

Title: PSI 2015/2016 Quantum Information - Lecture 4

Date: Feb 25, 2016 11:30 AM

URL: <http://pirsa.org/16020081>

Abstract:

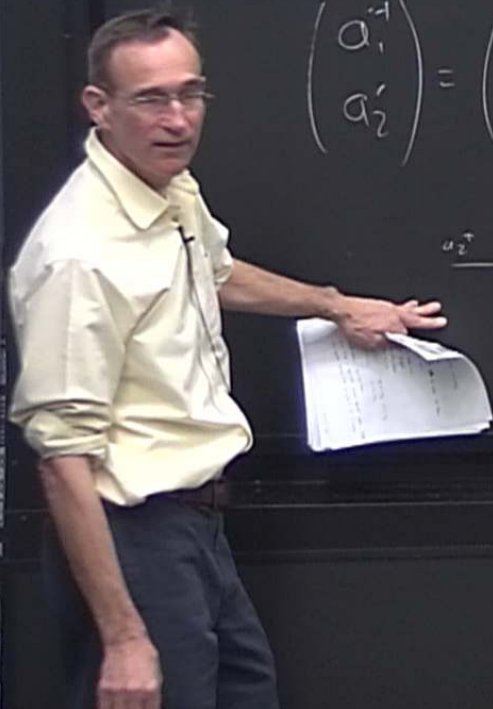
$\{CNDI, H, T\}$

$$\begin{pmatrix} a_1' \\ a_2' \end{pmatrix} = \begin{pmatrix} \cos\theta & -\sin\theta e^{i\phi} \\ \sin\theta e^{i\phi} & \cos\theta \end{pmatrix} \begin{pmatrix} a_1 \\ a_2 \end{pmatrix}$$

$a_1' \rightarrow (a_1' + a_2')$   
 $a_2' \rightarrow (-)$   
 $|0\rangle \sim |a\rangle + |b\rangle = b_1' + i b_2'$

$$a_1' a_2' \rightarrow (a_1')^2 - (a_2')^2$$

$\downarrow$   
 $|20\rangle - |02\rangle$



$$a_1^+ a_2^+ \rightarrow (a_1^+)^2 - (a_2^+)^2$$

$$\downarrow$$

$$|20\rangle_M - |02\rangle_M$$

How Mandel exp?

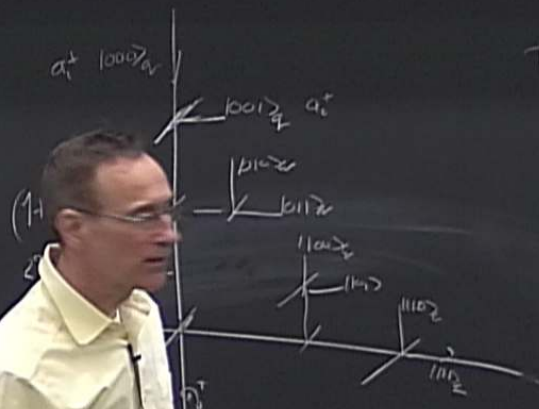
$$- \sin \theta \begin{pmatrix} a_1^+ \\ a_2^+ \end{pmatrix}$$

$$\cos \theta \begin{pmatrix} a_1^+ \\ a_2^+ \end{pmatrix}$$

$$a_1^+ \rightarrow (a_1^+ + a_2^+)$$

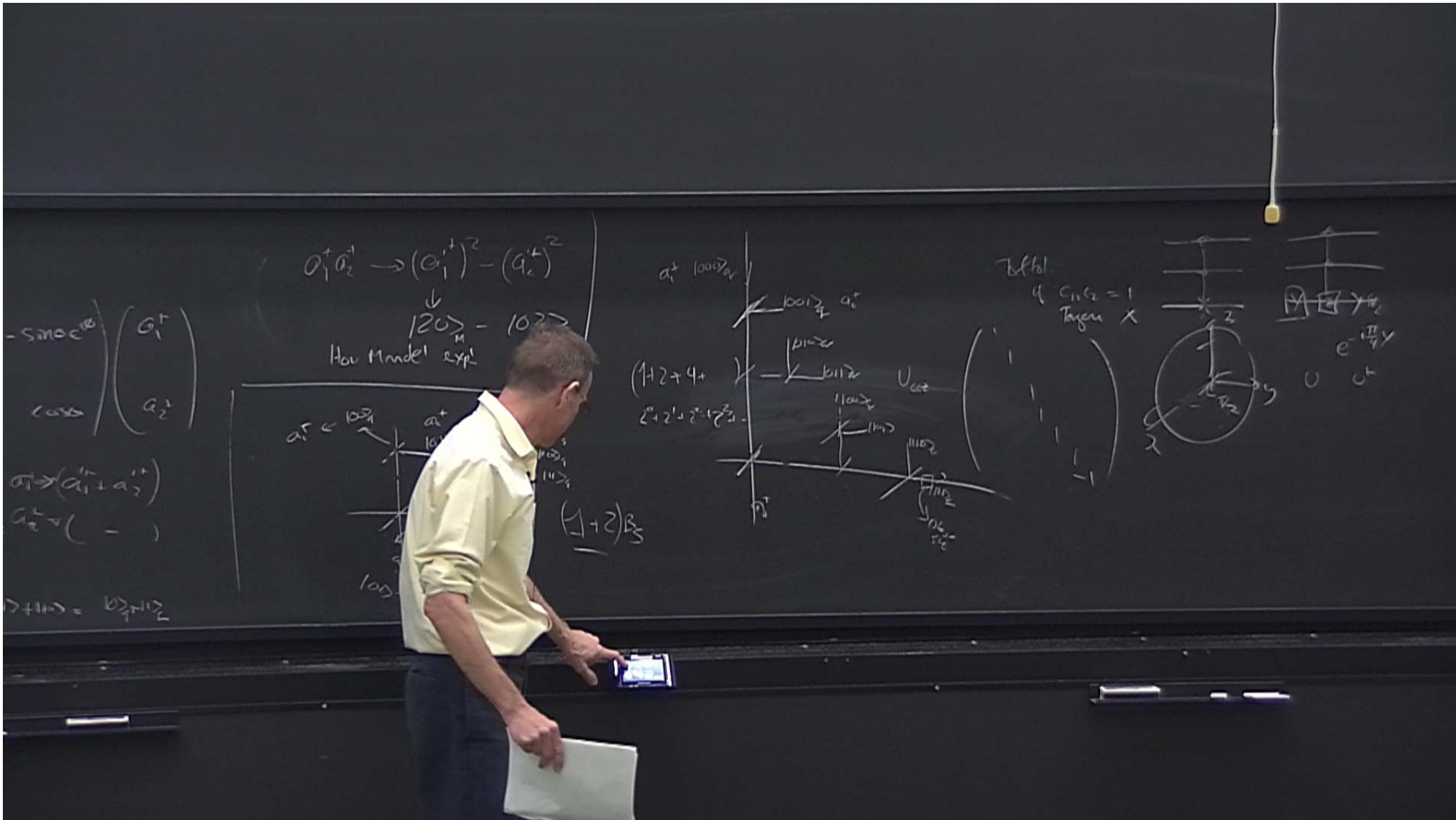
$$a_2^+ \rightarrow (-)$$

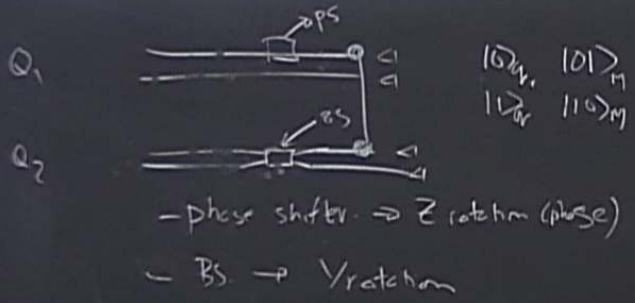
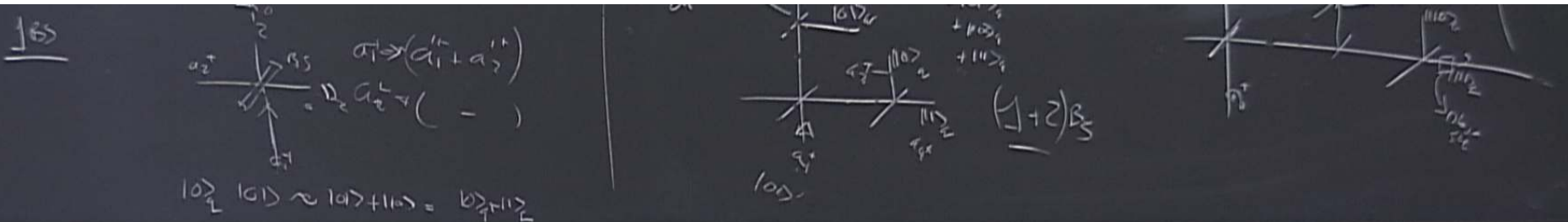
$$|11\rangle = |0\rangle_1 |1\rangle_2$$



Eff.  $\chi$   
 $\chi = C_{112} = 1$   
 Taper  $\chi$







Z quantum gate.

Kerr media

$$H = a_1^\dagger a_1 a_3^\dagger a_3$$

$$H |100\rangle_M = |00\rangle_M \rightarrow 0$$

$$H |100\rangle_M = |100\rangle_M \rightarrow 1$$

$e^{i\chi}$

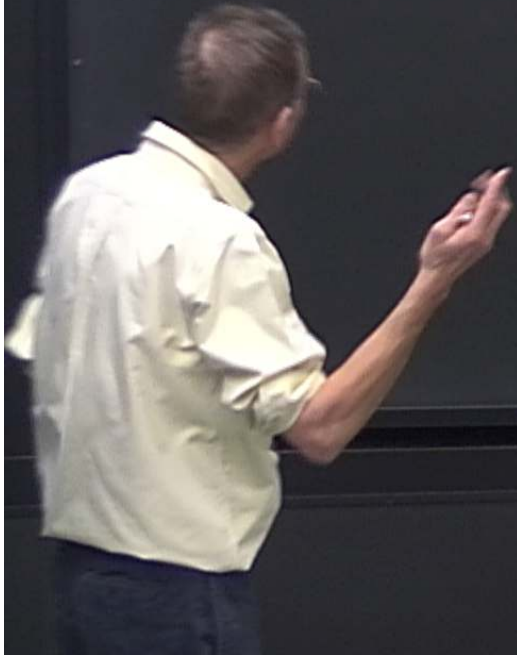
Quant gates:

$$e^{iXH} \rightarrow e^{iH}$$

$$|0\rangle \Rightarrow |1\rangle$$

$$|0\rangle \rightarrow |1\rangle$$

(FLM) LOQC



Zqubit gate:

$$e^{iX_H} \rightarrow e^{i\pi}$$

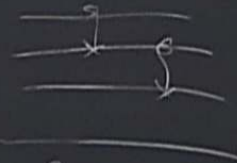
$a^\dagger$   
 $|0\rangle$

$|1\rangle$

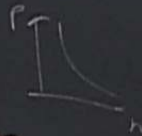
$0$   
 $\uparrow$

LOQC

$$\left(\frac{1}{\sqrt{2}}\right)^2$$



$$\left(\frac{1}{\sqrt{2}}\right)^n$$



Zqubit gate:

$$\boxed{e^{iXH}} \rightarrow e^{i\pi}$$

$a^{\dagger}$   
 $|0\rangle$

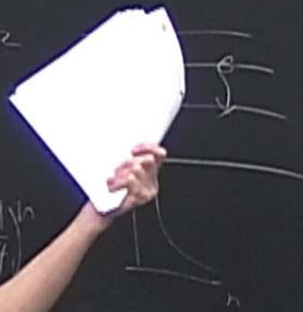
$|1\rangle$

$0$   
 $1$

LOQC

$$\left(\frac{1}{4}\right)^2$$

$$\left(\frac{1}{4}\right)^n$$



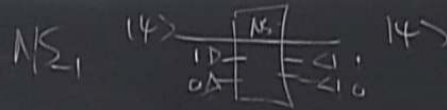
Zqubit gate:

$$\boxed{e^{iXH}} \rightarrow e^{iH}$$

$a^\dagger$   
 $|0\rangle$   
 $|1\rangle$

$q$   
 $\uparrow$

LOQC



$$\alpha + \beta a^\dagger + \gamma a^\dagger$$

$H_{\Sigma_1}$

$$\alpha + \beta a^\dagger - \gamma (a^\dagger)^2$$

$$\theta_1 = \theta_3 = 22.5^\circ$$

$$\theta_2 = 65.5^\circ$$

$$\phi_4 = 180^\circ$$

$a^\dagger |0\rangle$

$|0\rangle$

$H_{\Sigma_2}$

$(a^\dagger)$

$0$

Zqubit gates:

$$e^{iXH} \rightarrow e^{i\pi}$$

$$|0\rangle$$

$$|1\rangle$$

$$|1\rangle$$

$$|0\rangle$$

LOQC

$$NS_1 \quad (14) \quad \begin{array}{|c|c|} \hline & NS_2 \\ \hline 1D & -\Delta_1 \\ \hline 0A & -\Delta_2 \\ \hline \end{array} \quad (14)$$

$$\alpha + \beta a^\dagger + \gamma a_2^\dagger$$

$$|P_0\rangle$$

$$|\theta_1, \phi_2\rangle$$

$$\alpha + \beta a^\dagger - \gamma (a^\dagger)^2$$

$$\frac{1}{16}$$

$$\theta_1 = \theta_2 = 22.5^\circ$$

$$\theta_2 \approx 65.5^\circ$$

$$\phi_0 = 180^\circ$$

$$(1/4)$$

$$|1\rangle$$

$$|\theta_1, \phi_1\rangle$$

$$|\theta_2, \phi_3\rangle$$

$$|a^\dagger\rangle$$

$$|0\rangle$$

$$|0\rangle$$