

Title: PSI 2016/2017 Explorations in Quantum Information - Lecture 5

Date: Mar 24, 2017 09:00 AM

URL: <http://pirsa.org/17030062>

Abstract:

Decoherence

$$\frac{1}{T_2} = \frac{1}{T_2'} + \frac{1}{T_2^{\text{other}}}$$

rate of coherence loss,

$$T_2' = \begin{cases} T_1, & x, y \\ 2T_1, & x \end{cases}$$

2 Examples

2-levels & $\mathcal{H}_{\text{cont}} = \frac{\omega_c(t)}{2} \sigma_y$ under our control

$$\frac{1}{T_1} + \frac{1}{T_2 \text{ other}}$$

hercules loss,

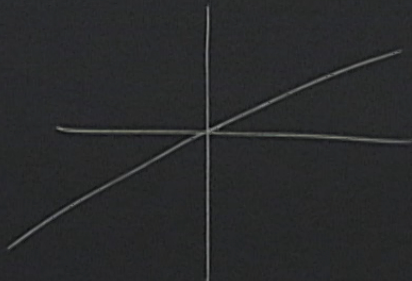
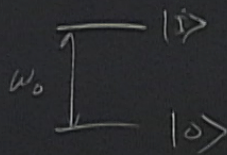
T_1 ; x, y

$2T_1$, x

2 Examples

2-levels & $\mathcal{H}_{\text{cont}} = \frac{\omega_c(t)}{2} \sigma_y$

under our control



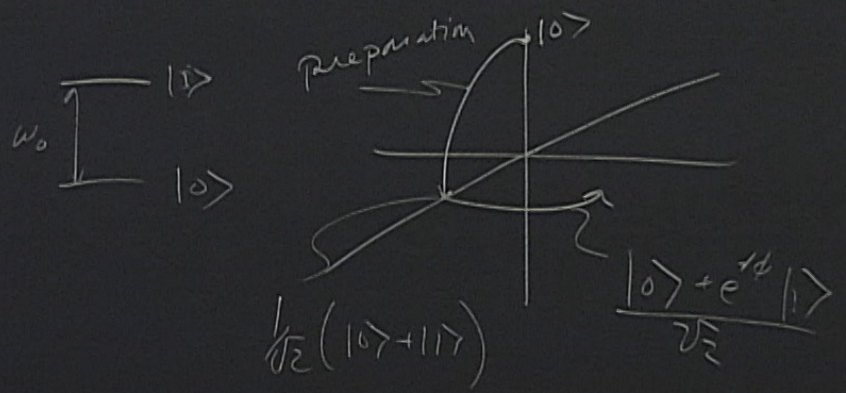
Mod. Schrödinger interference

2 Examples

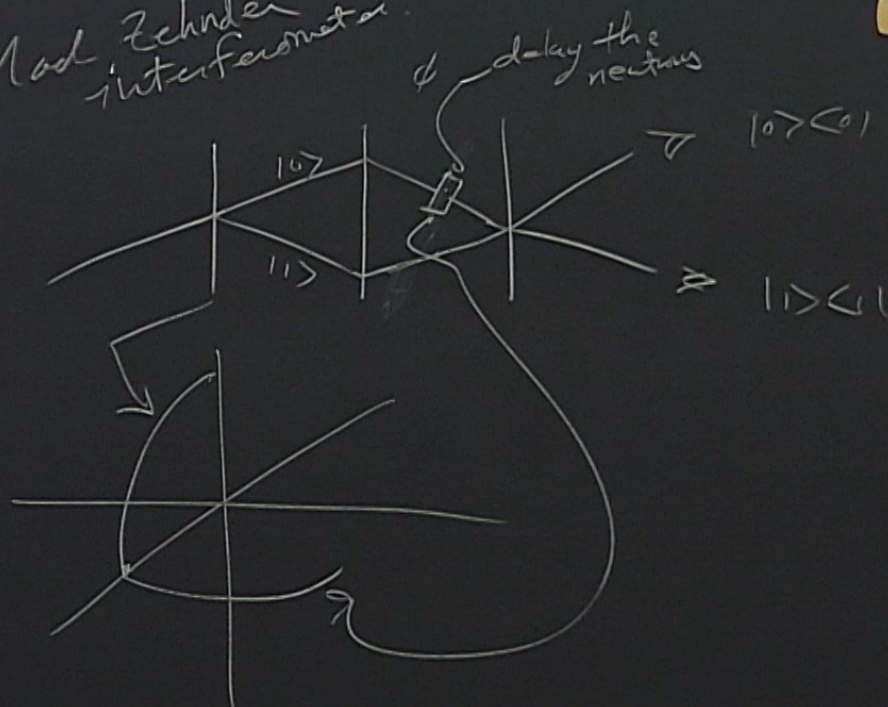
2-levels & $\mathcal{H}_{\text{cont}} = \frac{\omega_c(t)}{2} \sigma_y$

under our control

Mod. Zehnder interferometer



Mad Zehnder
interferometer



Decoherence

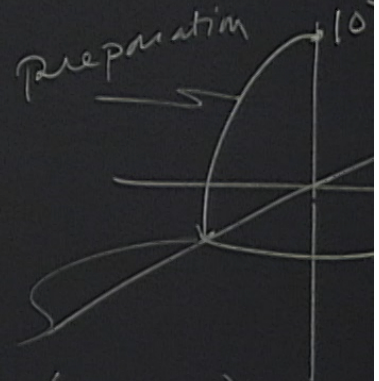
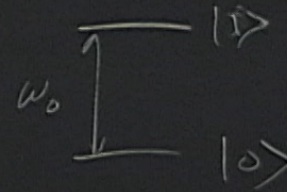
$$\frac{1}{T_2} = \frac{1}{T_2'} + \frac{1}{T_2^{\text{other}}}$$

rate of coherence loss,

$$T_2' = \begin{cases} T_1 & ; \text{ x, y } \\ 2T_1 & ; \text{ z } \end{cases}$$

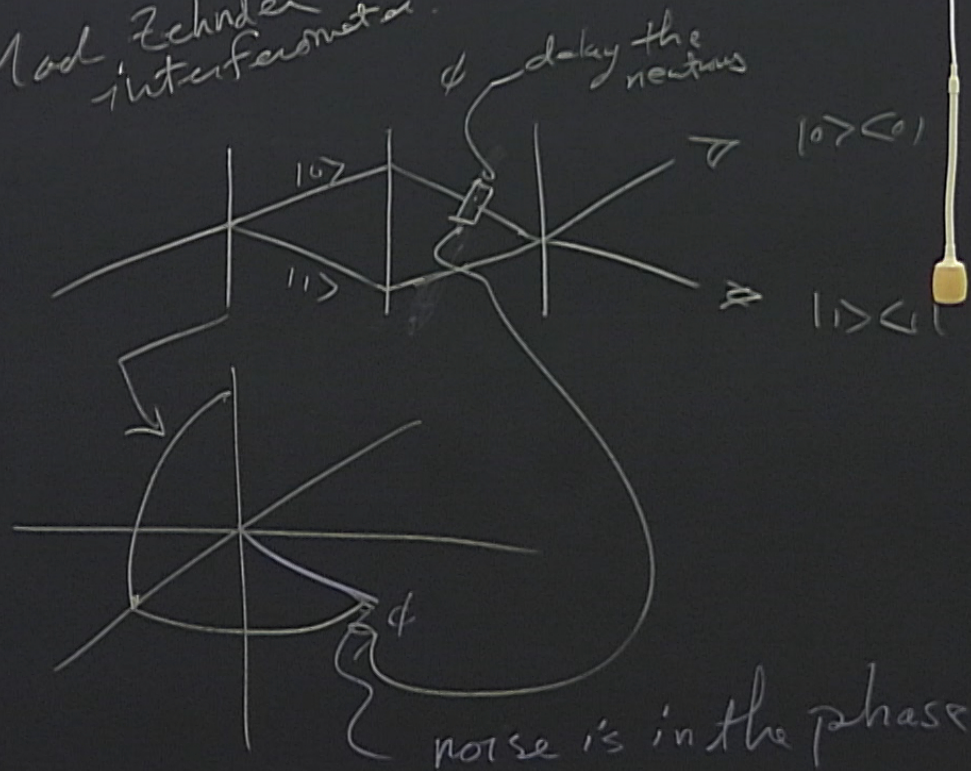
2 Examples

2-levels & $\mathcal{H}_{\text{cont}}$

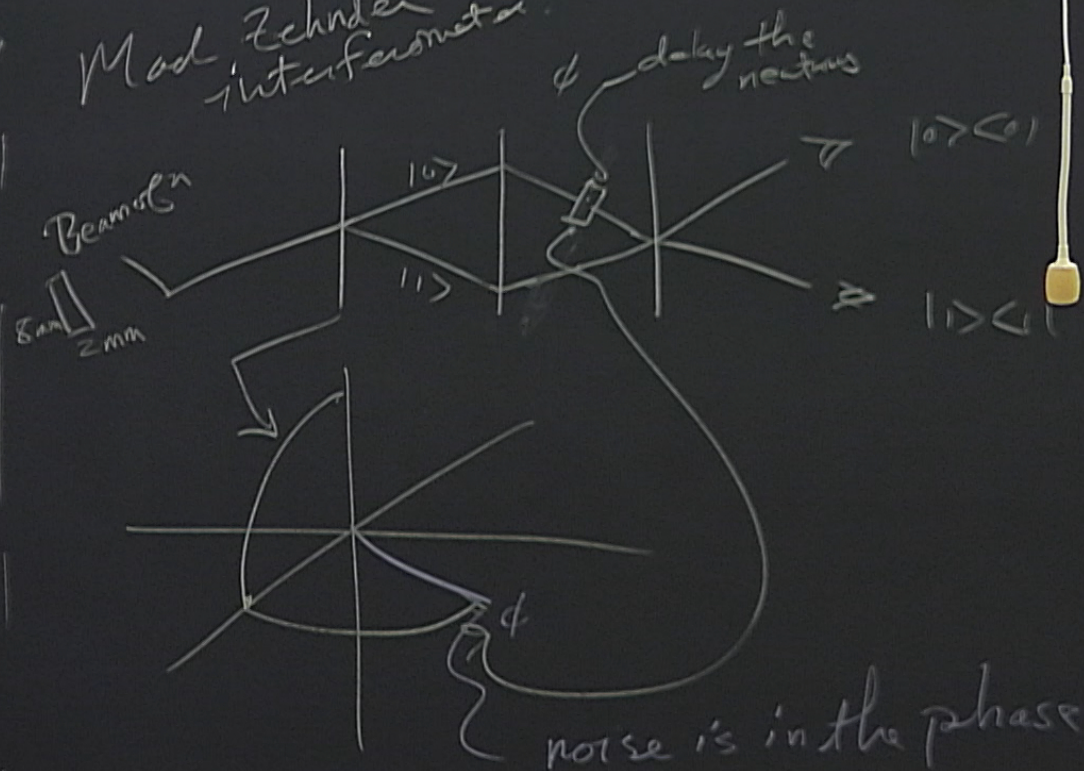


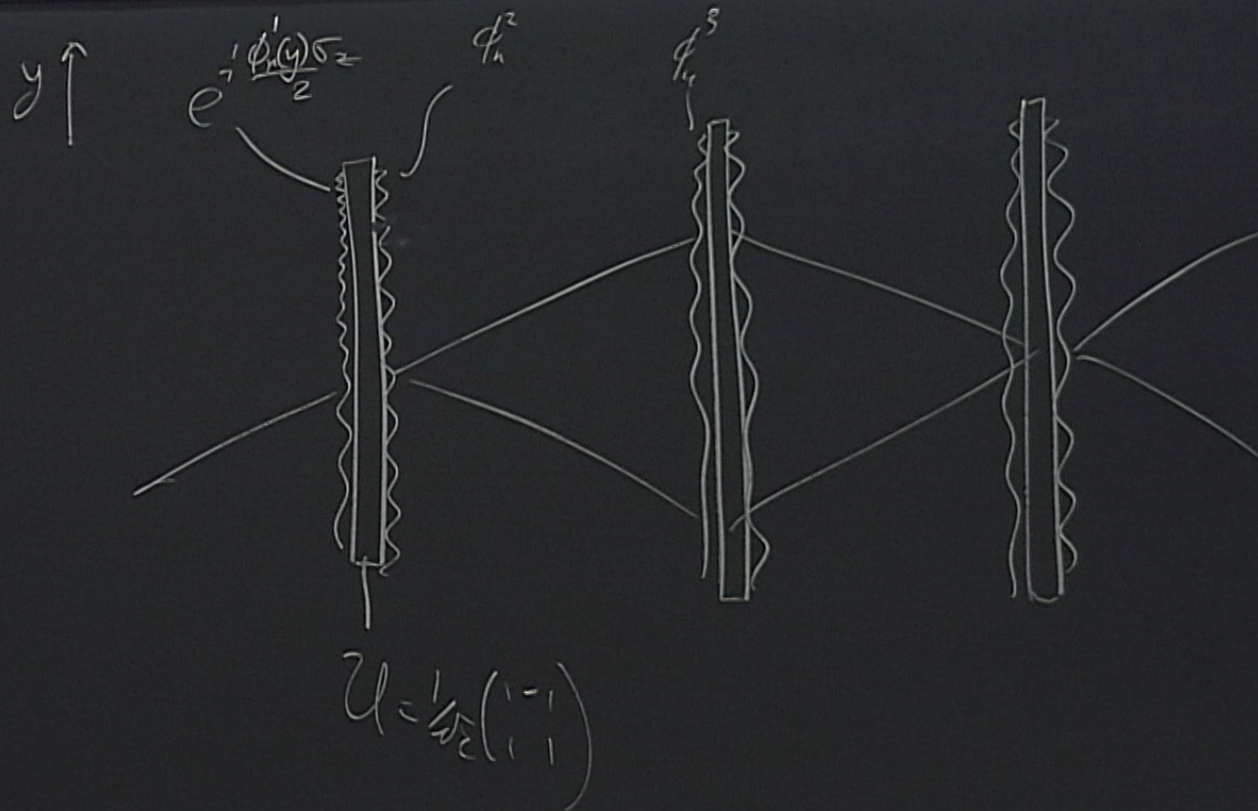
$$\frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$$

Mad Zehnder
interferometer



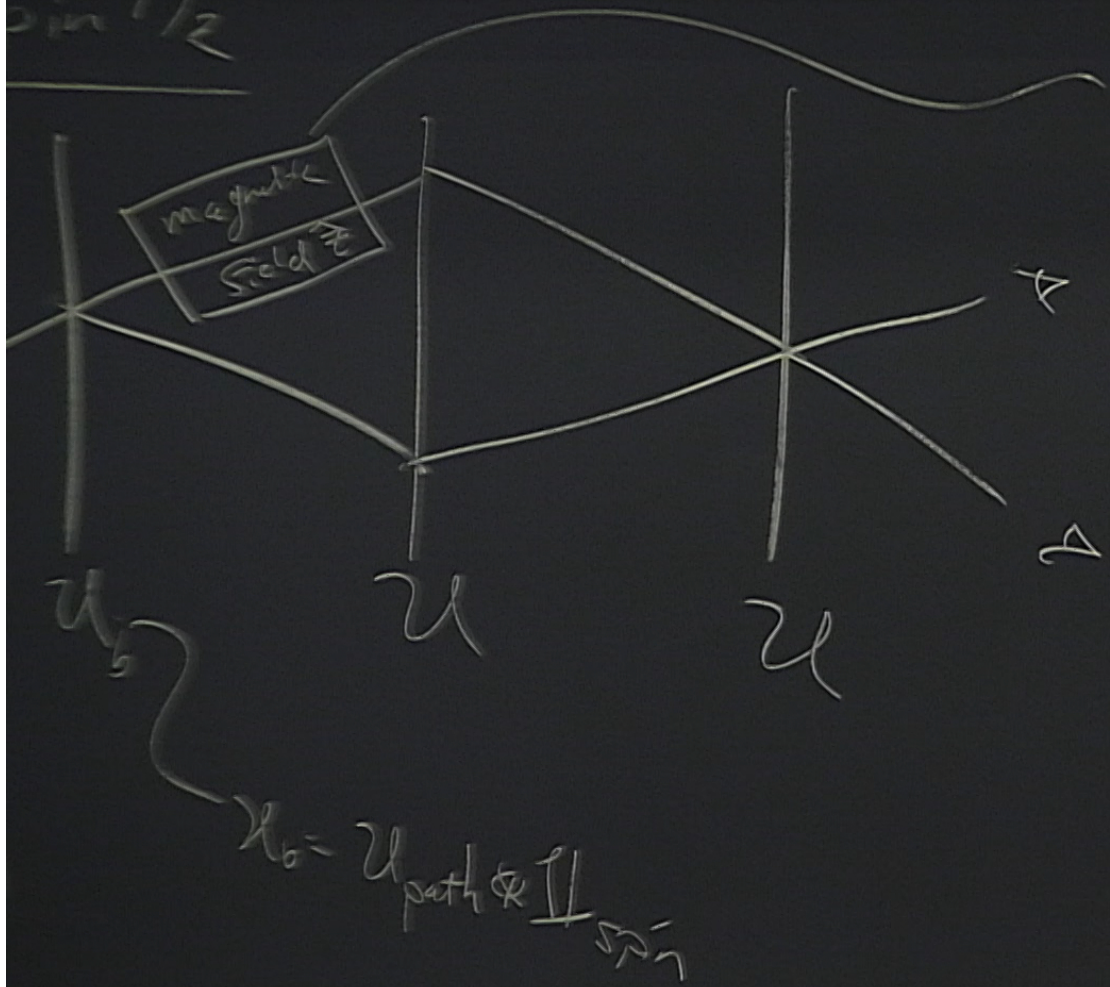
Mad Zehnder interferometer



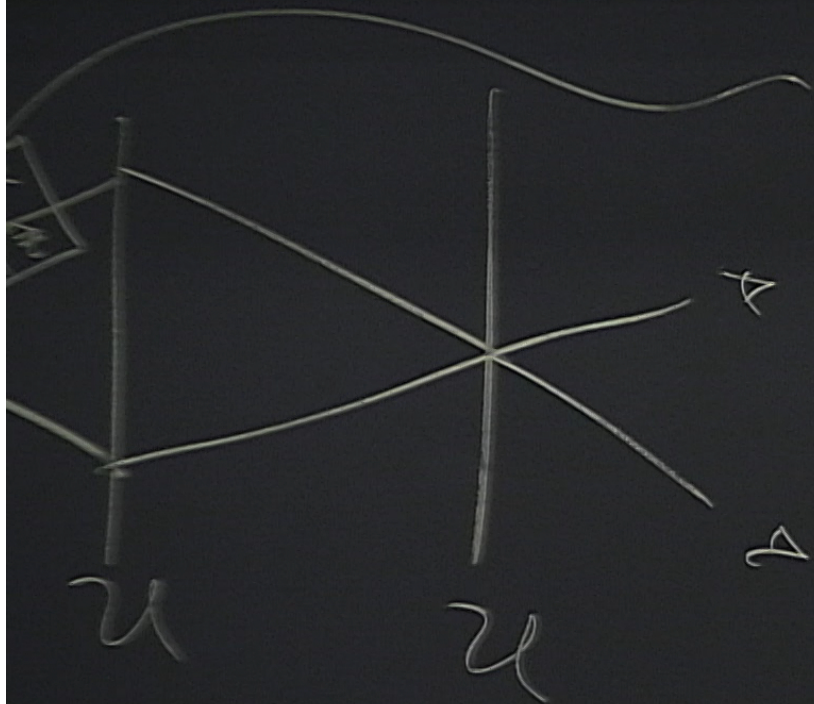


neutron is spin $1/2$

spin 1/2



$$\text{Energy} = \gamma_n B_z m_z$$



Energy =

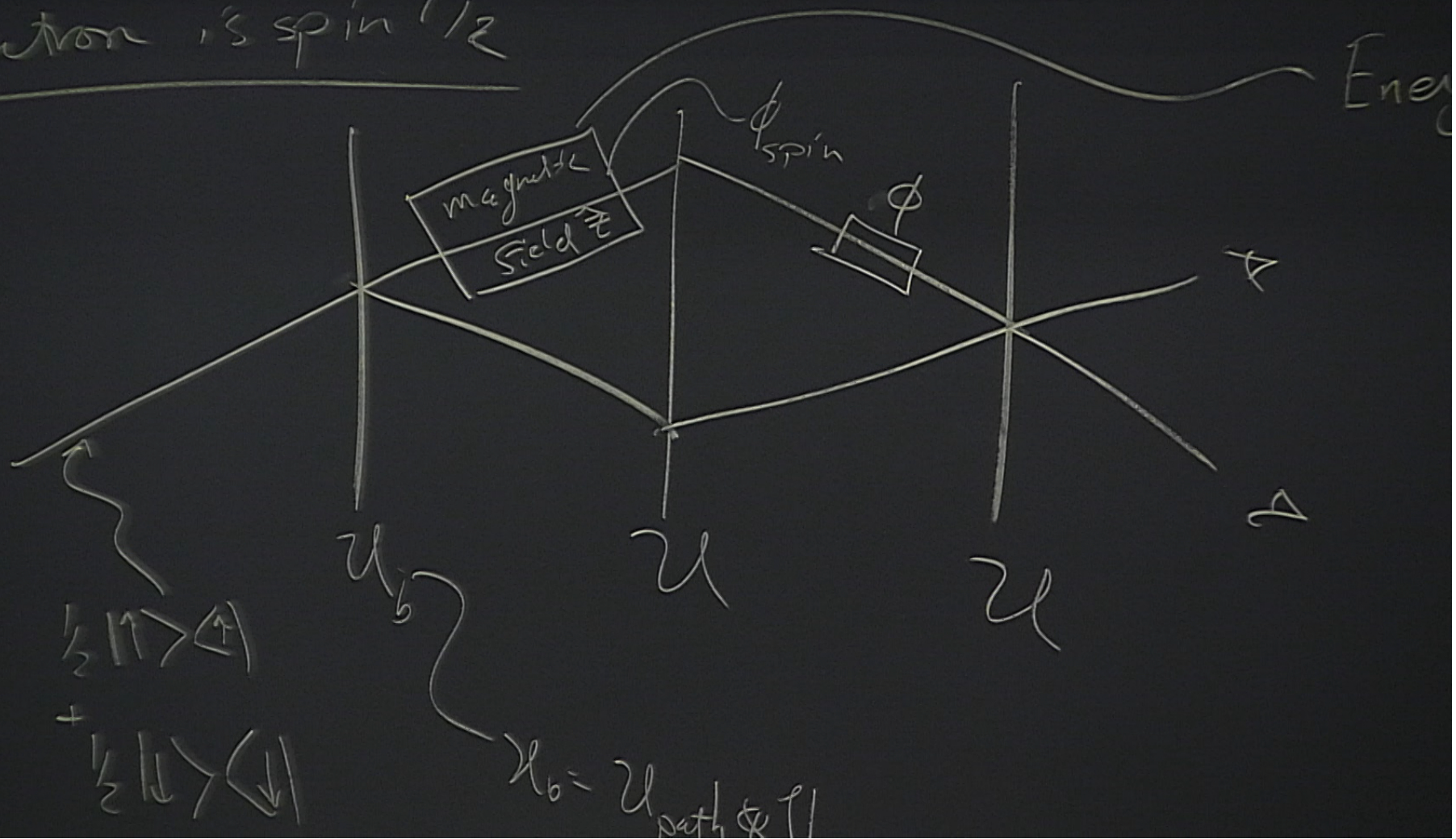
$$\gamma_n B_z m_z$$

m_z
 $+1/2$
 0
 $-1/2$

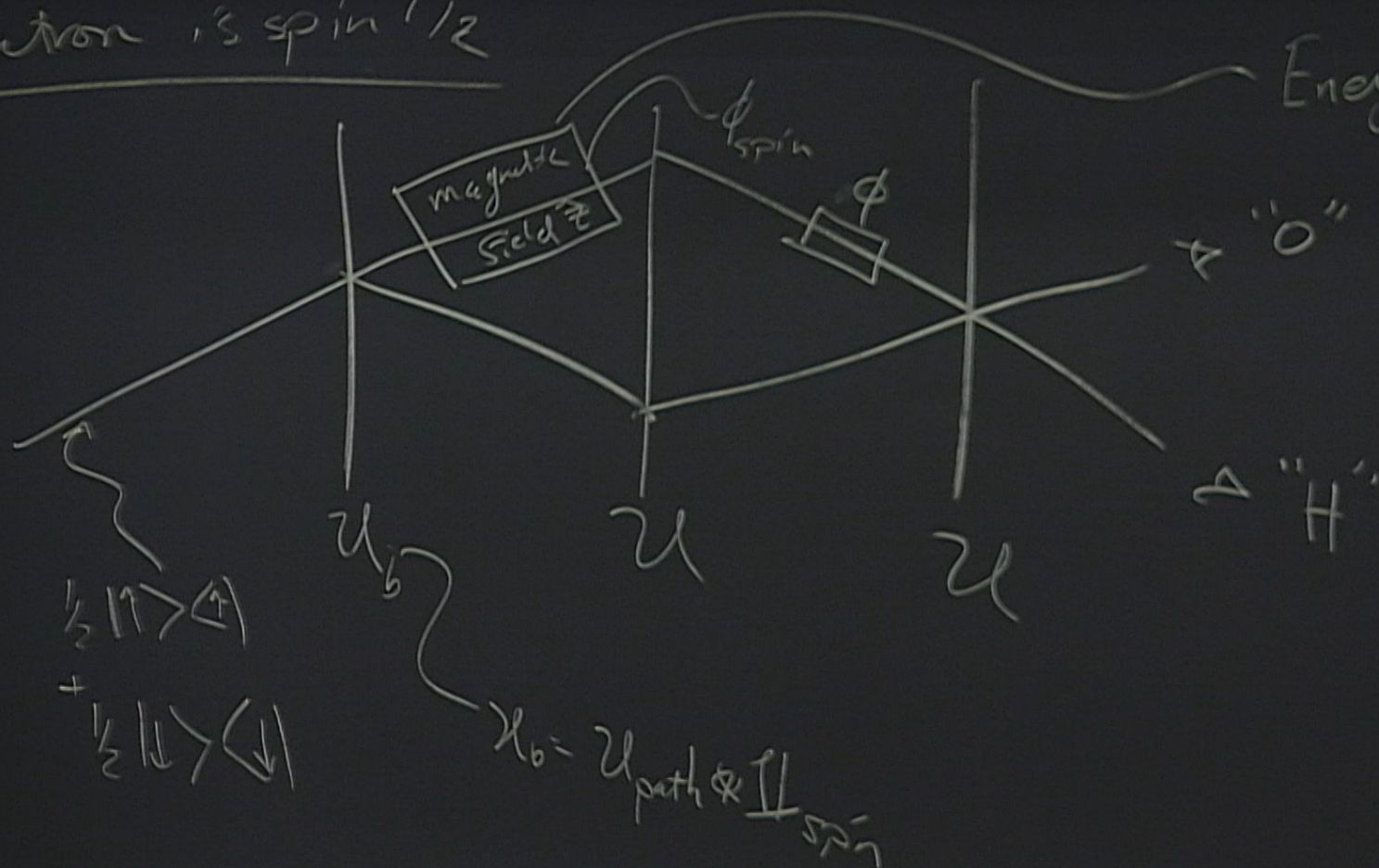
gyromagnetic ratio
 $\sim 2\pi 2000 \text{ Hz/G}$

$$U_{\text{path}} \propto \vec{I} \cdot \vec{S}$$

neutron is spin $1/2$

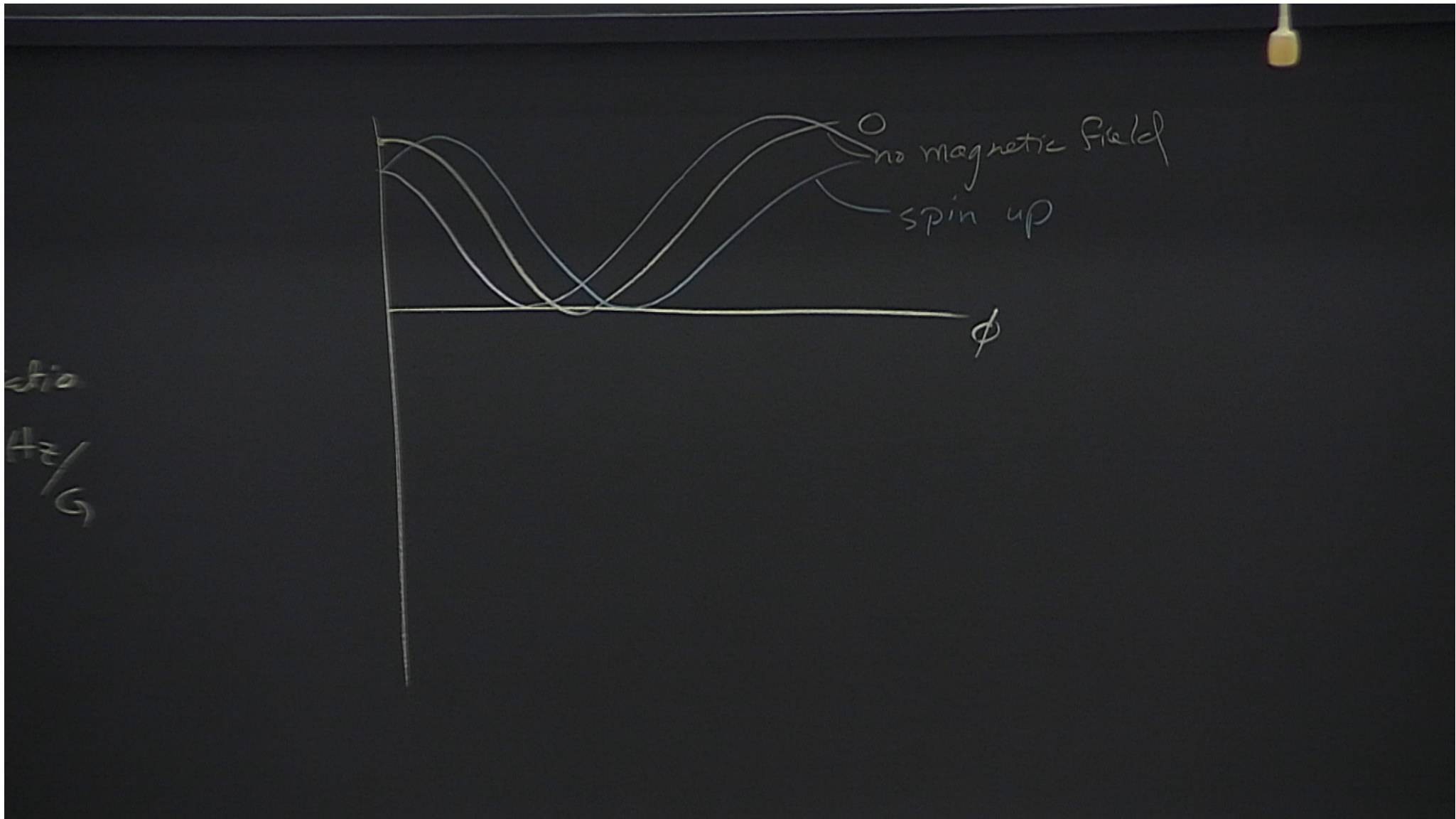


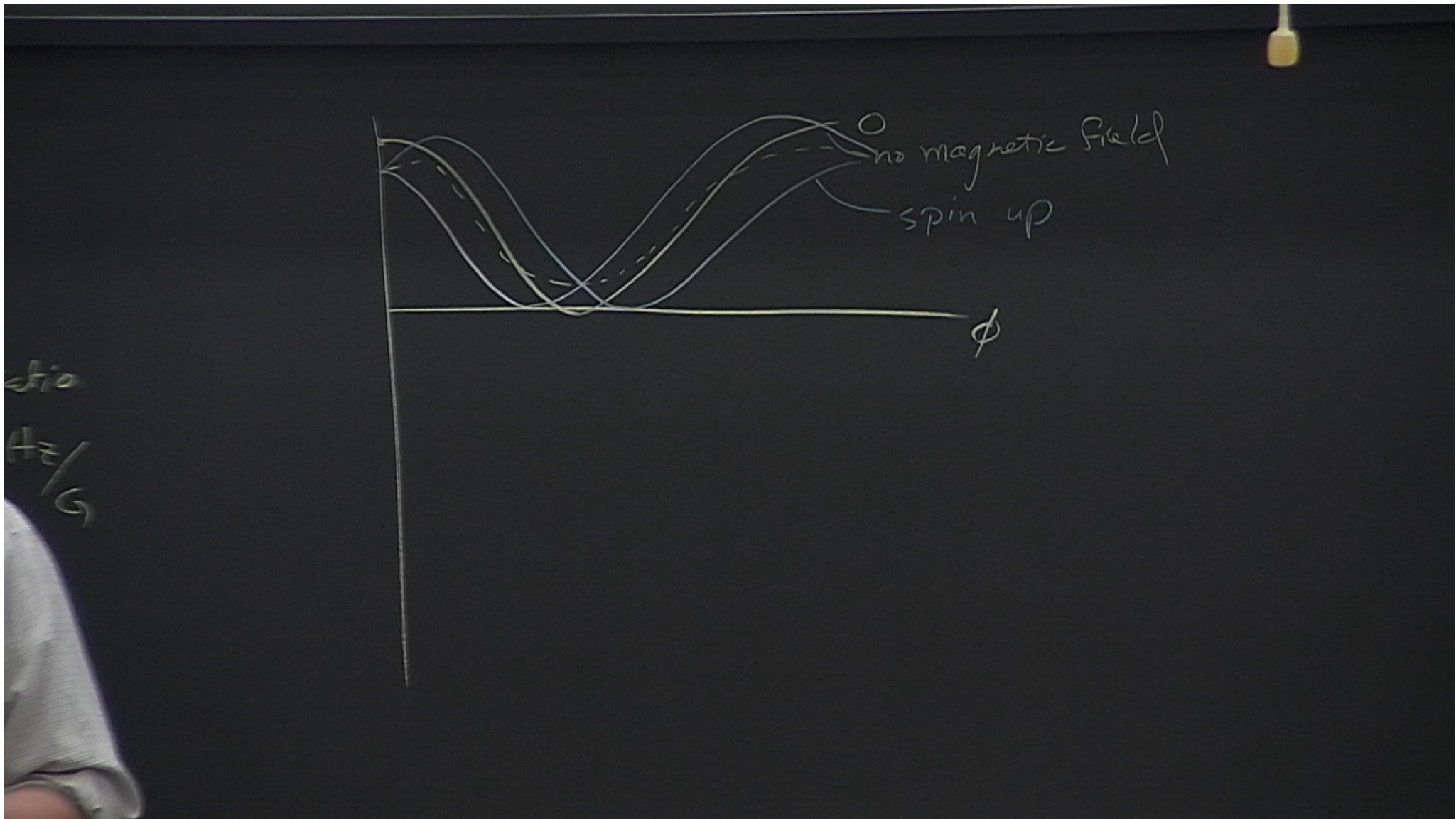
neutron is spin $1/2$



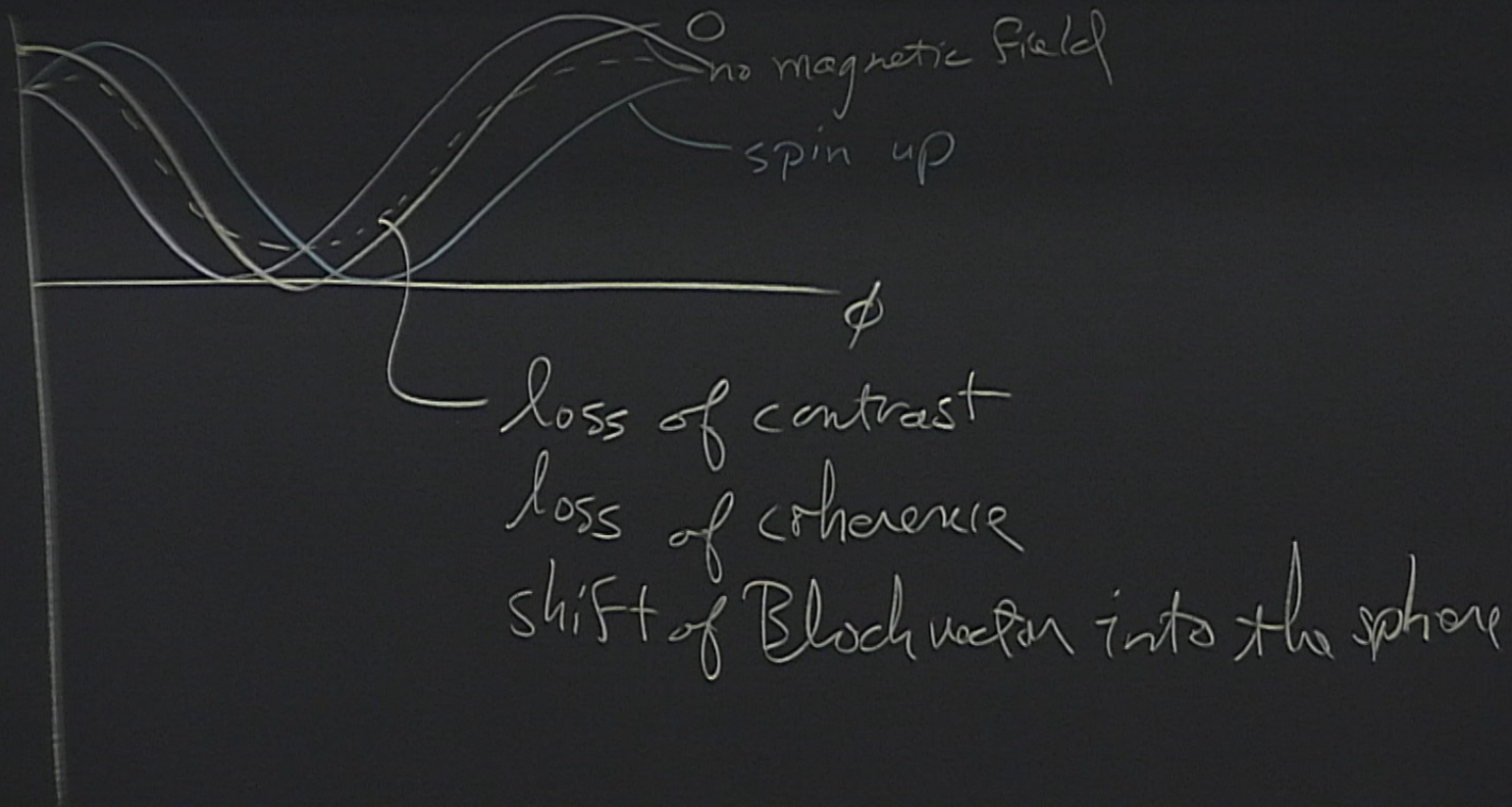
Energy = $\gamma_n B_z m_z$

gyromagnetic ratio ~ 25

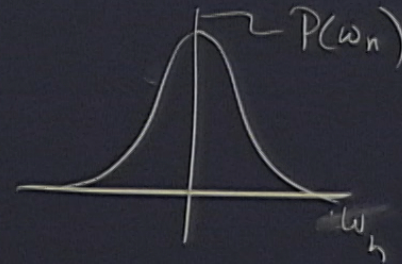


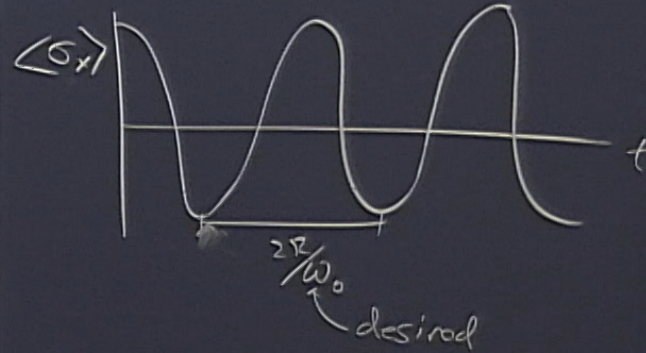
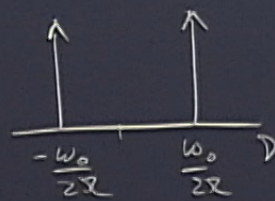


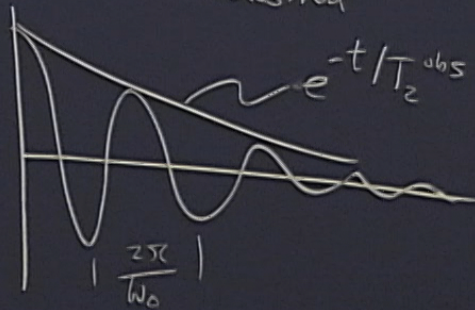
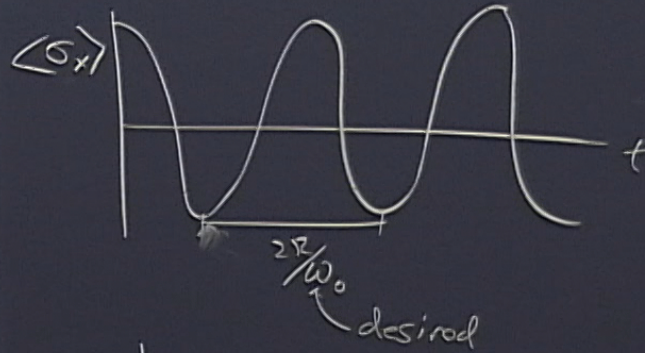
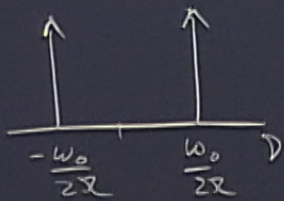
dia
 $H = \frac{e}{g}$



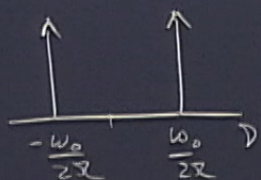
$$S(\omega) = \int P(\omega_n) \underbrace{U_n(\omega_n)}_{\rightarrow \frac{\omega_n T}{2} \sigma_z} S_{\rightarrow h} U_n^{-1}(\omega_n) d\omega_n$$



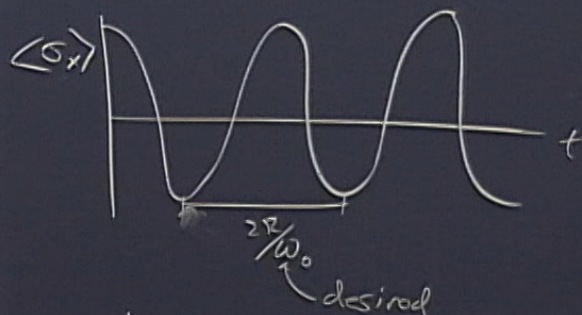




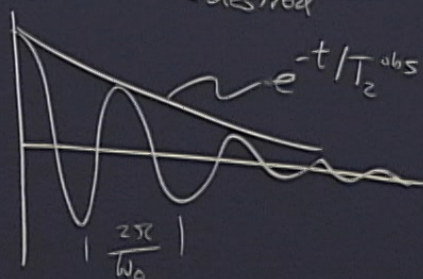
$$\mathcal{S}(\omega) = \int$$



$\hat{F}$
 $\Leftrightarrow$

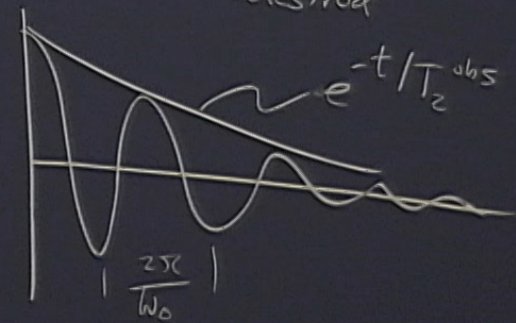
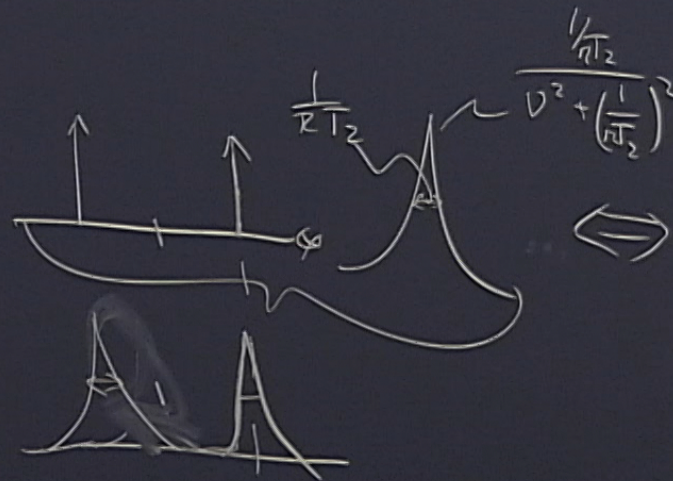
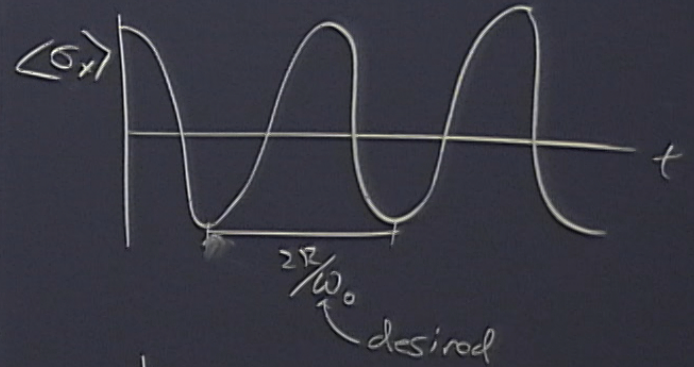
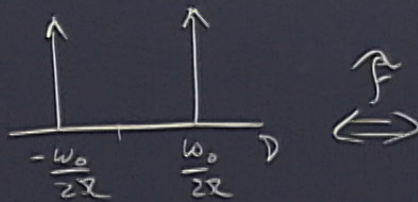


$\Leftrightarrow$

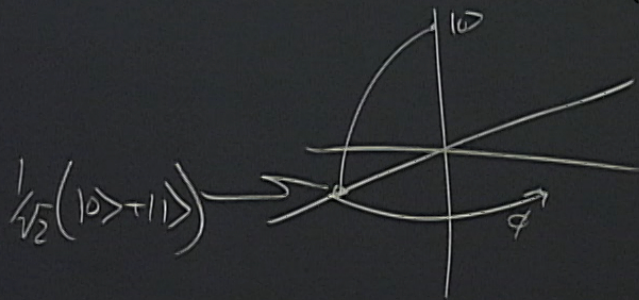


$$S(\omega) = \int P(\omega_n) d\omega_n$$

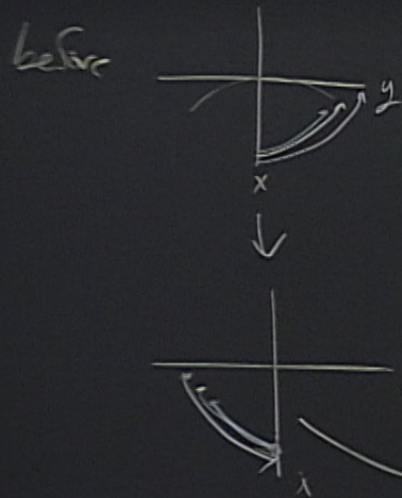
$$\overline{\{f(t) \cdot g(t)\}} = \overline{\{f(t)\}} \cdot \overline{\{g(t)\}}$$



Hahn
If the underlying distribution is static, then it may be



is static. then it may be removed,



echo - contains no information
about noise;

Hahn
 If the underlying distribution is static, then it may be removed

