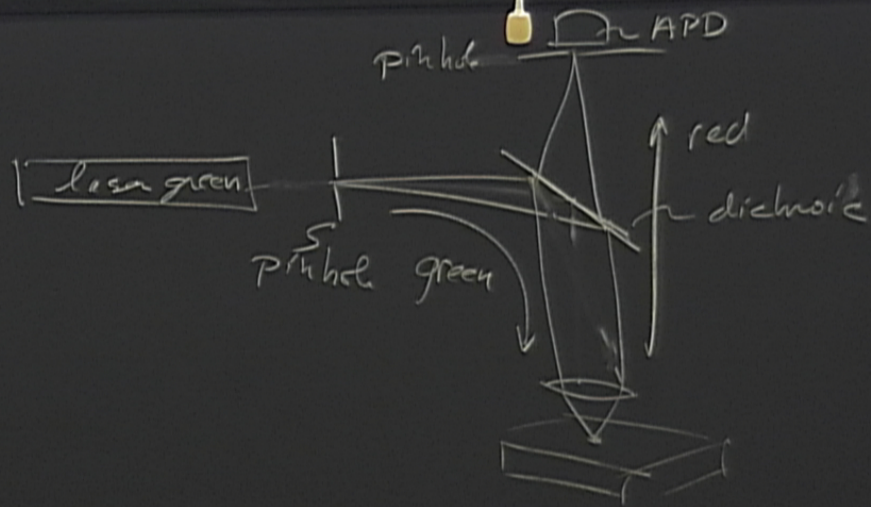


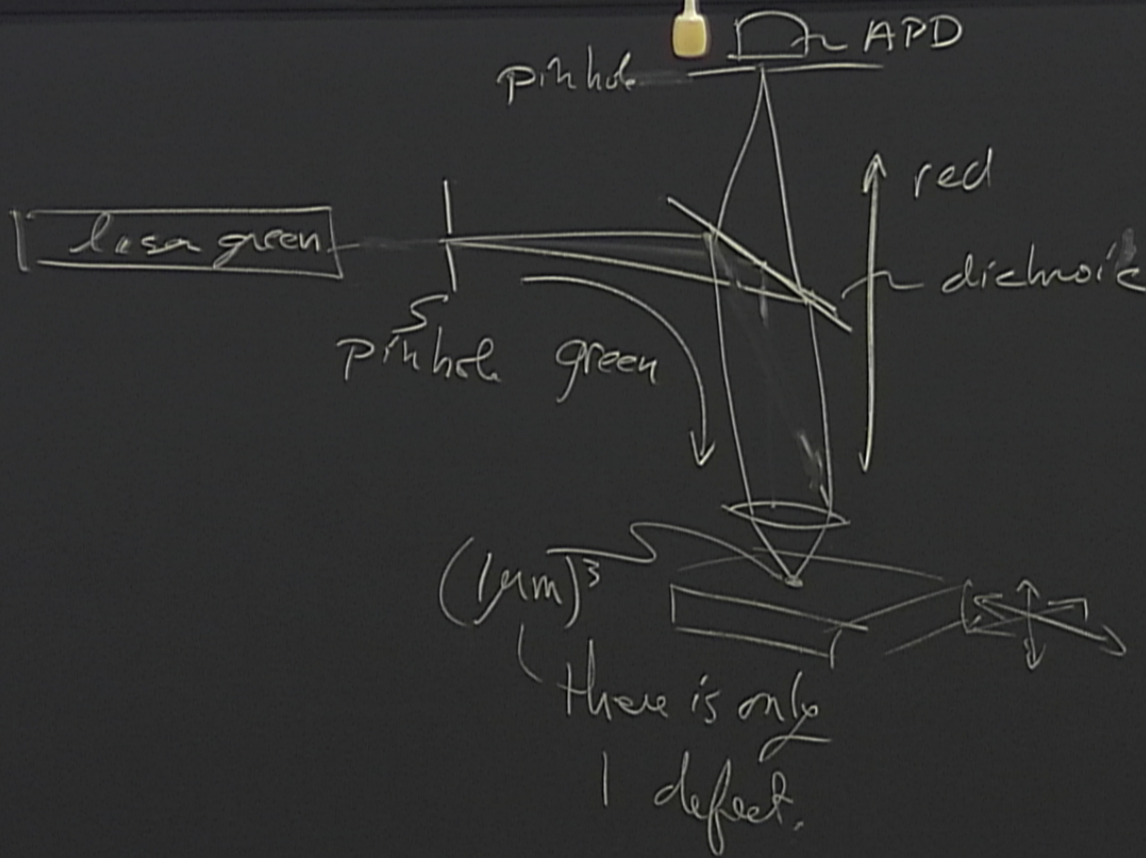
Title: 13/14 PSI - Explorations in Quantum Information - Lecture 14

Date: Apr 03, 2014 09:00 AM

URL: <http://pirsa.org/14040011>

Abstract:



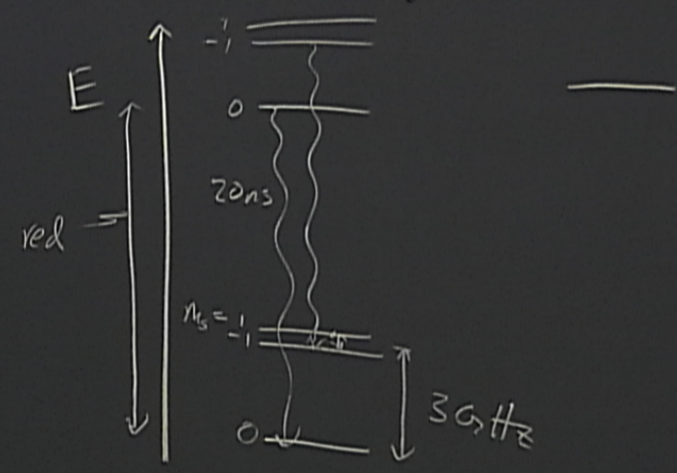




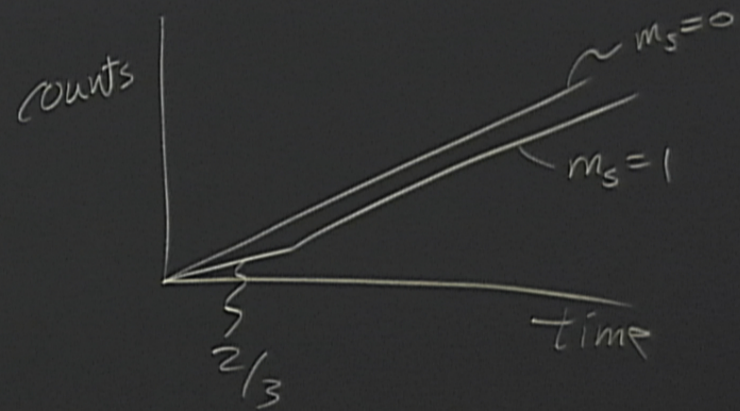
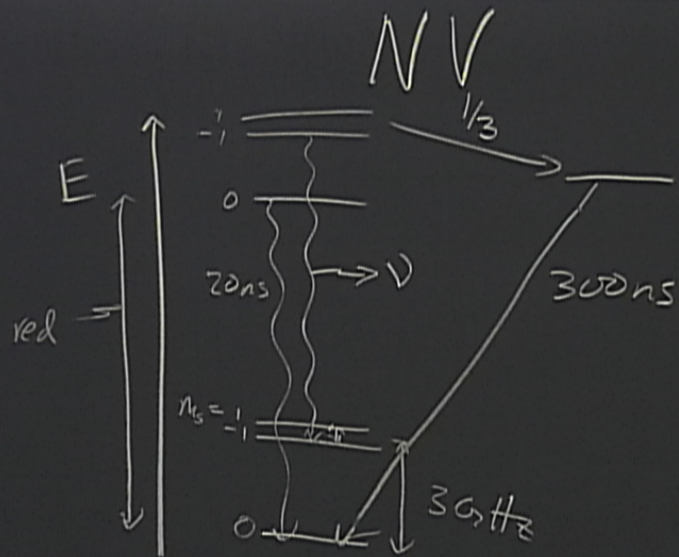
spin, electron

=  
-  
-  
T S

NV



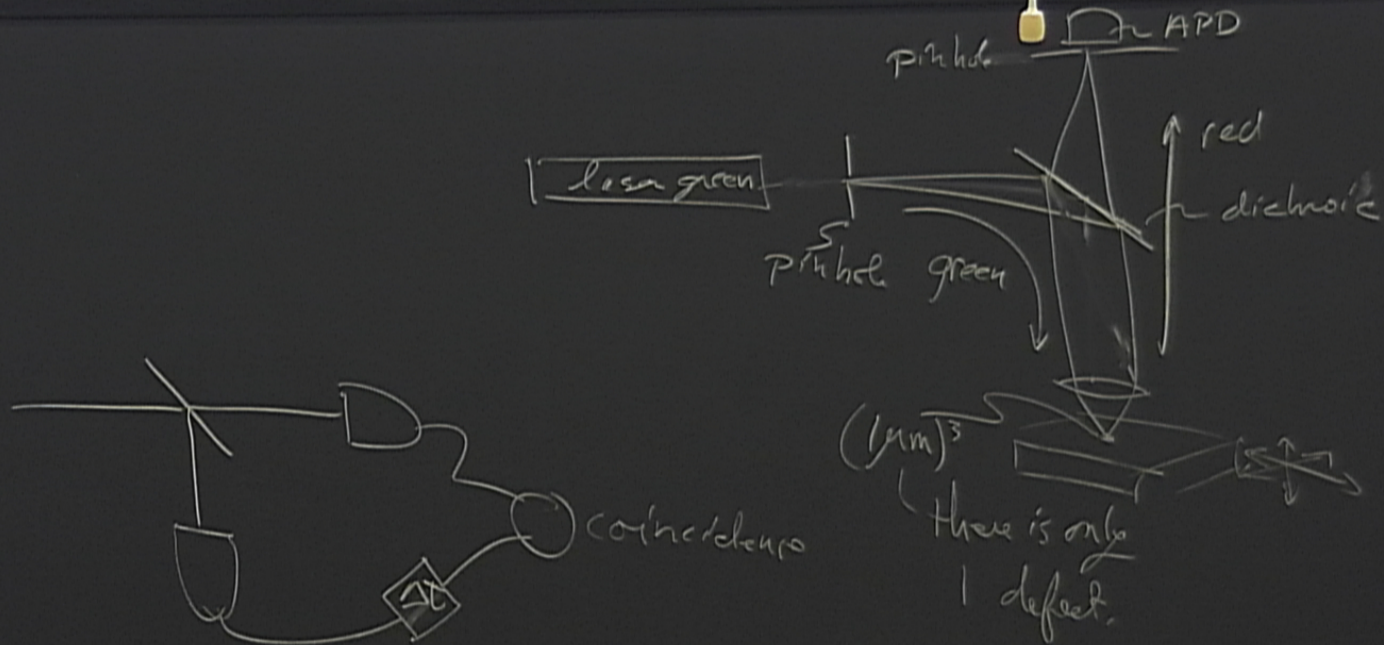




$m_s = 0$

$m_s = 1$

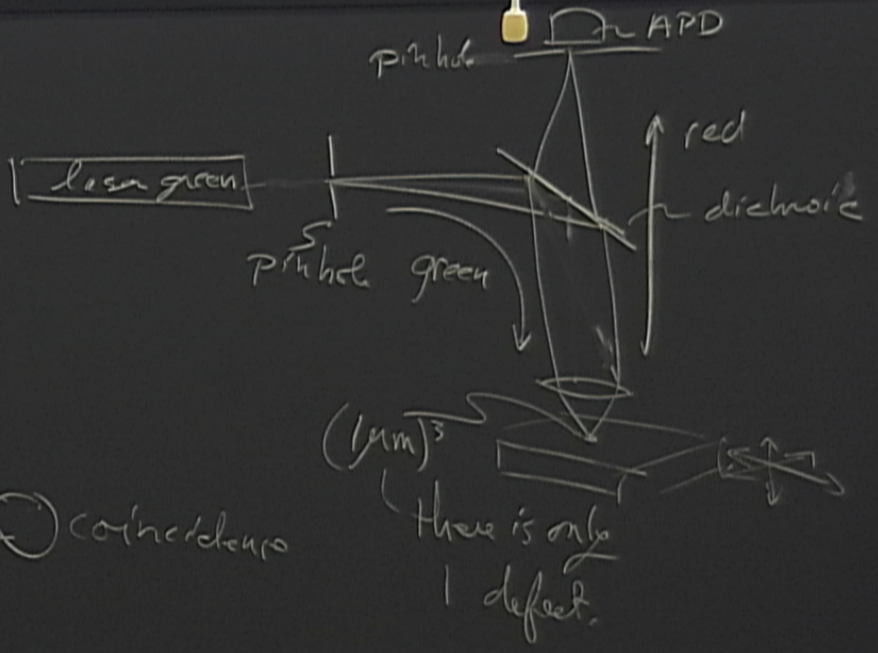
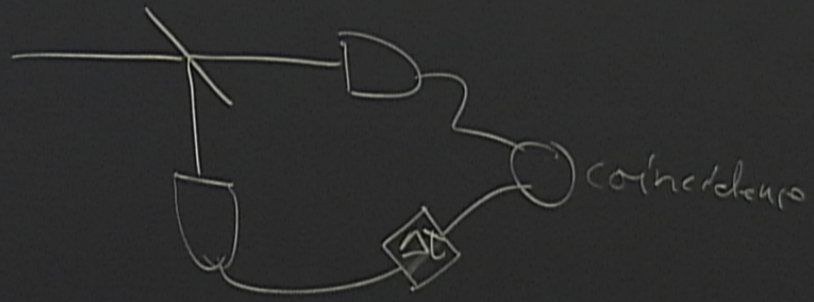
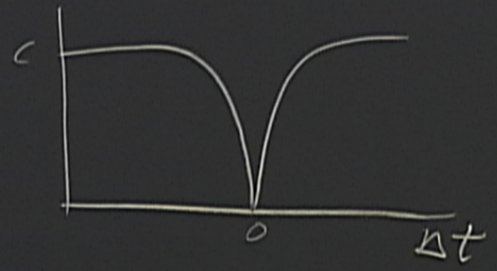
time





$m_s = 0$   
 $m_s = 1$

time



$e / \text{BC}$

cool  $|0\rangle \otimes |1\rangle$

swap  $|1\rangle \otimes |0\rangle$

cool  $|00\rangle$

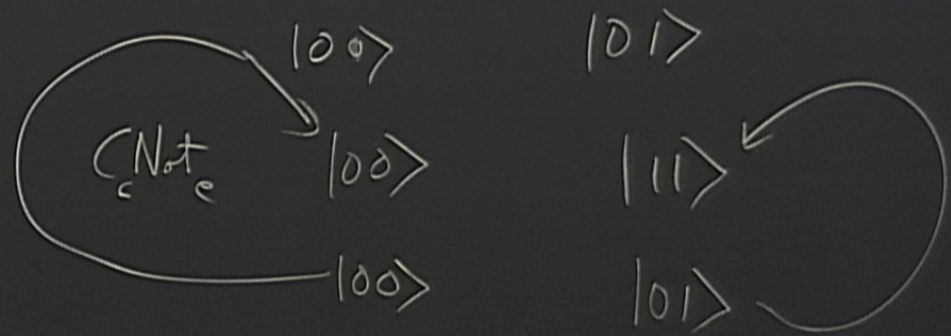
rotate  $e$   $(\alpha|0\rangle + \beta|1\rangle) \otimes |0\rangle$

$C_{\text{Not}_e}$   $\alpha|00\rangle + \beta|11\rangle$

$$\alpha|00\rangle + \beta|11\rangle$$

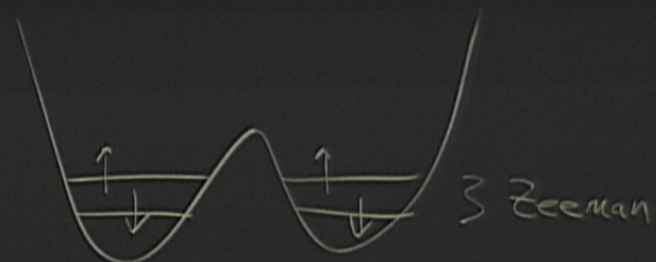
$$|0\rangle \cdot \alpha^2$$

$$|1\rangle \cdot \beta^2$$

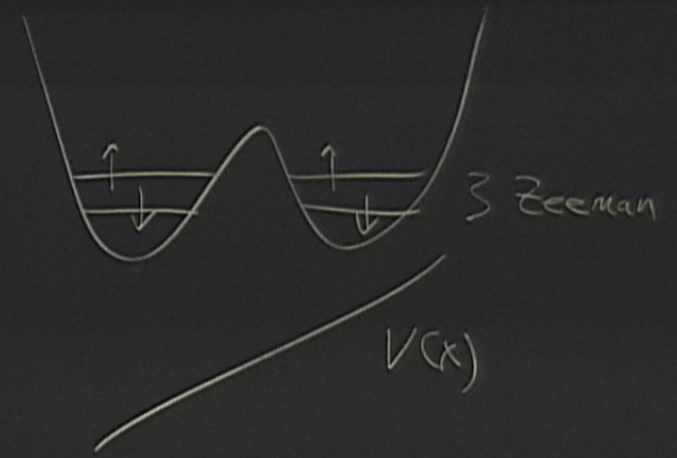




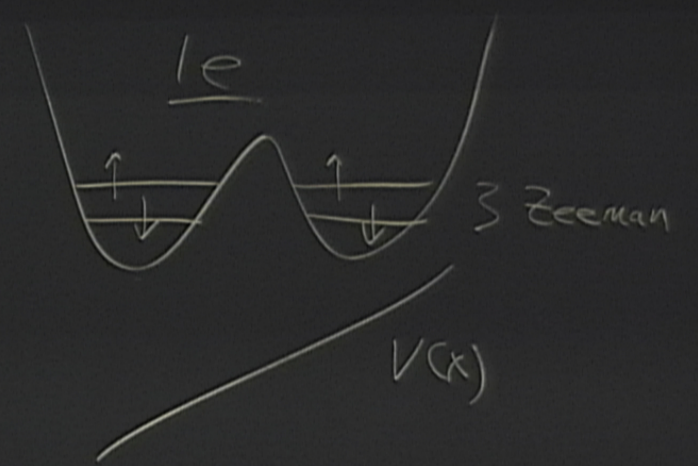
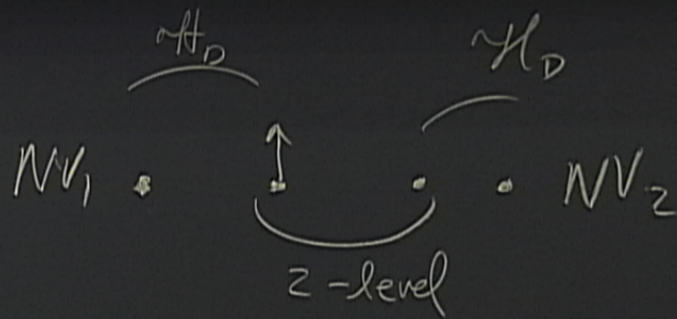
$1$   
↑  
z-level • NV<sub>2</sub>

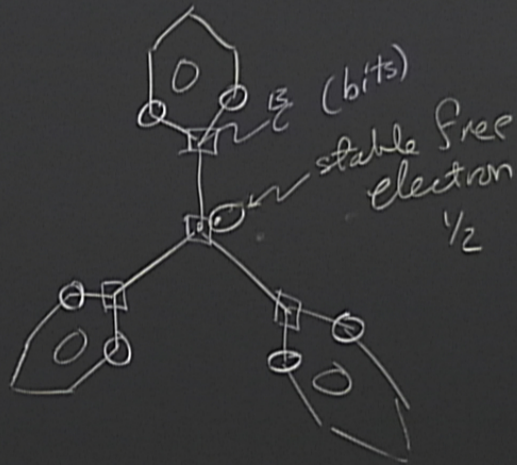
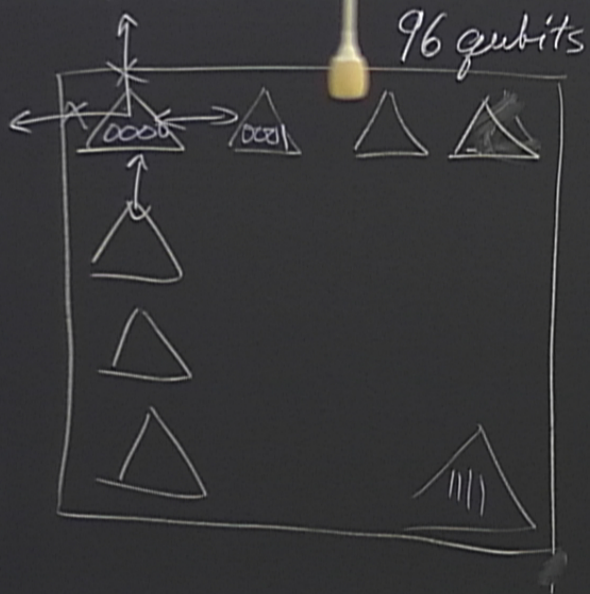


$NV_1$  •  $NV_2$   
z-level





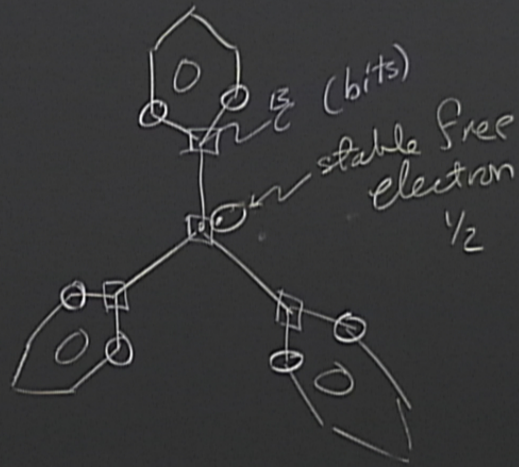
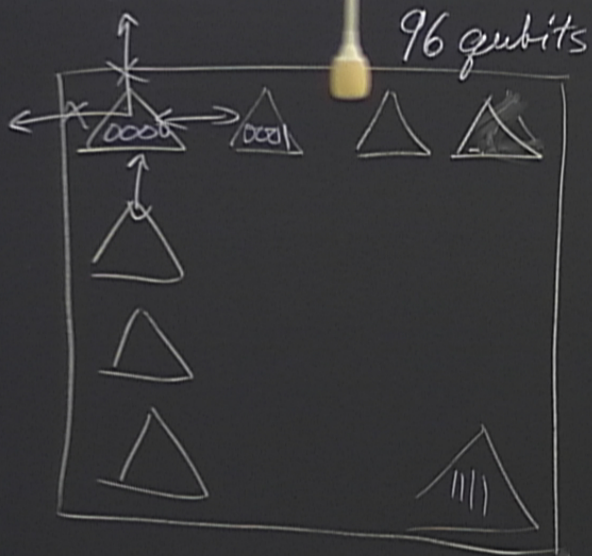




$$H = \omega_e \sigma_z^e + \sum_k^{\text{nucleon}} \omega_k^A \sigma_z^e \sigma_z^A$$

↑  
1/2, -1/2

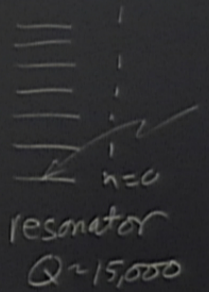
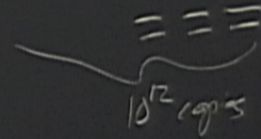


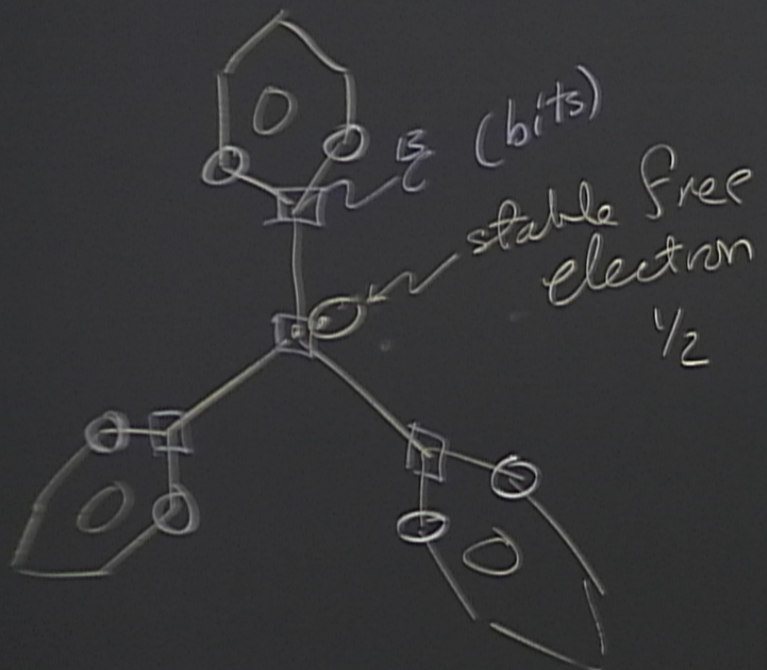


$$H = \omega_e \sigma_z^e + \sum_k^{\text{nuclear}} \omega_k^A \sigma_z^e \sigma_z^A$$

$\uparrow$   
 $1/2, -1/2$

polarize e-spin

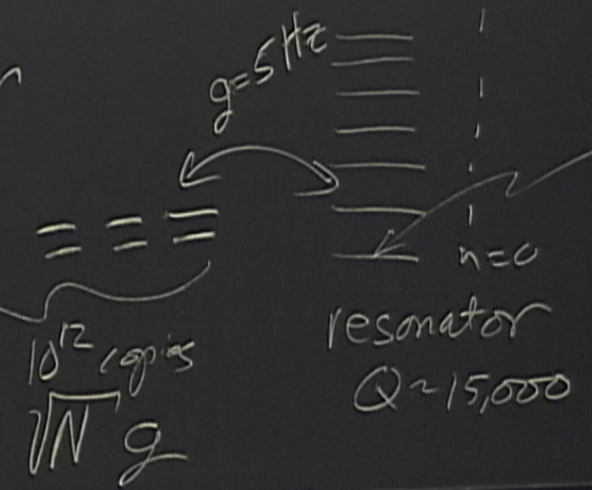
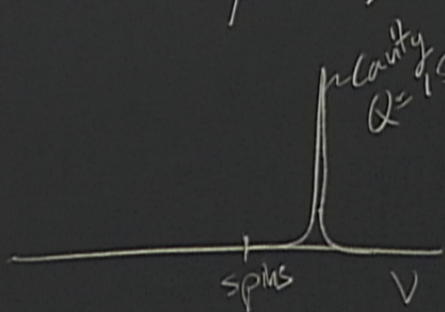




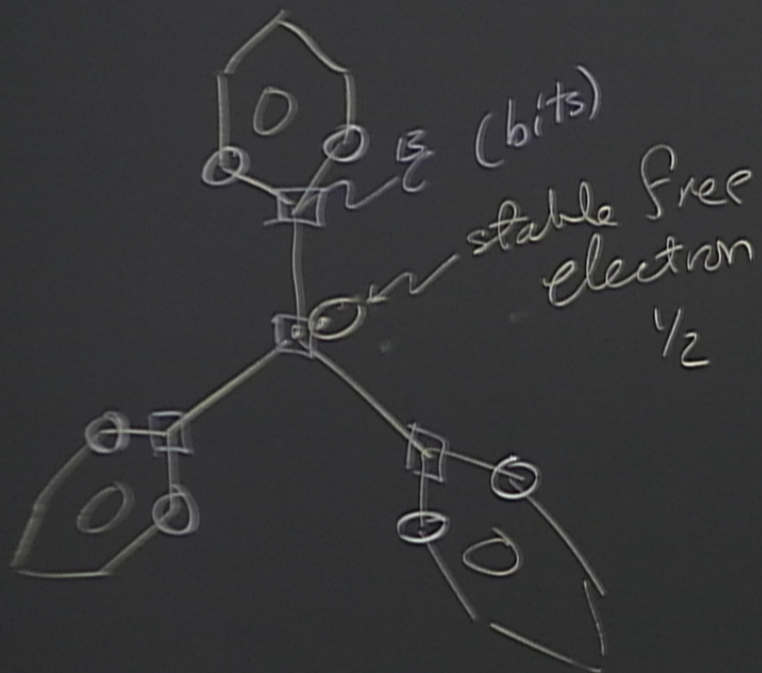
$$H = \omega_e \sigma_z^e + \sum_k^{\text{nuclear}} \omega_k^A \sigma_z^e \sigma_z^k$$

$\uparrow$   
 $\frac{1}{2}, -\frac{1}{2}$

polarize e-spin



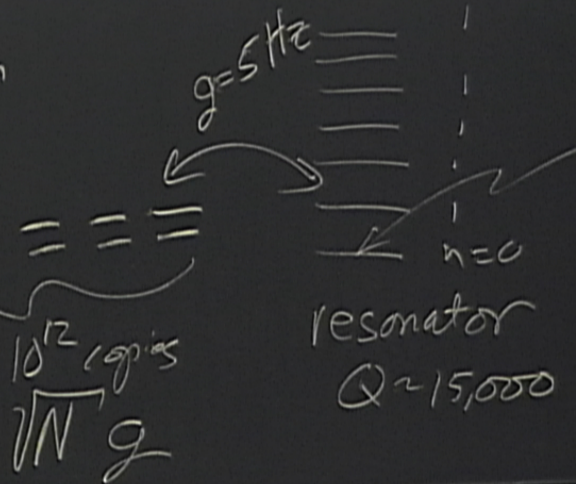
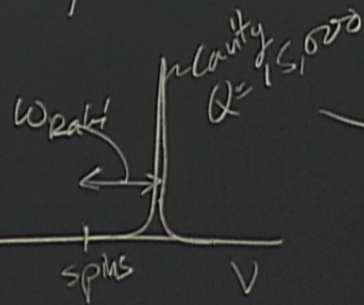




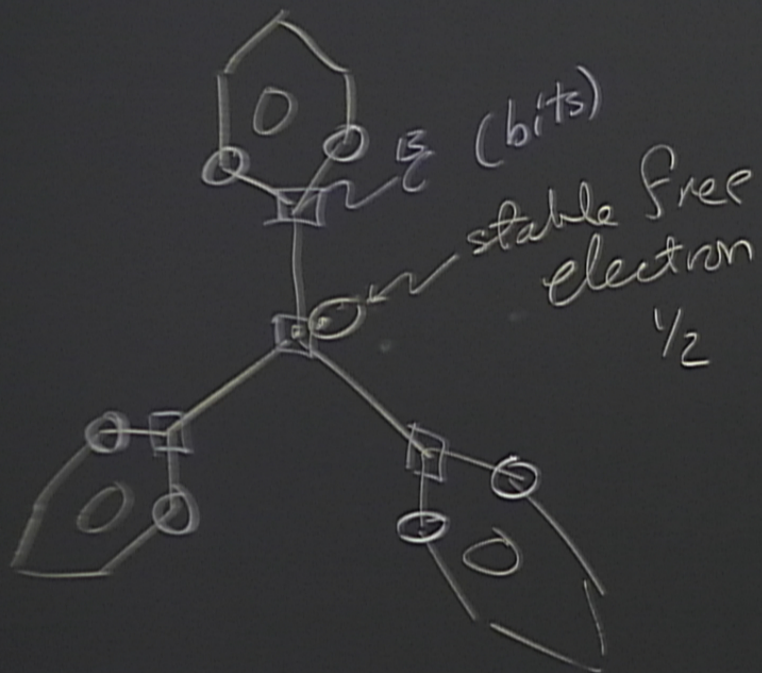
$$H = \omega_e \sigma_z^e + \sum_k^{\text{nuclear}} \omega_k^A \sigma_z^e \sigma_z^k$$

↑  
1/2, -1/2

polarize e-spin

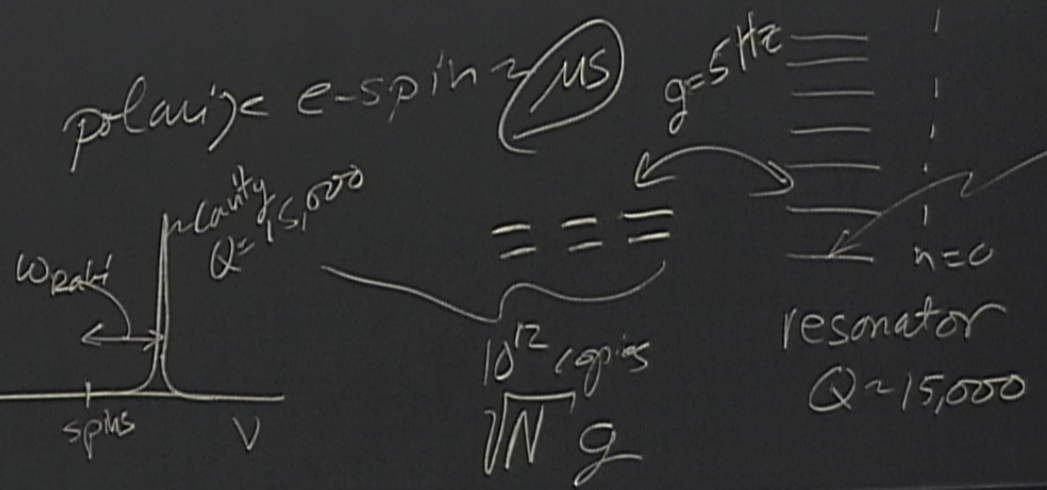




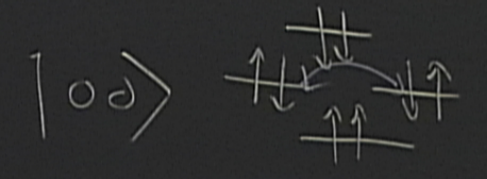
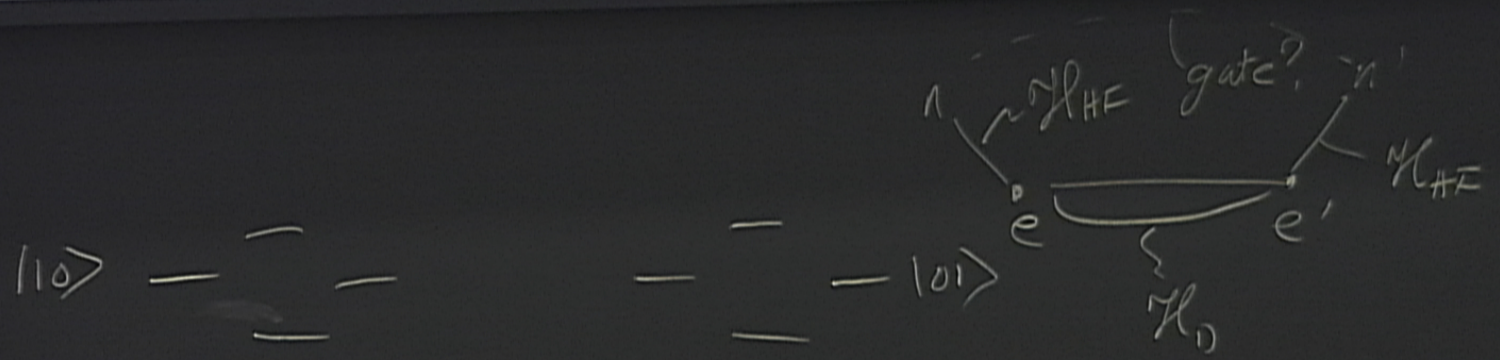
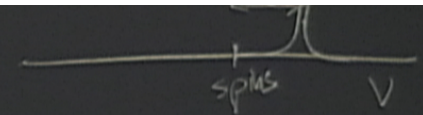


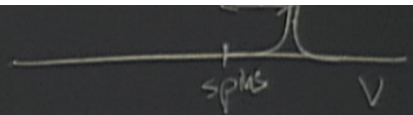
$$H = \omega_e \sigma_z^e + \sum_k^{\text{nuclear}} \omega_k^A \sigma_z^e \sigma_z^k$$

$\uparrow$   
 $\frac{1}{2}, -\frac{1}{2}$



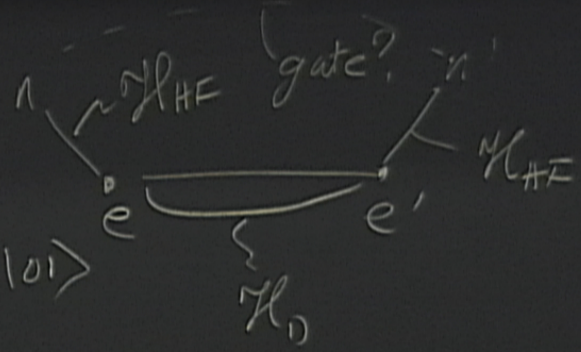
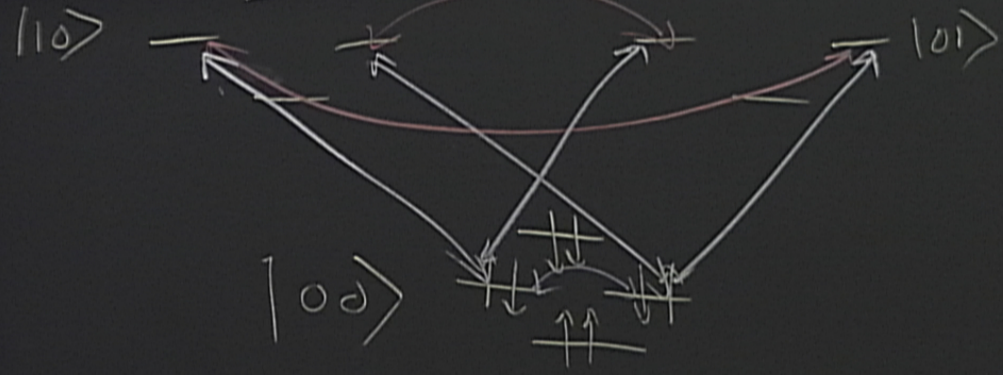






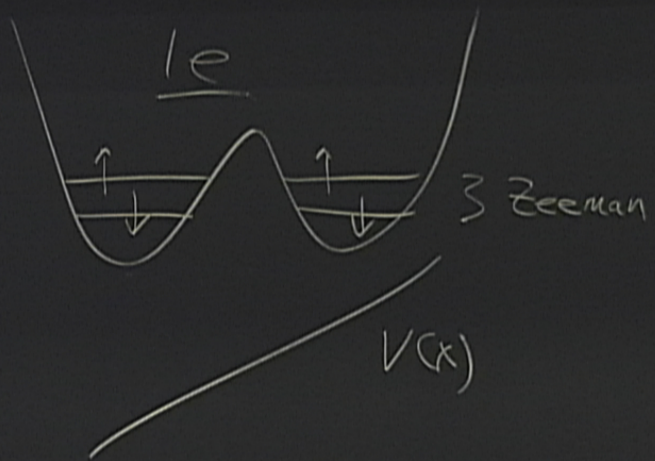
$$[\mathcal{H}_D, \mathcal{H}_{HF}] \mathcal{H}_{HF}$$

$$(\sigma_+ \sigma_- + \sigma_- \sigma_+) (\sigma_+ \sigma_- + \sigma_- \sigma_+)$$





$V_z$



- initialize
- universal gates
- measure
- decoherence
- scalable