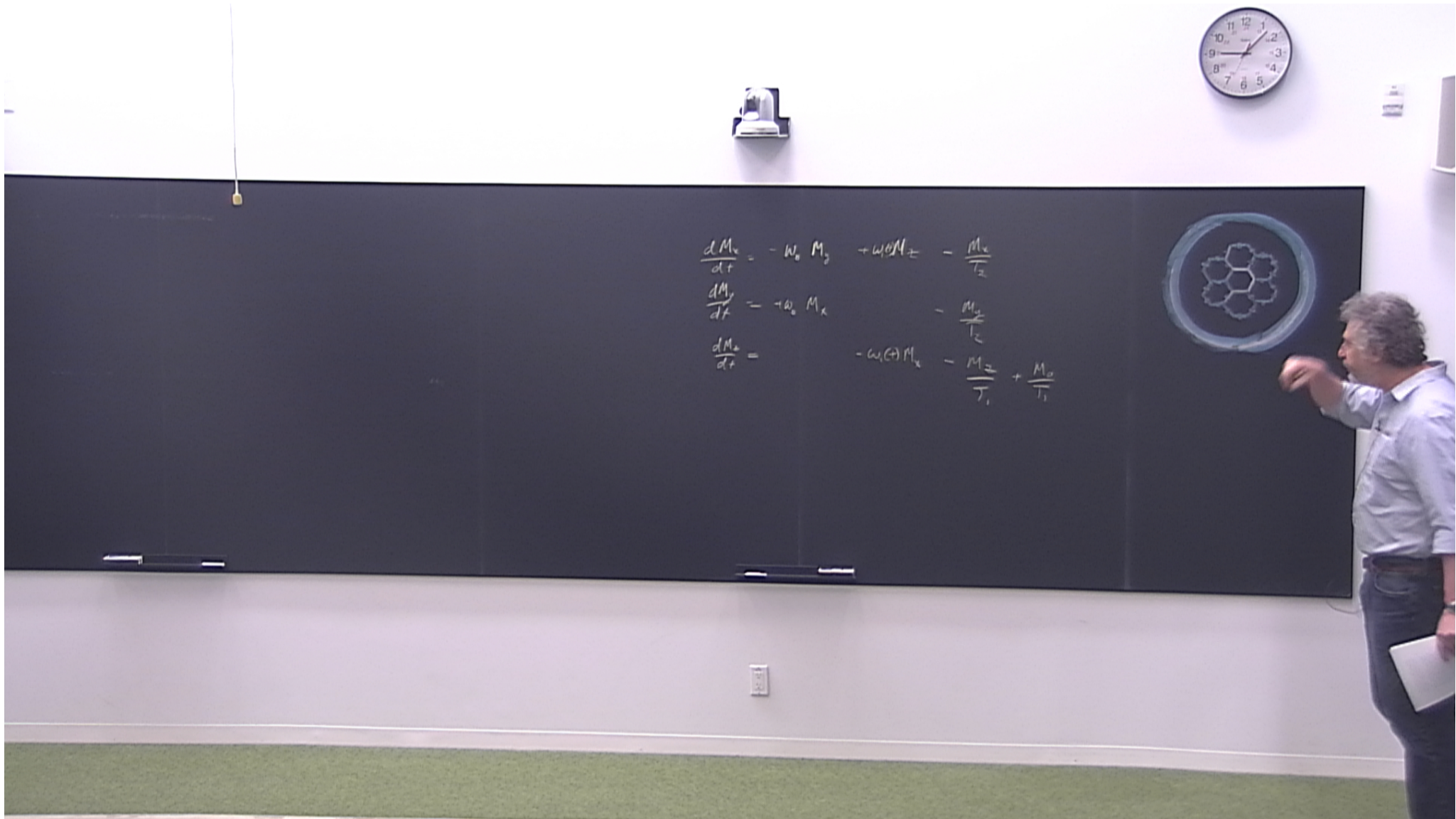


Title: PSI 2015/2016 Explorations in Quantum Information - David Cory - 4

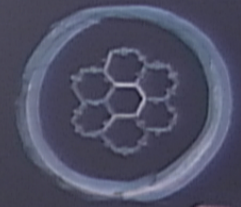
Date: Mar 24, 2016 09:00 AM

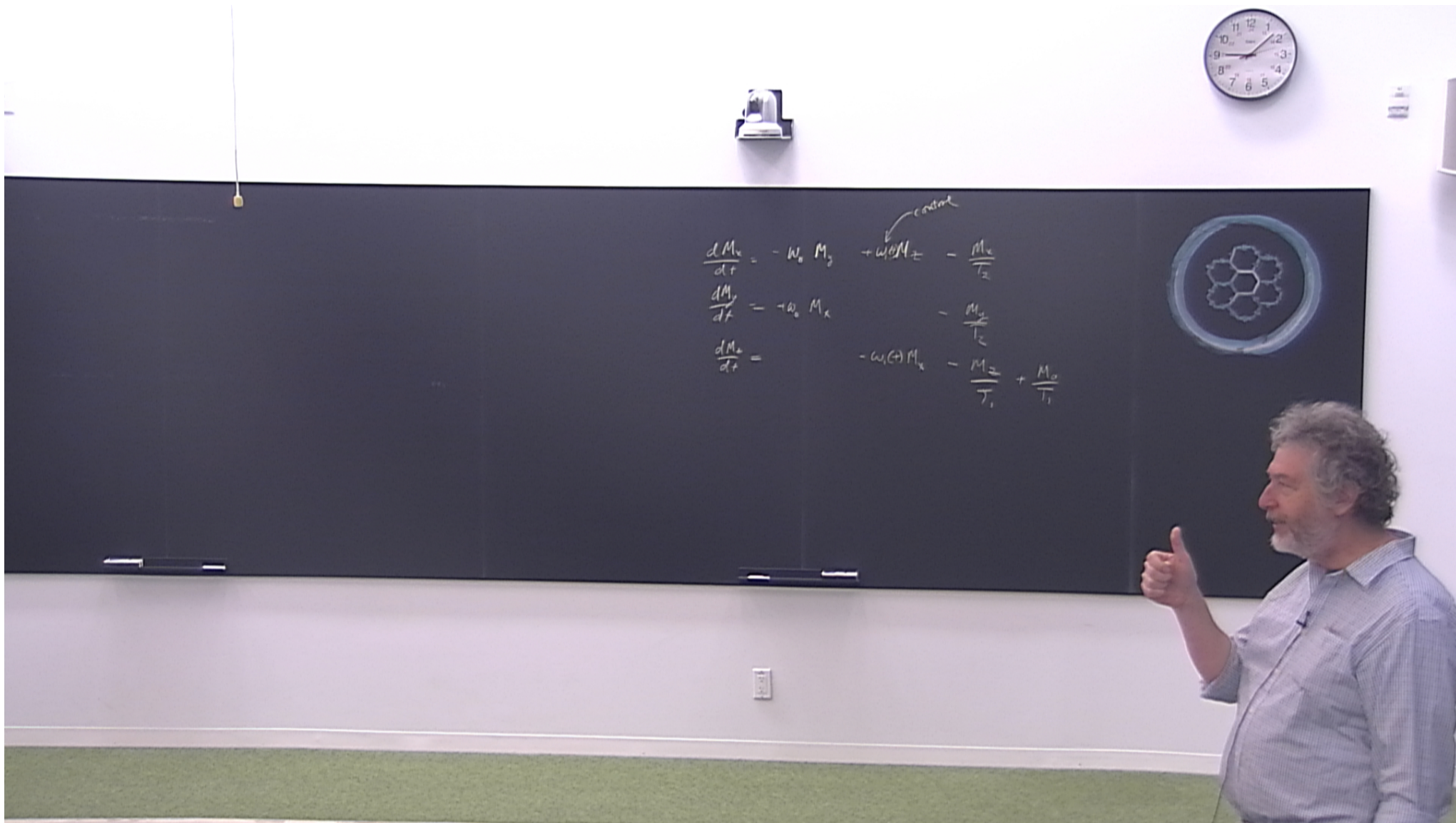
URL: <http://pirsa.org/16030003>

Abstract:



$$\begin{aligned}\frac{dM_x}{dt} &= -\omega_0 M_y + \omega_1 M_z - \frac{M_x}{T_2} \\ \frac{dM_y}{dt} &= +\omega_0 M_x - \frac{M_y}{T_2} \\ \frac{dM_z}{dt} &= -\omega_1 M_x - \frac{M_z}{T_1} + \frac{M_0}{T_1}\end{aligned}$$





$$P(B_{\text{local}})$$

$$\omega_0 = \gamma B_0$$

$$\omega_{\text{obs}} = \gamma(B_0 + B_{\text{local}})$$

$$\frac{dM_x}{dt} = -\omega_0 M_y \quad \text{Rabi}$$

$$\frac{dM_y}{dt} = -\omega_0 M_x$$

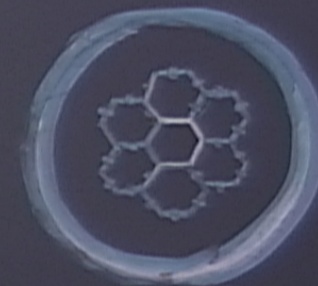
$$\frac{dM_z}{dt} =$$

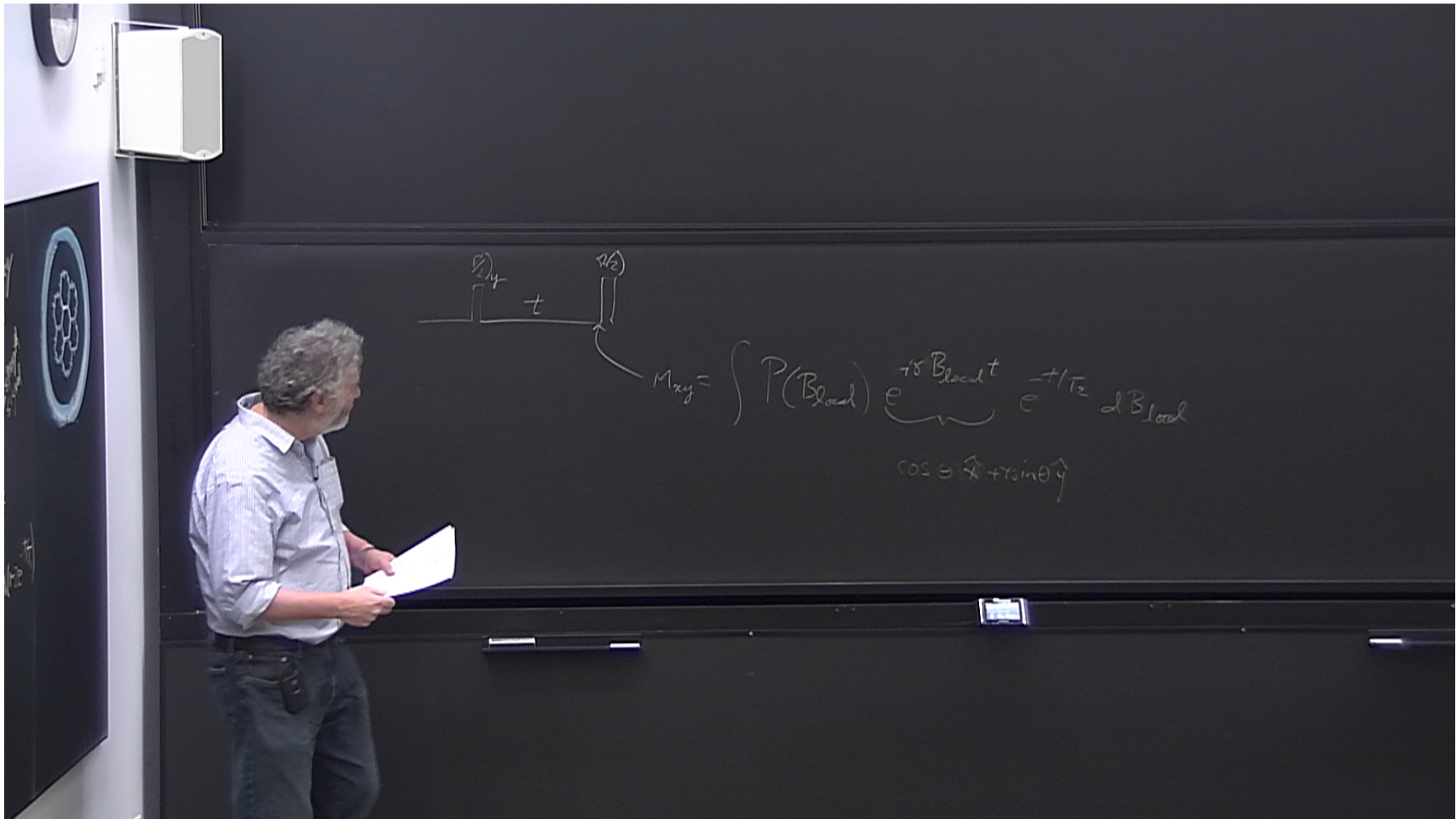
$$-\omega_1 M_y$$

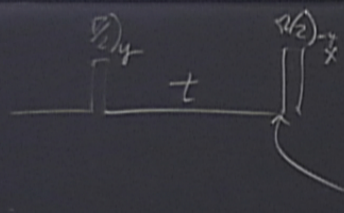
$$+ \omega_1 M_z \quad \text{Rabi}$$

$$- \frac{M_x}{T_2} \quad \text{Ramsey echo}$$

$$+ \frac{M_0}{T_1} \quad \text{strength signal}$$



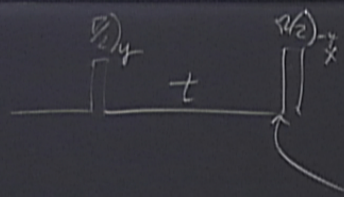




$$M_{xy} = \int P(B_{\text{local}}) \underbrace{e^{i\gamma \frac{B_{\text{local}}}{\hbar} t}}_{\cos \theta \hat{x} + \sin \theta \hat{y}} e^{-t/T_2} dB_{\text{local}}$$

B_{local}

- spin reporter of env.
- spin as sensor



$$M_{xy} = \int P(B_{\text{local}}) \underbrace{e^{i\theta \frac{B_{\text{local}}}{\hbar} t}}_{\cos \theta \hat{x} + \sin \theta \hat{y}} e^{-t/T_2} dB_{\text{local}}$$

B_{local}

- spin reporter of env.
- spin as sensor
- if B_{local} changes slowly

$$\cos\theta \hat{x} + \sin\theta \hat{y}$$

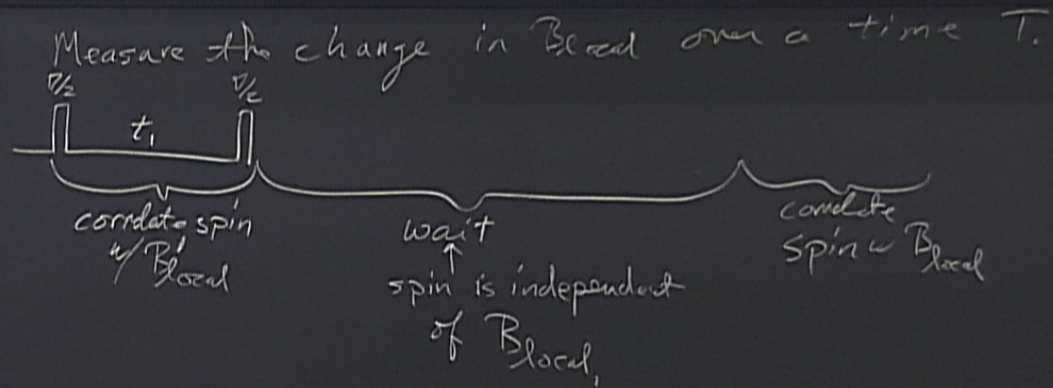
Measure the change in B_{local} over a time T .

correlate spin
w/ B_{local}

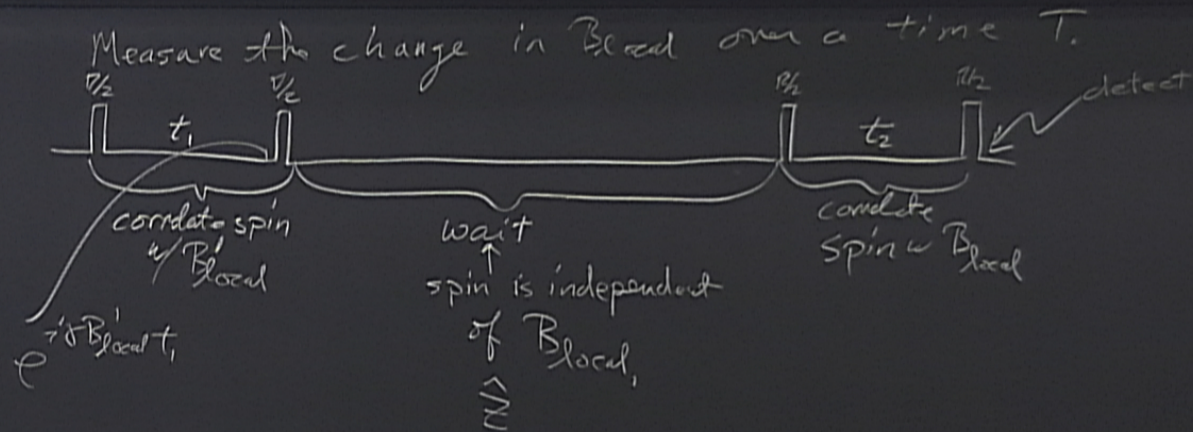
wait
↑
spin is independent
of B_{local}

correlate
Spin w/ B_{local}

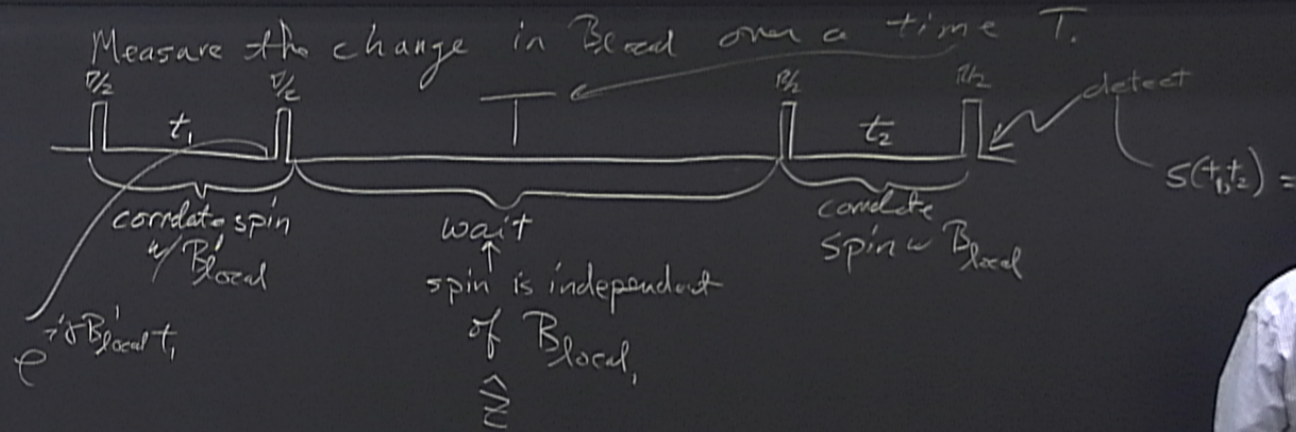
$$\cos \theta \hat{x} + \sin \theta \hat{y}$$



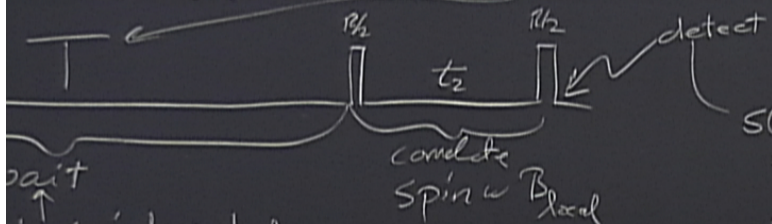
$$\cos \theta \hat{x} + \sin \theta \hat{y}$$



$$\cos \theta \hat{x} + \sin \theta \hat{y}$$



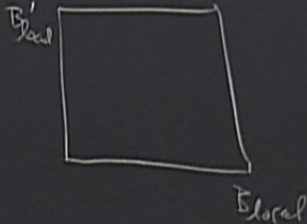
in B_{local} over a time T .



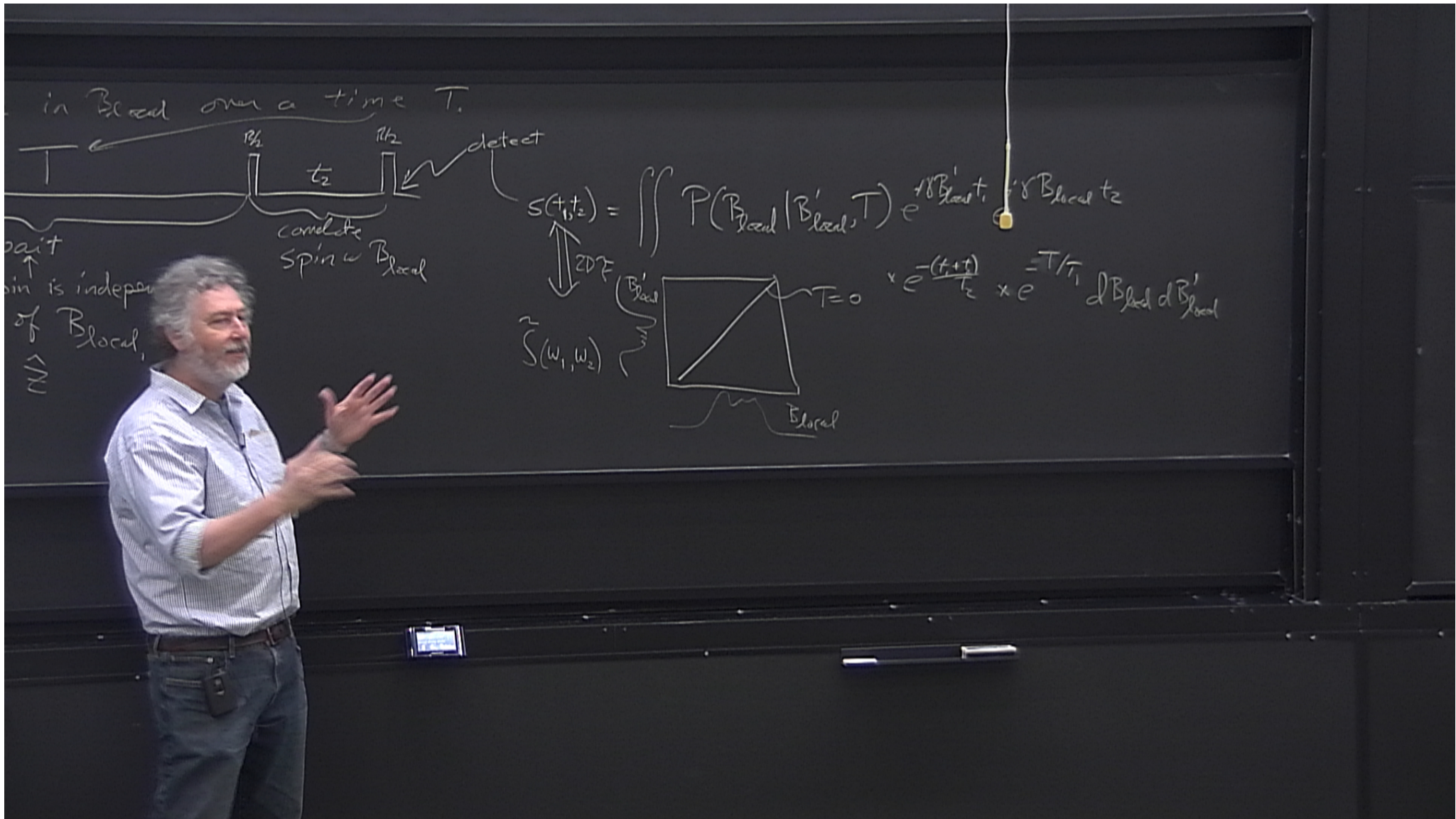
pair
↑
is independent
of B_{local} ,
 $\sum$

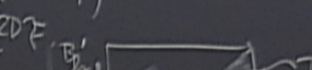
$$S(t_1, t_2) = \iint P(B_{\text{local}} | B'_{\text{local}}, T) e^{i\delta B'_{\text{local}} t_1} e^{i\delta B_{\text{local}} t_2}$$

$\updownarrow$ 2DF
 $\tilde{S}(w_1, w_2)$



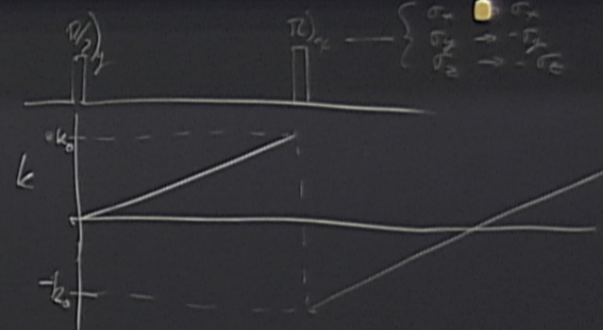
$$\times e^{-\frac{(t_1+t_2)}{T_2}} \times e^{-\frac{T}{T_1}} dB_{\text{local}} dB'_{\text{local}}$$



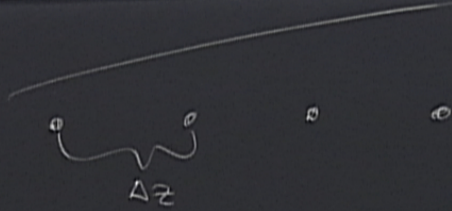


$$e^{-\frac{(t+t_1)}{T_2}} \times e^{-\frac{T}{T_1}} dB'_{\text{ind}} dB'_{\text{ext}}$$

$\frac{\partial \mathcal{L}}{\partial \mathbf{z}} = \mathbf{t}$
 $\frac{\partial \mathcal{L}}{\partial \mathbf{z}_1} = \frac{C_1}{C_M} \quad C_M \quad 50\%$
 $\mathbf{k} = \frac{\partial \mathcal{L}}{\partial \mathbf{z}} \mathbf{t}$



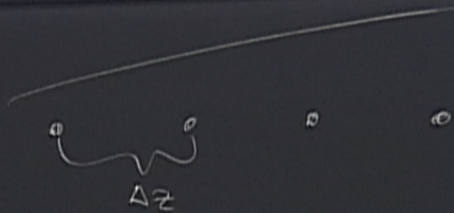
10^{17} spins
 10^{10}



$$\gamma \hbar \frac{\partial B_z}{\partial z} = 2\pi \hbar$$



10^{17} spins
 10^{10}



$$\gamma \hbar \frac{\partial B_z}{\partial z} = 2\pi \hbar$$

