

Title: PSI 2015/2016 Explorations in Quantum Information - David Cory - 1

Date: Mar 21, 2016 09:00 AM

URL: <http://pirsa.org/16030000>

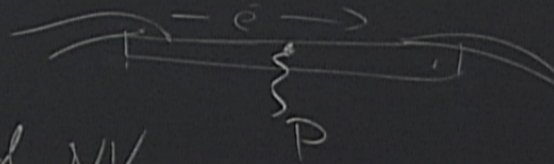
Abstract:

Spin $1/2$ control

NMR-

atomic beams - { insight }

scattering of e off deft



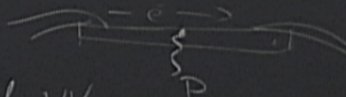
diamond, NV

Spin 1/2 control

NMR-

atomic beams - { insight }

scattering of e off defit



diamond, NV

Spin 1/2 control

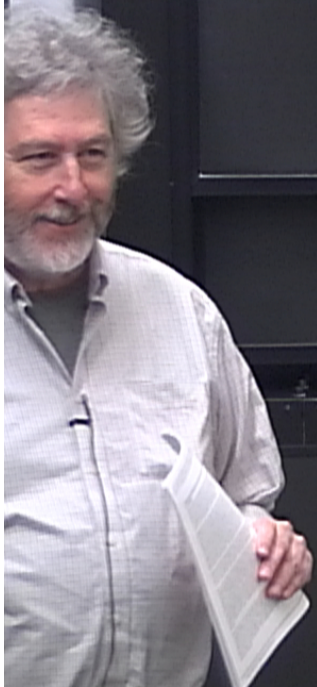
NMR-

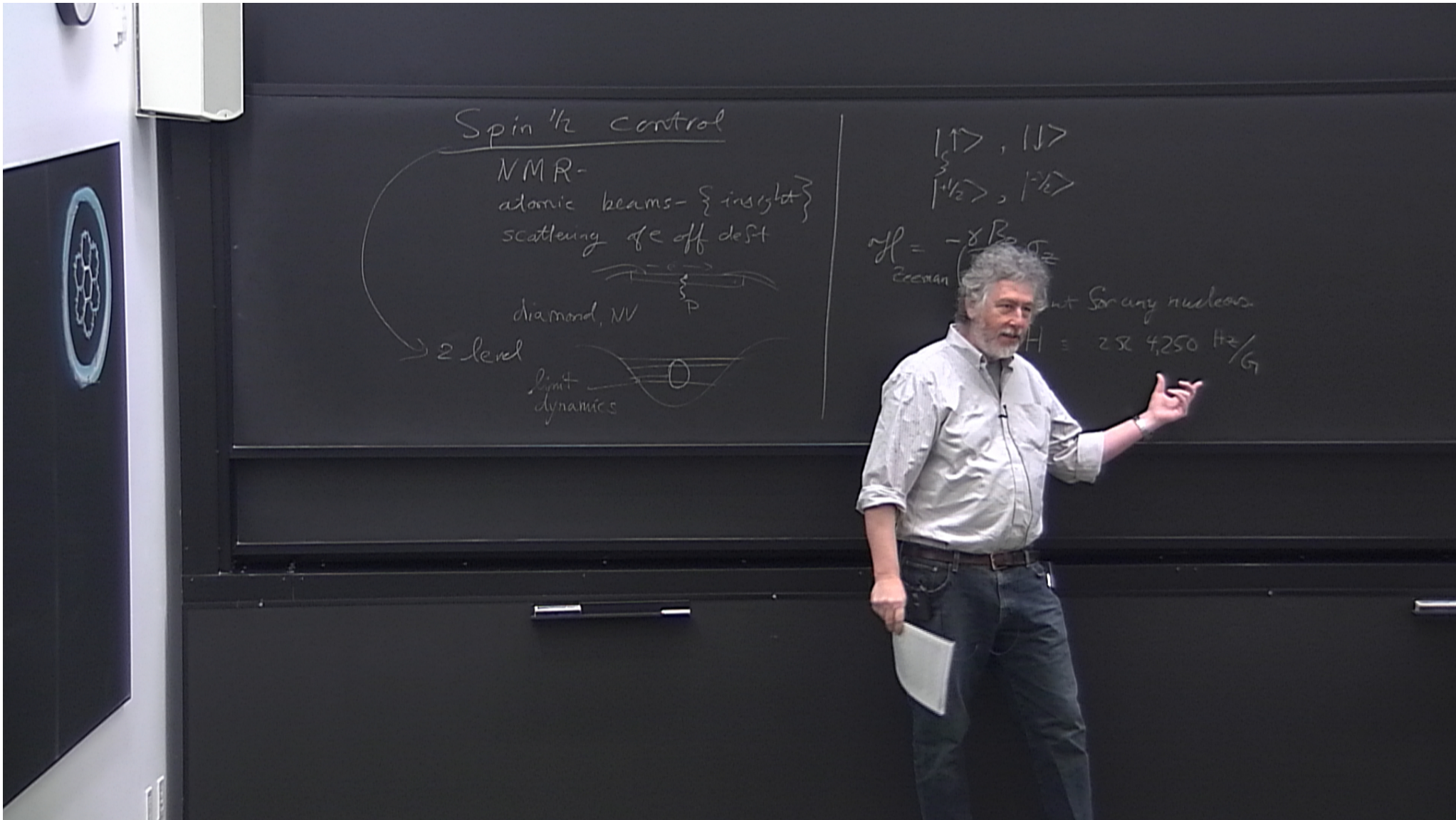
atomic beams - {insight}

scattering of e off deft



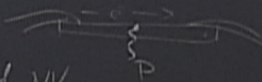
diamond, NV



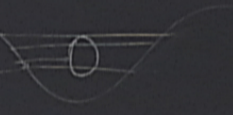


Spin 1/2 control

NMR-
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scattering of e off d e f t



diamond, NV



→ 2 level

light dynamics

$|\uparrow\uparrow\rangle, |\downarrow\downarrow\rangle$
 $|\uparrow\downarrow\rangle, |\downarrow\uparrow\rangle$

$$H = -\gamma B_0 I_z$$

Eccman

not for any nucleus

$$H = 2\pi 4250 \text{ Hz/G}$$

$$|\uparrow\rangle, |\downarrow\rangle$$

$$|\pm 1/2\rangle$$

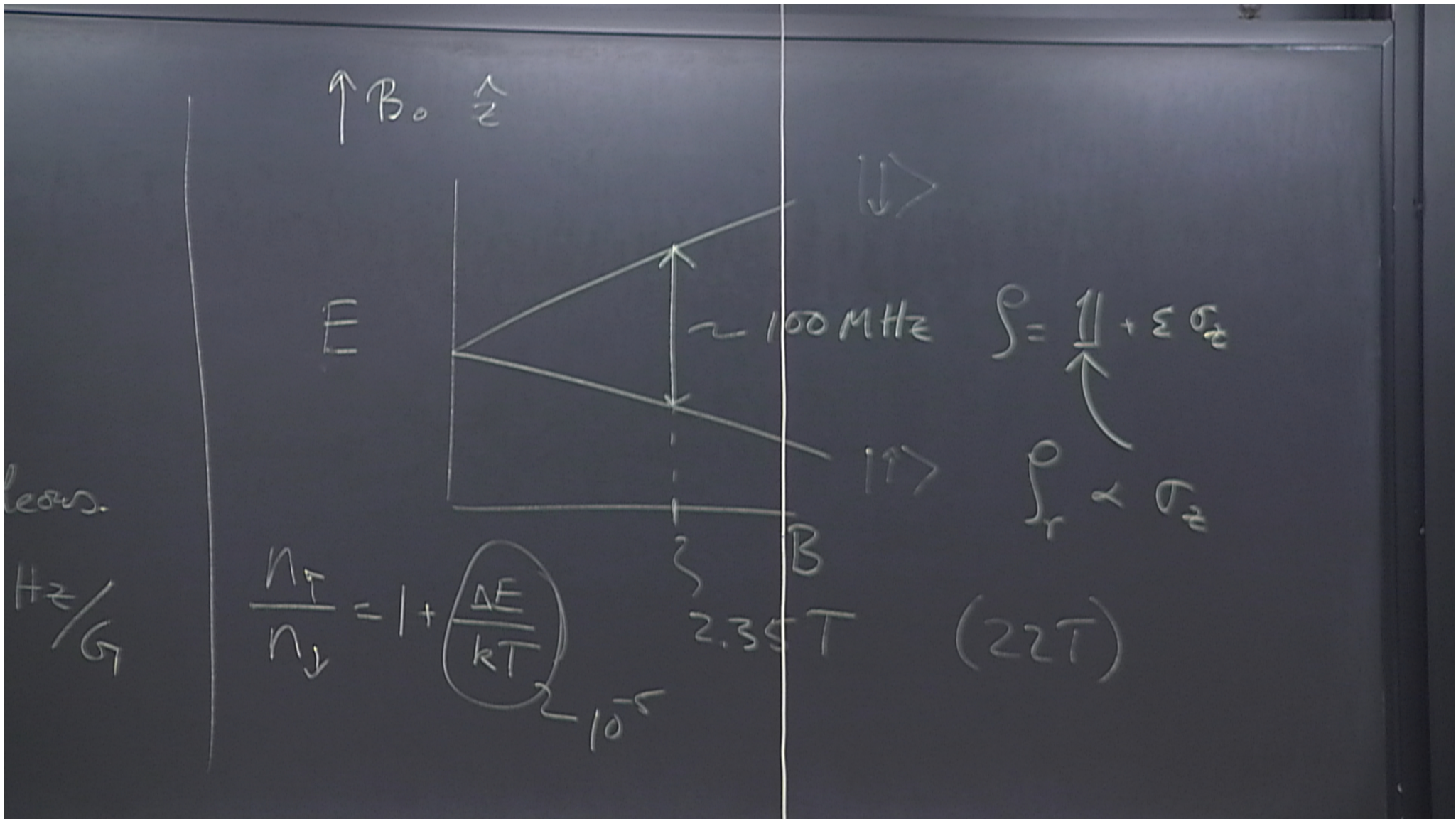
$$\mathcal{H}_{\text{Zeeman}} = -\frac{\gamma B_0}{2} \sigma_z ; \hbar = 1$$

constant for any nucleus.

$${}^1\text{H} = 2\pi \cdot 4,250 \text{ Hz/G}$$

$$1 \text{ G} = 10^{-4} \text{ T}$$

$$\frac{n_{\uparrow}}{n_{\downarrow}}$$



Bloch's Eqs

$$\frac{d\langle \sigma_x \rangle}{dt}; \quad d \frac{M_x}{dt} = +\omega_0 M_y$$

$$d \frac{M_y}{dt} = -\omega_0 M_x$$

$$\frac{dM_z}{dt} = 0$$

Bloch's Eqs

$$\frac{d\langle \sigma_x \rangle}{dt}; \quad d \frac{M_x}{dt} = +\omega_0 M_y$$

$$d \frac{M_y}{dt} = -\omega_0 M_x$$

$$\frac{dM_z}{dt} = \omega_0 \circ$$

$$- \frac{M_x}{T_2}$$

$$- \frac{M_y}{T_2}$$

$$- \frac{M_z}{T_1} + \frac{M_0}{T_1}$$

equilibrium
value

Bloch's Eqs

$$\frac{d\langle \sigma_x \rangle}{dt}; \quad d\frac{M_x}{dt} = +\omega_0 M_y$$

$$d\frac{M_y}{dt} = -\omega_0 M_x$$

$$d\frac{M_z}{dt} = \underbrace{\quad}_0$$

Unitary
control

$$\begin{aligned} & -\frac{M_x}{T_2} \\ & -\frac{M_y}{T_2} \\ & -\frac{M_z}{T_1} + \frac{M_0}{T_1} \end{aligned}$$

life time of coherences.

equilibrium
value

$$\sigma_z = \begin{bmatrix} \cos(\frac{\theta}{2}) & -i \sin(\frac{\theta}{2}) \\ i \sin(\frac{\theta}{2}) & \cos(\frac{\theta}{2}) \end{bmatrix} \sigma_z$$

$$\sigma_y \rightarrow \sigma_x : \sigma_y \cos(\theta) - \sigma_x \sin(\theta)$$

dynamics

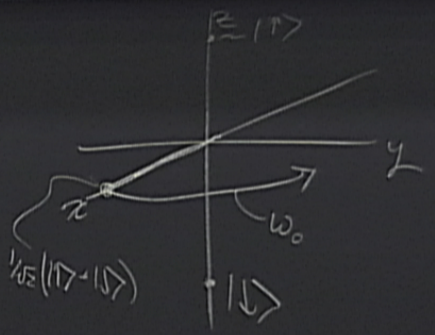
Unitary control

life time of coherence,

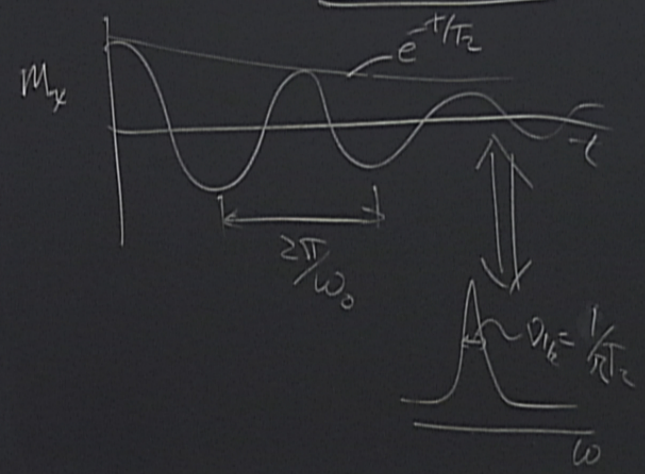
equilibrium value,

$$\frac{M_x}{T_2}$$

$$-\frac{M_y}{T_3}$$

$$-\frac{M_z}{T_1} + \frac{M_0}{T_1}$$


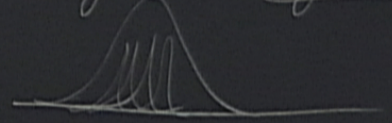
2 cases



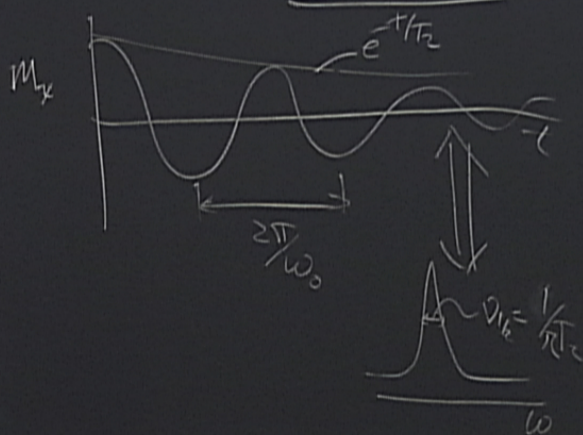
① short T_2



② long T_2 but many fields



2 cases



① short T_2



② long T_2 but many fields

