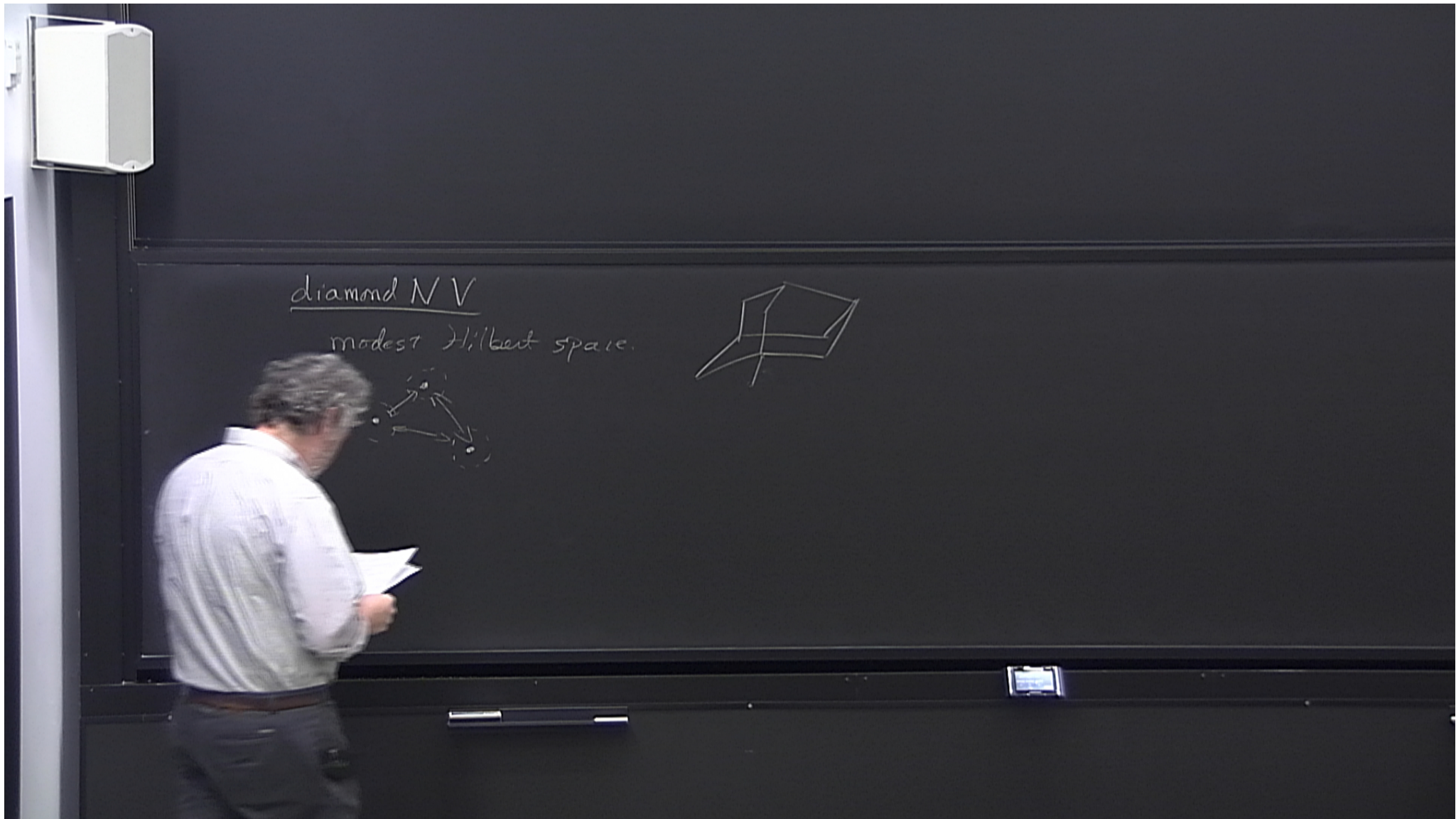


Title: PSI 2015/2016 Explorations in Quantum Information - David Cory - 6

Date: Mar 29, 2016 09:00 AM

URL: <http://pirsa.org/16030005>

Abstract:



2 electrons -

$$\hat{H} = \underbrace{\Delta_0}_{\omega_0} (\sigma_z^A - \sigma_z^B) + \omega_{ex} \left[\underbrace{\frac{1}{2} (\sigma_x^A \sigma_x^B + \sigma_y^A \sigma_y^B)}_{\sigma_+^A \sigma_-^B + \sigma_-^A \sigma_+^B} + \sigma_z^A \sigma_z^B \right]$$

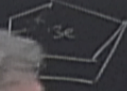
electrons

diamond NV

modest Hilbert space



vacancy



6 electrons
like a
1 e

2 electrons -

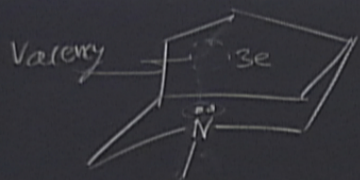
$$H = \Delta E (\sigma_x^A - \sigma_x^B) + \frac{1}{2} \left[\underbrace{(\sigma_x^A \sigma_x^B + \sigma_y^A \sigma_y^B)}_{\sigma_A \sigma_B + \sigma_C \sigma_D} + \sigma_z^A \sigma_z^B \right]$$

Triplet {

$$= \frac{1}{\sqrt{2}} (|\uparrow\uparrow\rangle, |\uparrow\downarrow\rangle, |\downarrow\uparrow\rangle)$$

$$= \frac{1}{\sqrt{2}} (|\uparrow\downarrow\rangle + |\downarrow\uparrow\rangle)$$

$$= \frac{1}{\sqrt{2}} (|\uparrow\downarrow\rangle - |\downarrow\uparrow\rangle) \text{ singlet}$$



$NV^- = 6 \text{ electrons}$
 looks like a
 spin 1 e

2 electrons -

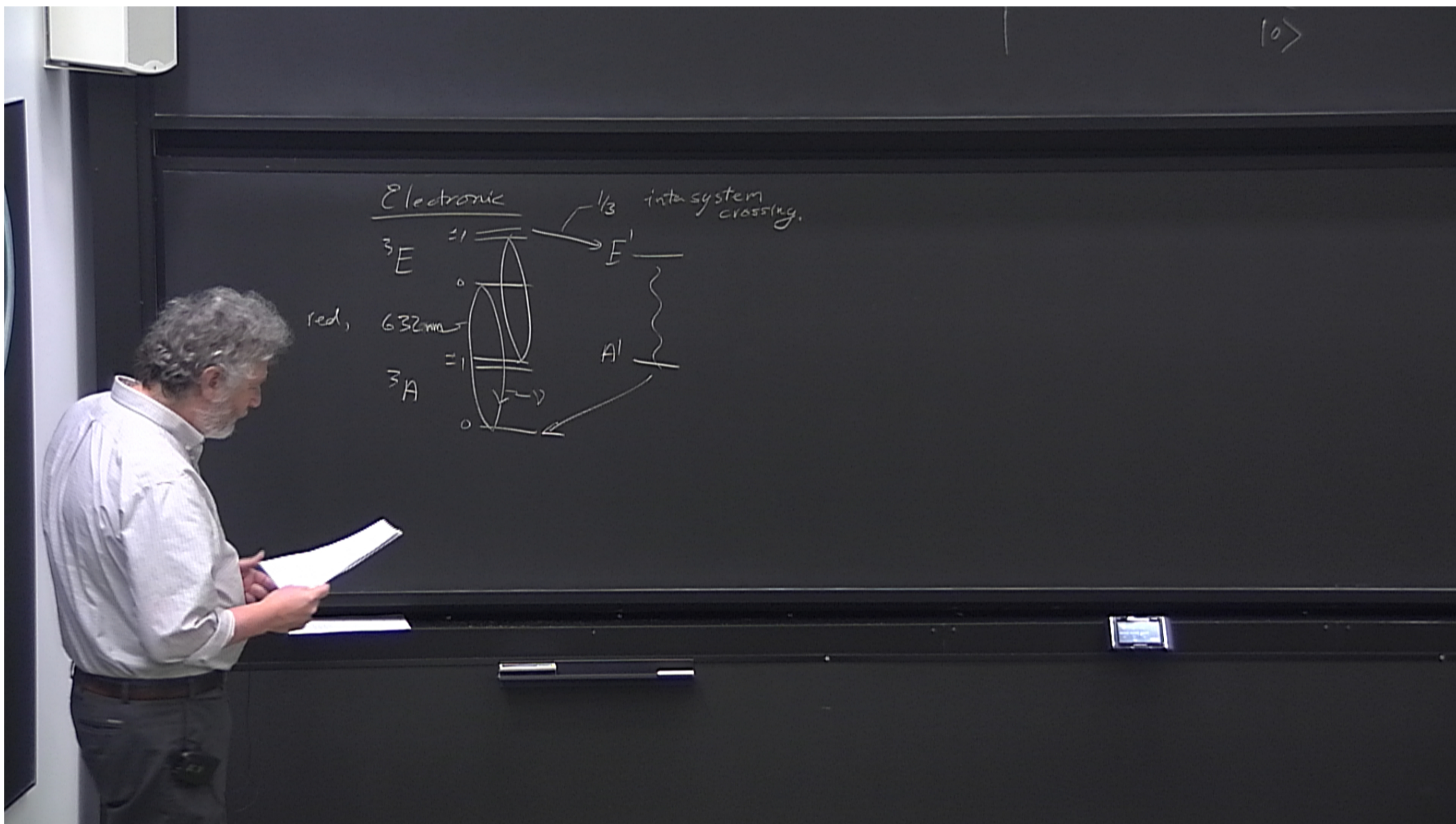
$$H = \underbrace{\Delta \omega}_{\omega_0} (\sigma_z^A - \sigma_z^B) + \omega_{ex} \left[\underbrace{\frac{1}{2} (\sigma_x^A \sigma_x^B + \sigma_y^A \sigma_y^B)}_{\sigma_+ \sigma_- + \sigma_- \sigma_+} + \sigma_z^A \sigma_z^B \right]$$

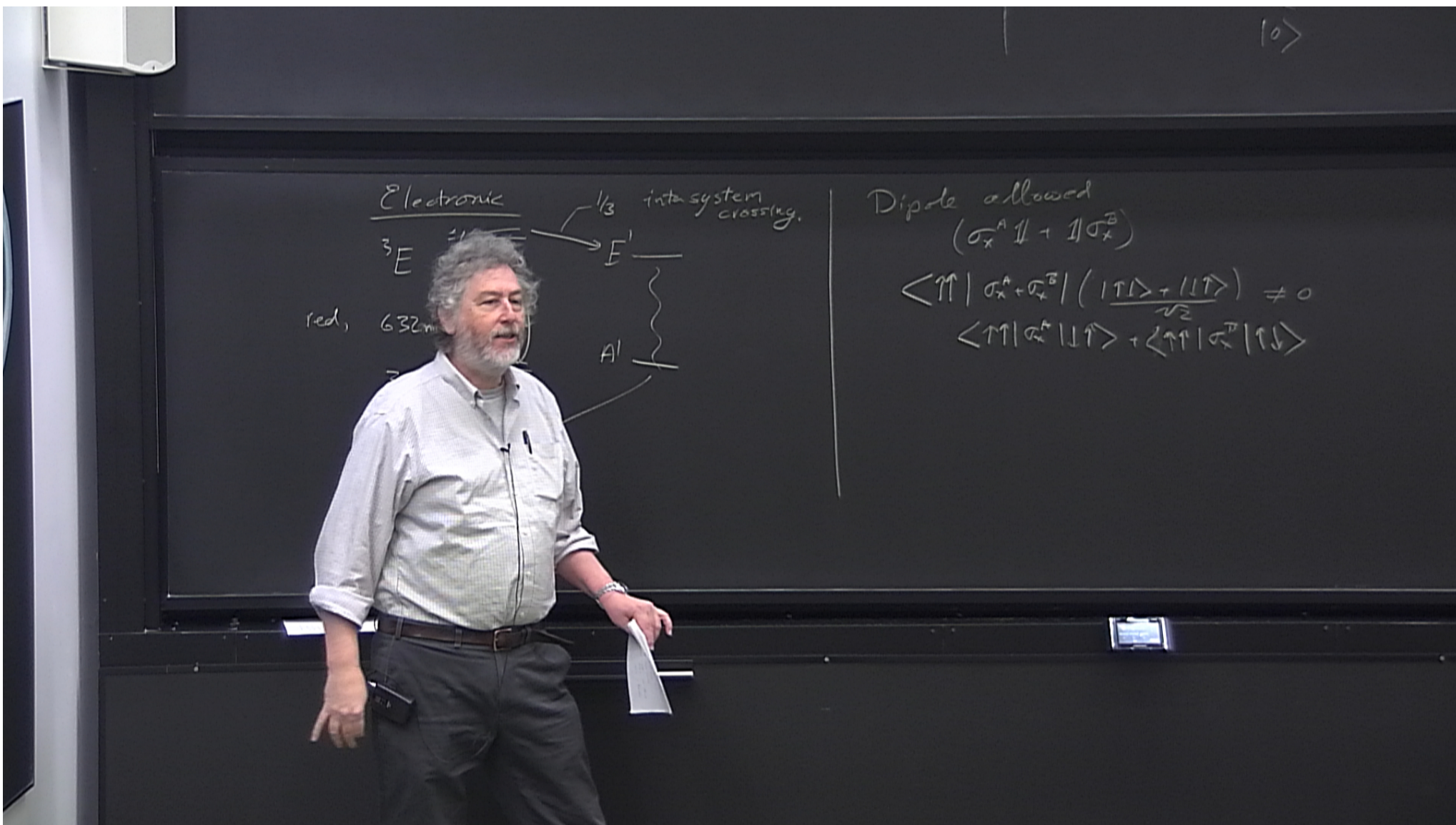
triplet {

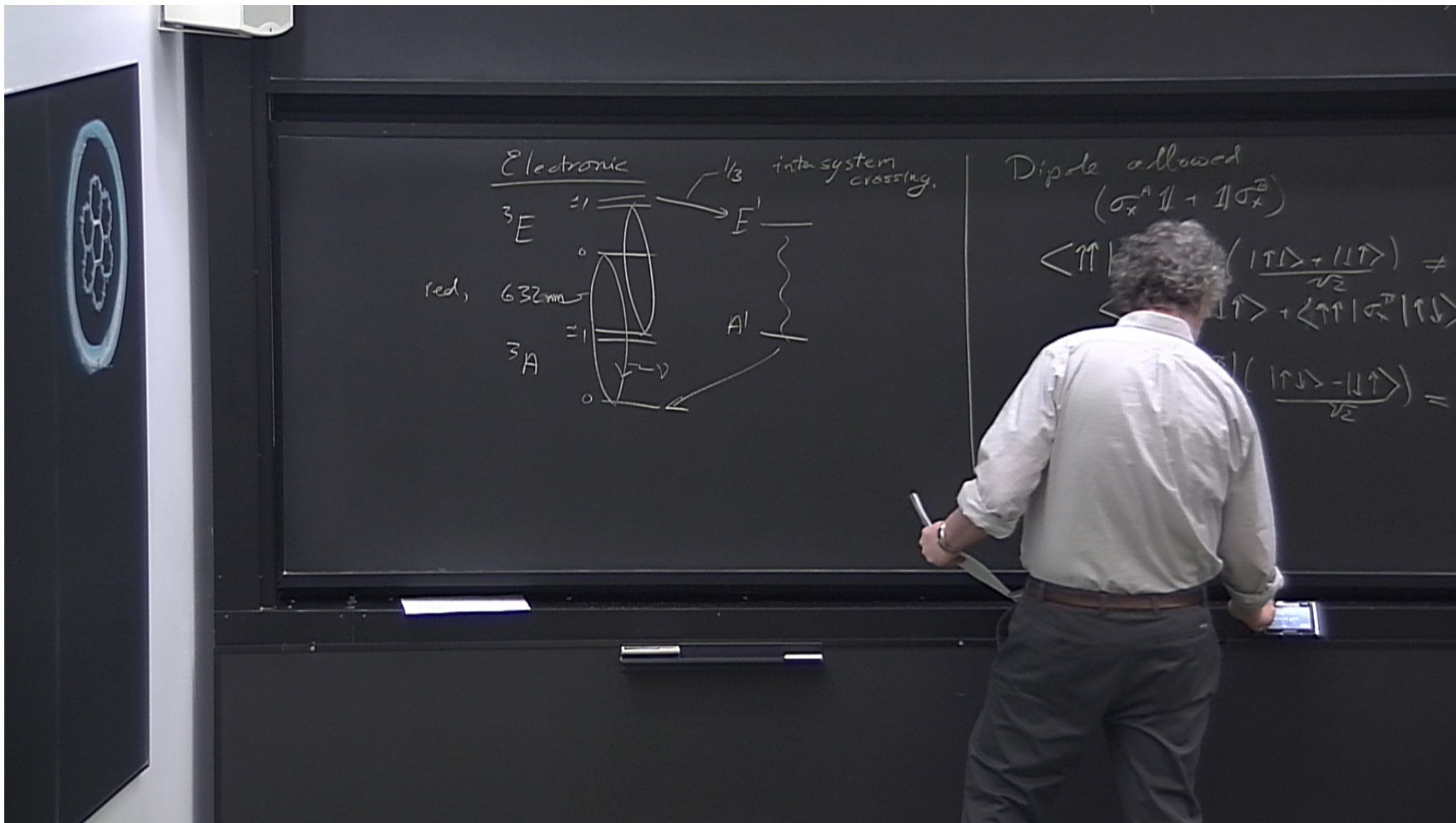
$$\begin{aligned}
 &= \begin{aligned} &= | \uparrow \uparrow \rangle, | \downarrow \downarrow \rangle \\ &| \uparrow \downarrow \rangle, | \downarrow \uparrow \rangle \end{aligned} \\
 &= \frac{| \uparrow \downarrow \rangle + | \downarrow \uparrow \rangle}{\sqrt{2}} \\
 &| 0 \rangle
 \end{aligned}$$

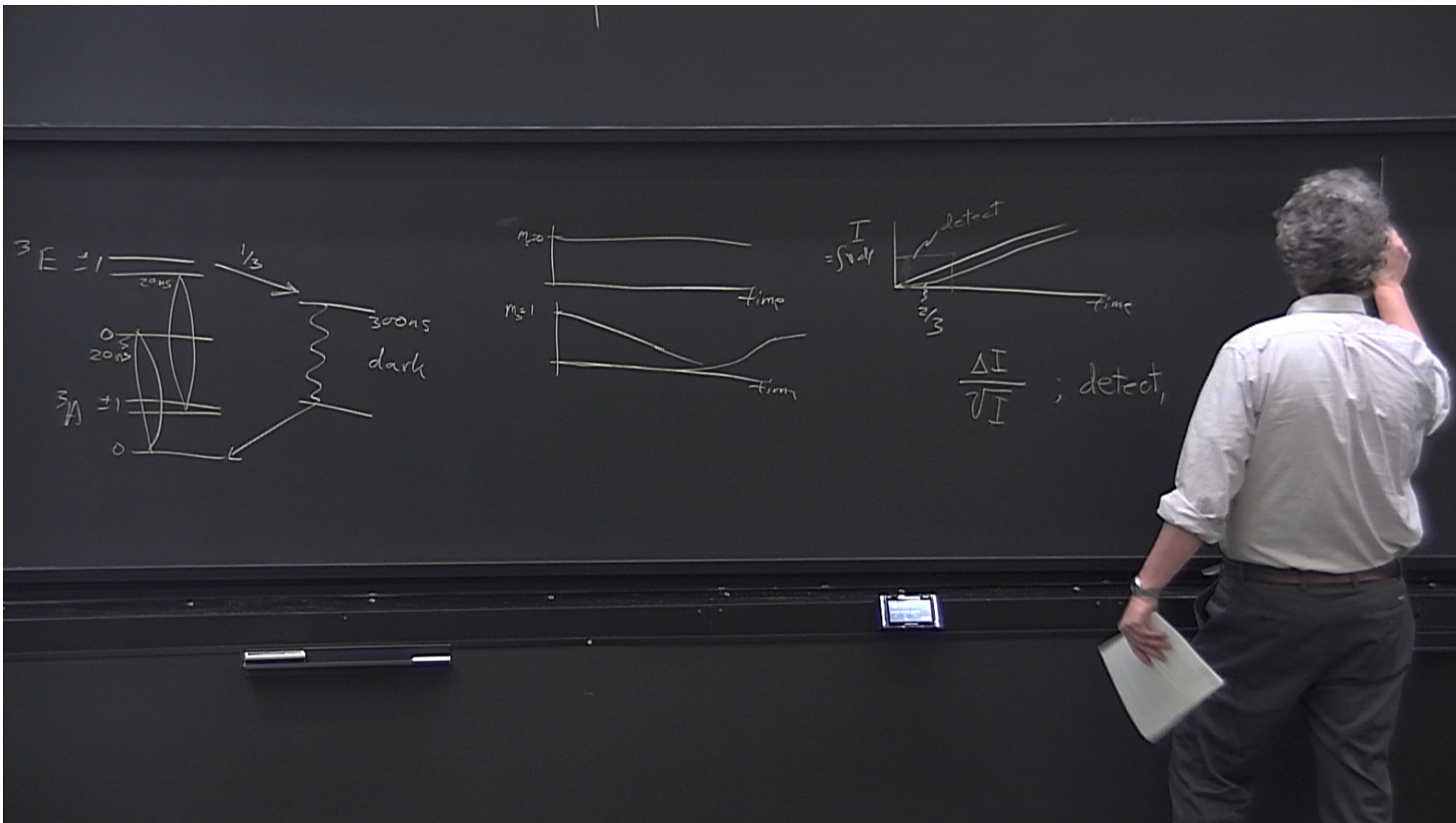
singlet

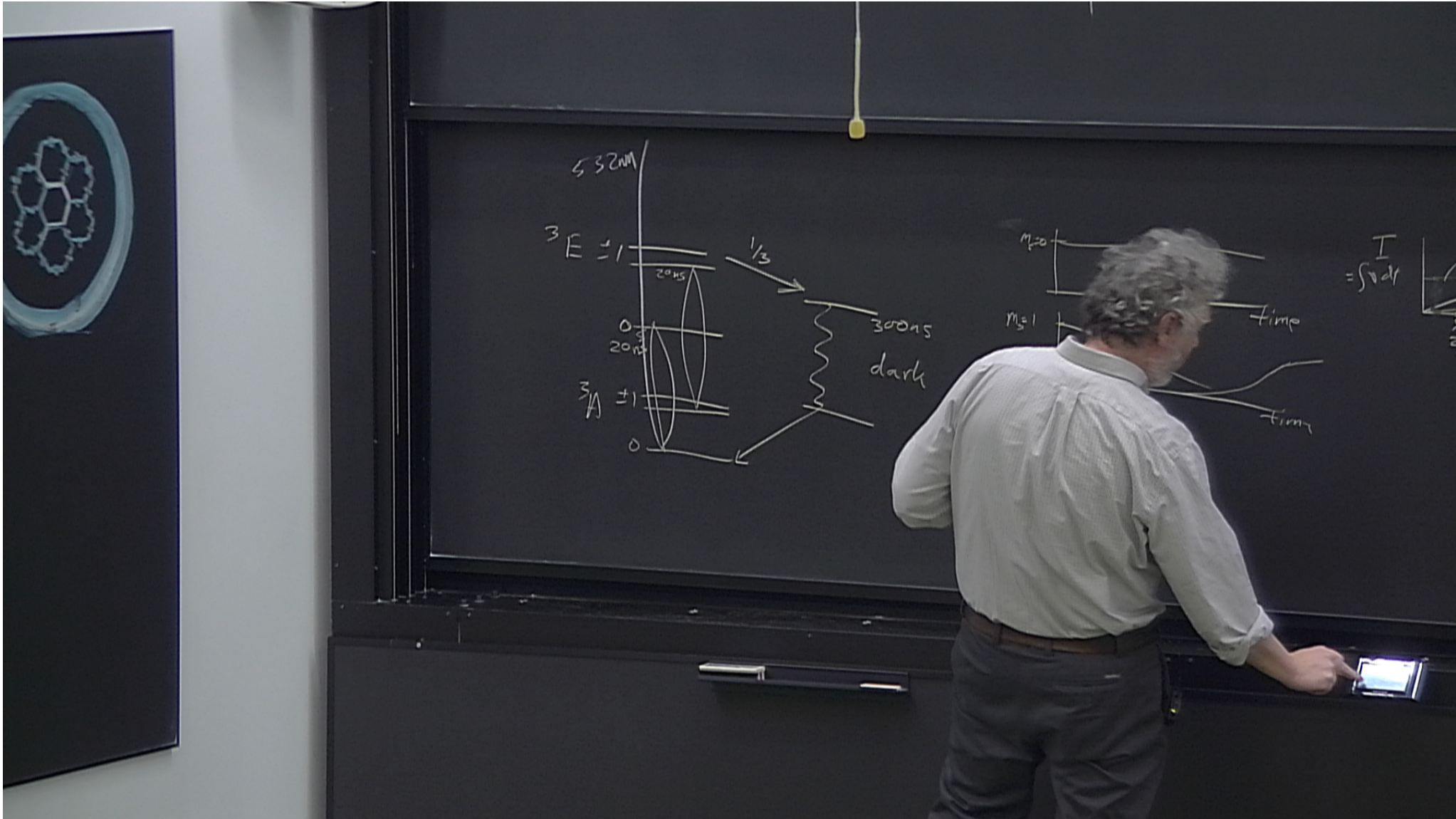
$$\frac{| \uparrow \downarrow \rangle - | \downarrow \uparrow \rangle}{\sqrt{2}} \quad | s \rangle$$

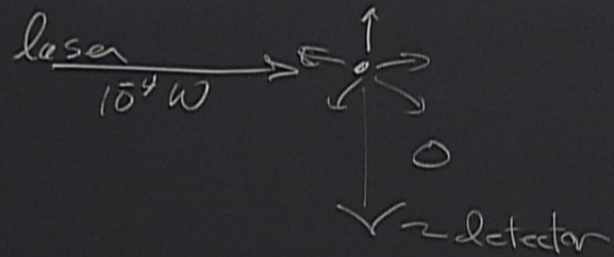




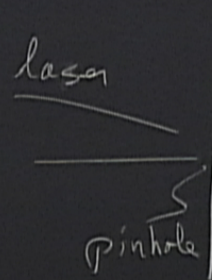


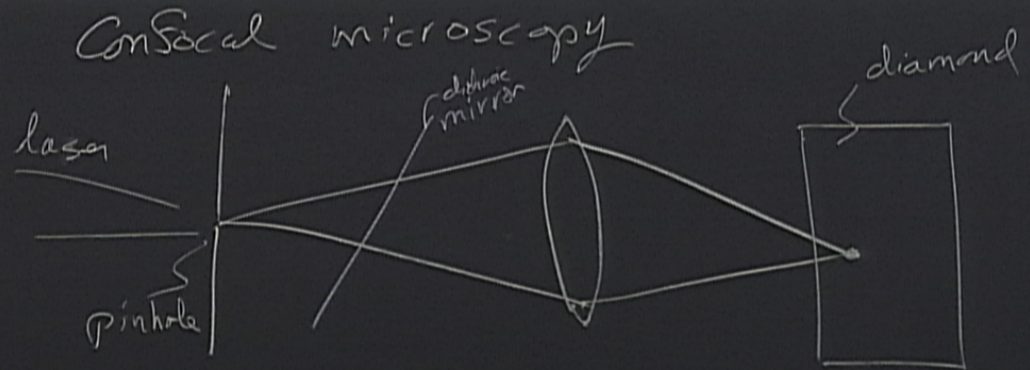
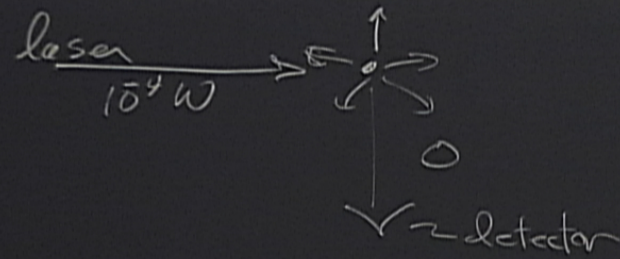


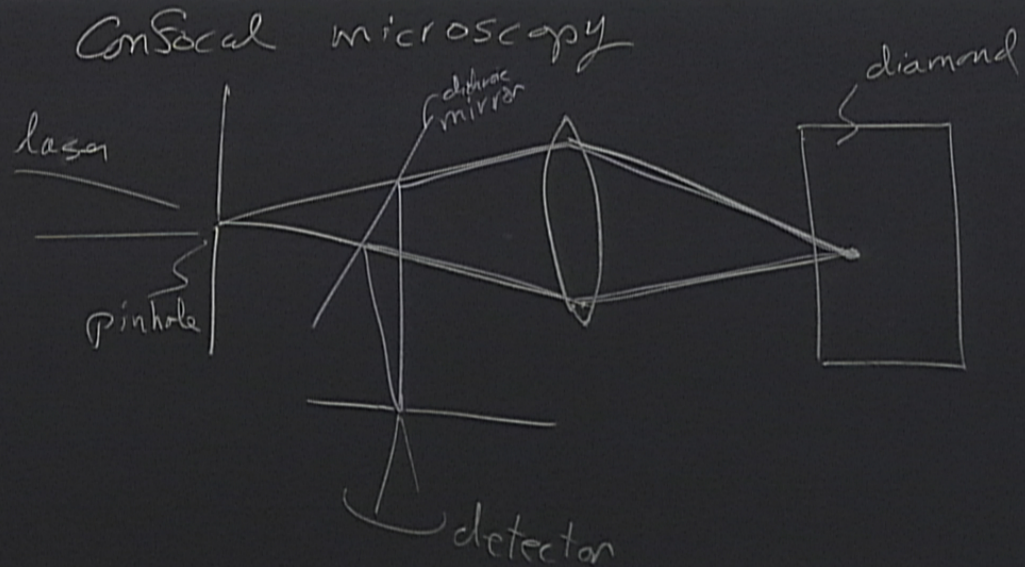
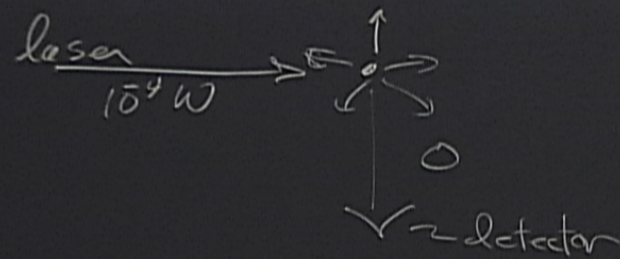




Confocal microscopy

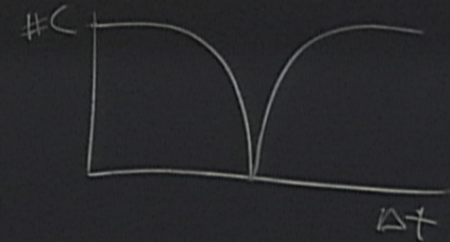
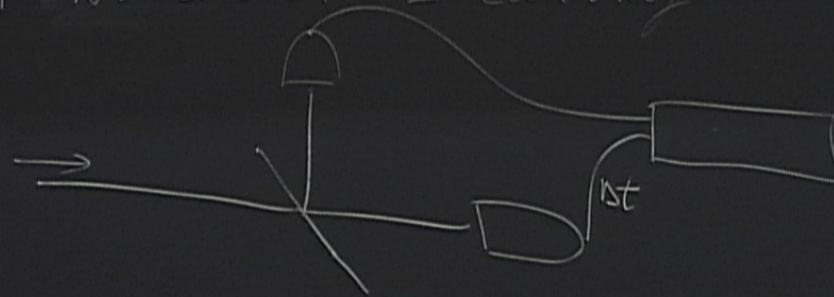






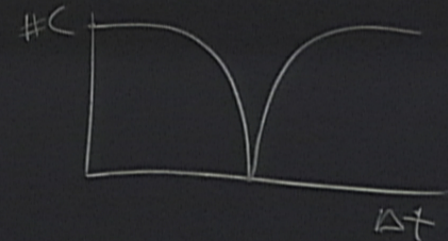
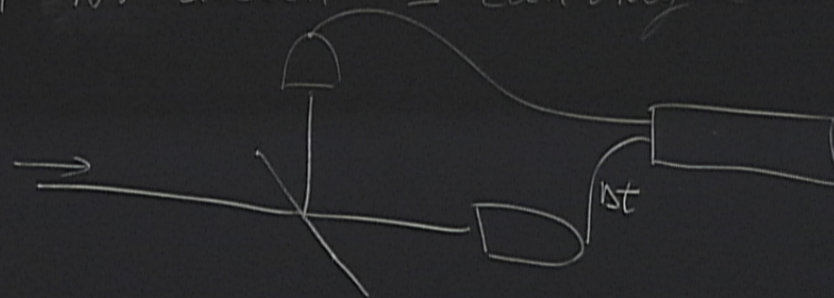
detector

1 NV defect. $\rightarrow$ can only emit 1 photon



detector

1 NV defect. $\rightarrow$ can only emit 1 photon



1 NV defect. $\rightarrow$ can only emit 1 photon

