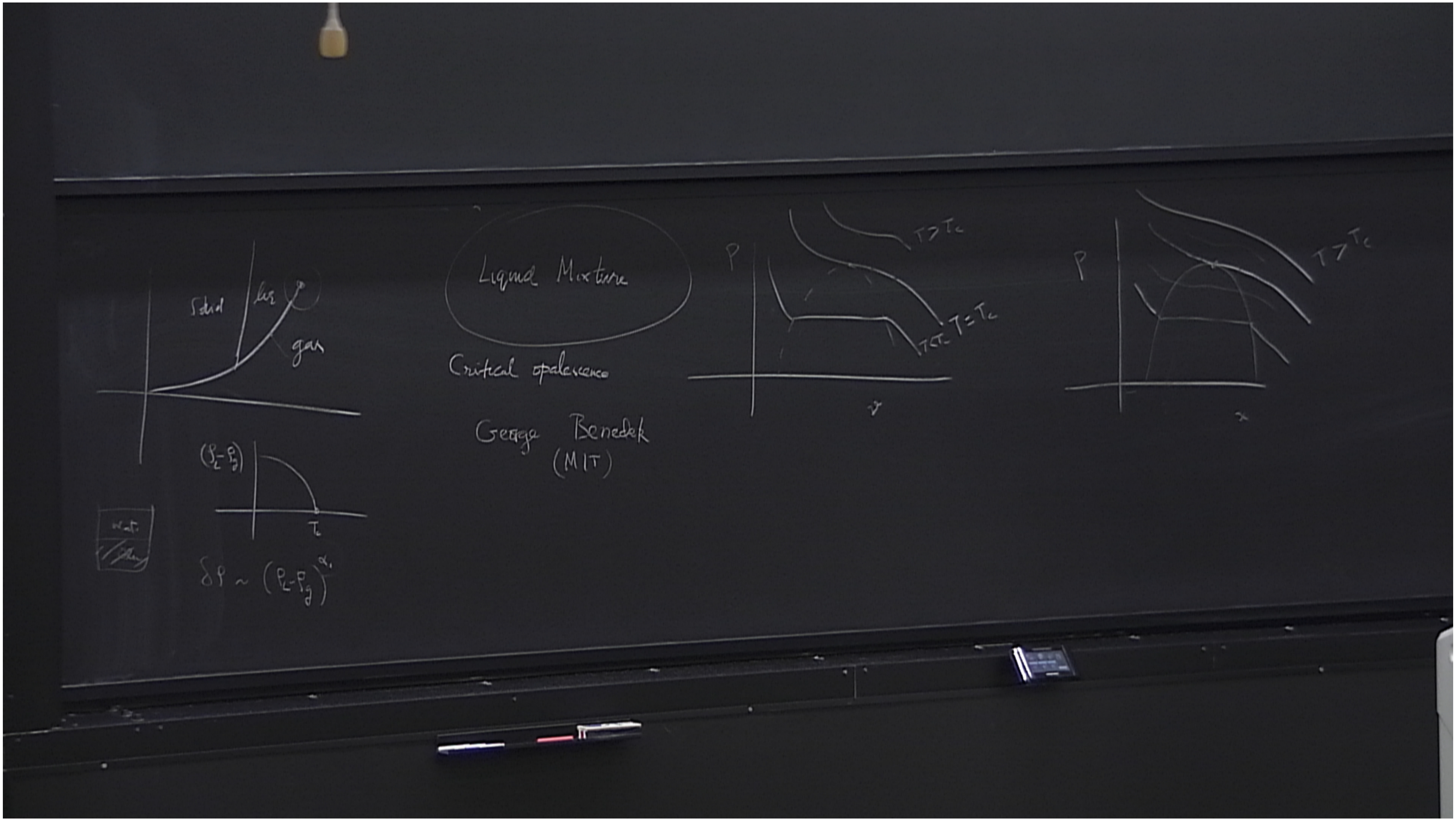
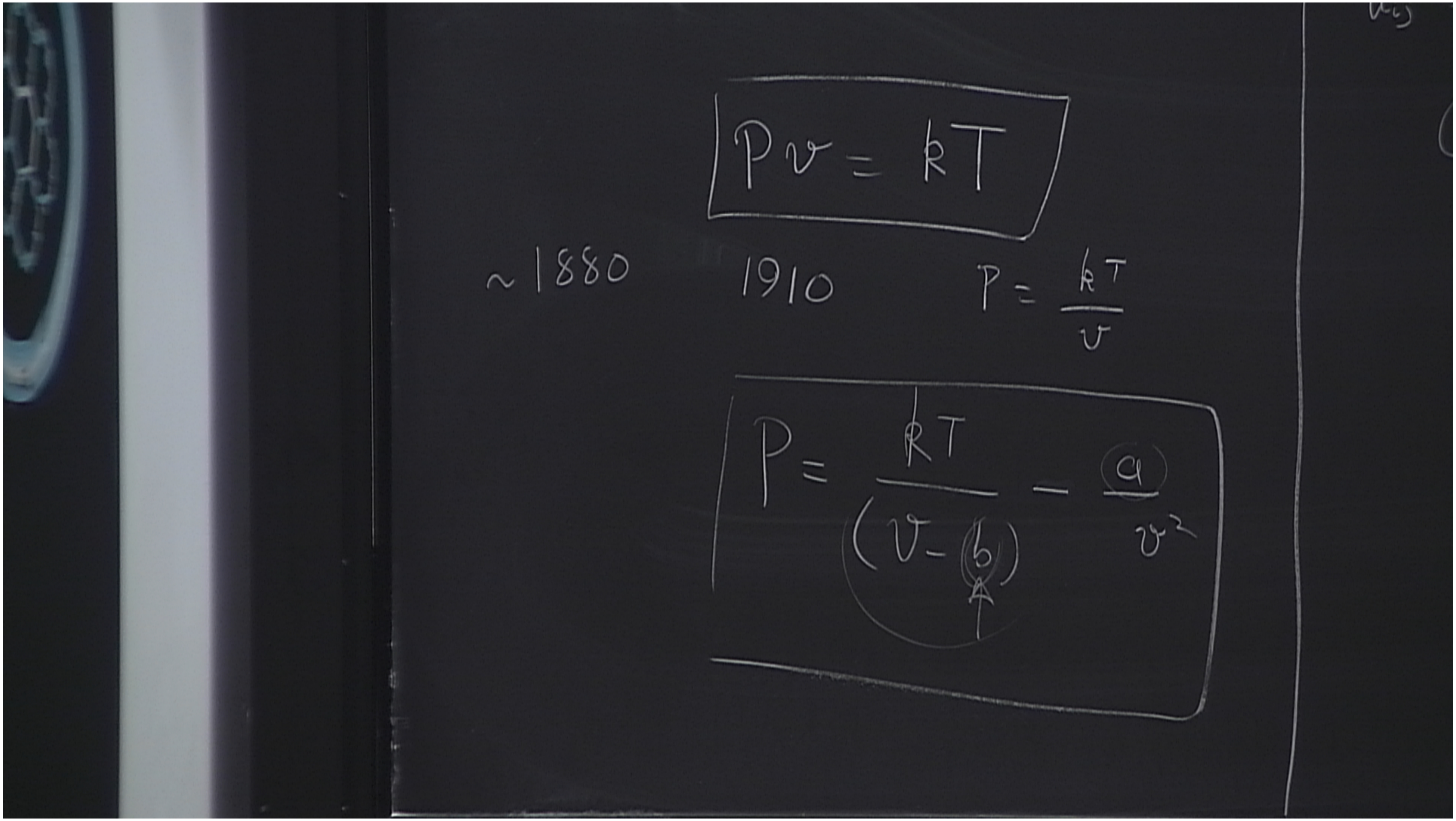

solid
liq
gas
$(\rho_L - \rho_g)$
T_c
$\delta\rho \sim (\rho_L - \rho_g)^{\alpha_1}$
Liquid Mixture
Critical opalescence
George Benedek
(MIT)
P
$T > T_c$
$T = T_c$
$T < T_c$
P
$T > T_c$
x

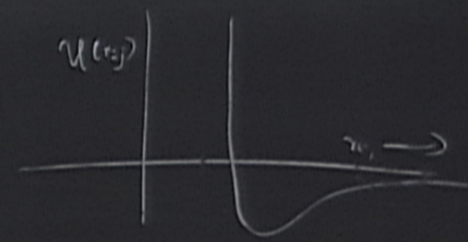

$Pv = kT$
~1880
1910
$P = \frac{kT}{v}$
$P = \frac{kT}{(v-b)} - \frac{a}{v^2}$

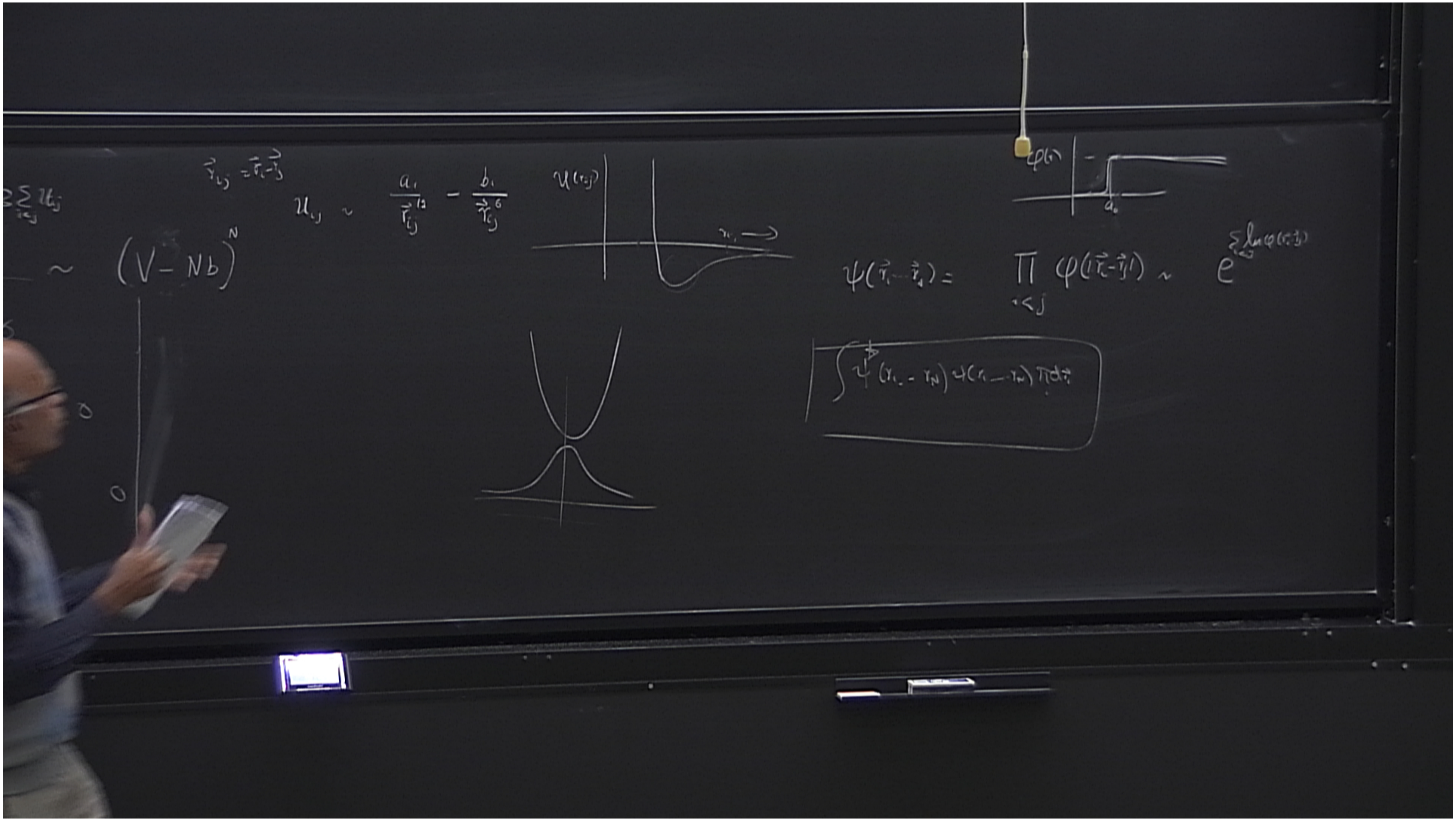
$u_{ij} = u(\vec{r}_i - \vec{r}_j)$

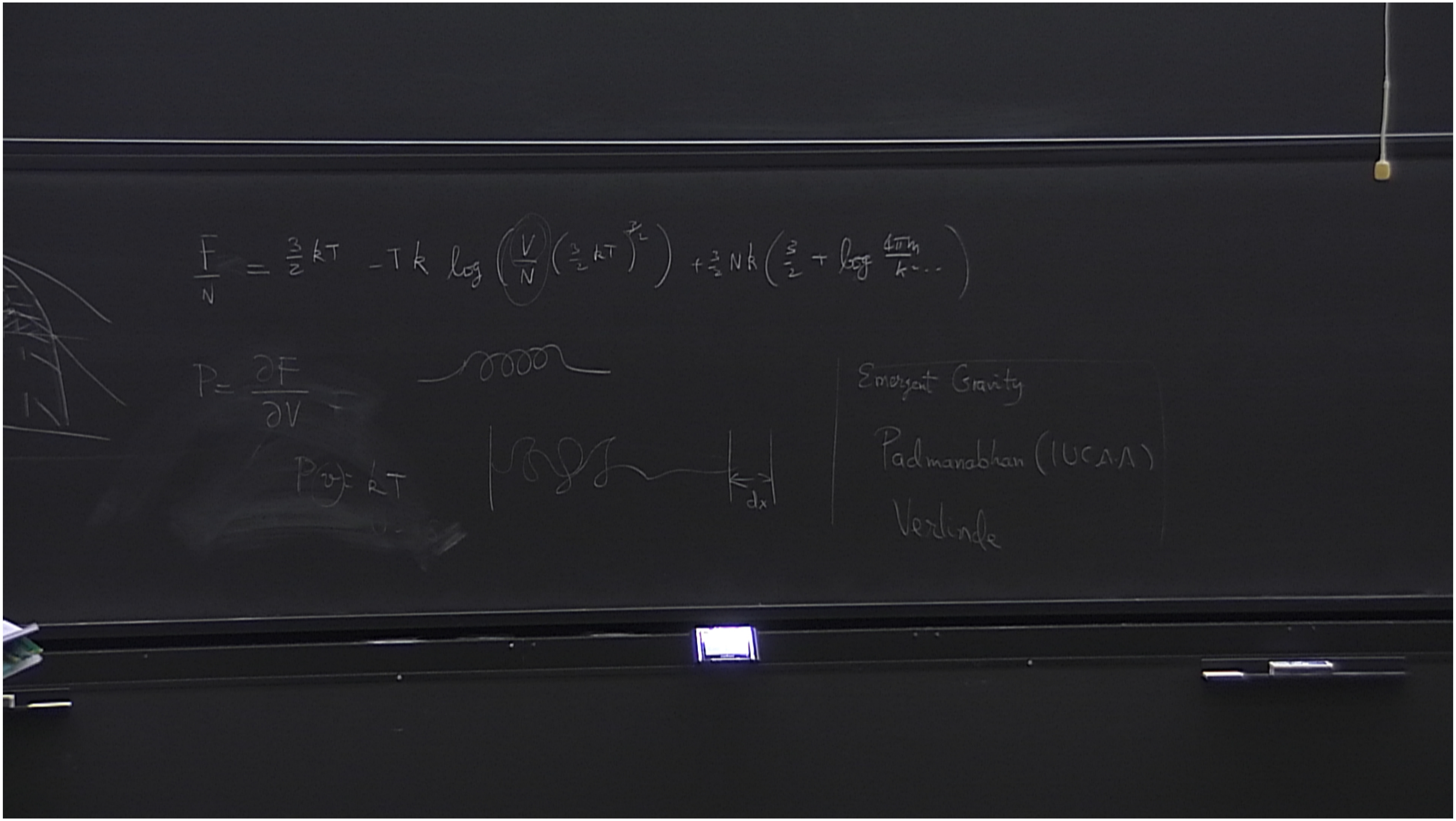
$$Q = \int \prod_i d\vec{r}_i \; e^{-\beta \sum_{i<j} u_{ij}} \sim V^N$$

$\vec{r}_{ij} = \vec{r}_i - \vec{r}_j$

$$u_{ij} \sim \frac{a_1}{\vec{r}_{ij}^{\,12}} - \frac{b_1}{\vec{r}_{ij}^{\,6}}$$







$\frac{F}{N} = \frac{3}{2}kT - Tk \log\left(\frac{V}{N}\left(\frac{3}{2}kT\right)^{3/2}\right) + \frac{3}{2}Nk\left(\frac{3}{2} + \log\frac{4\pi m}{k}\ldots\right)$
$P = \frac{\partial F}{\partial V}$
$Pv = kT$
dx
Emergent Gravity
Padmanabhan (IUCAA)
Verlinde