$|\psi\rangle = \alpha_1|b_1\rangle + \alpha_2|b_2\rangle + \alpha_3|b_3\rangle + \dots$

$P_r[\text{outcome } b_i] = |\alpha_i|^2$

$|0\rangle, |1\rangle$

$|+\rangle, |-\rangle$

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

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

$|1\rangle = 0|0\rangle + 1|1\rangle$

$|1\rangle$ in $|+\rangle, |-\rangle$ basis

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

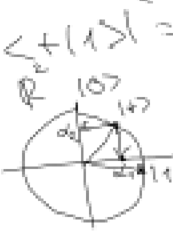
$\cancel{\frac{1}{2}|0\rangle} + \frac{1}{2}|1\rangle - \cancel{\frac{1}{2}|0\rangle} + \frac{1}{2}|1\rangle = |1\rangle$

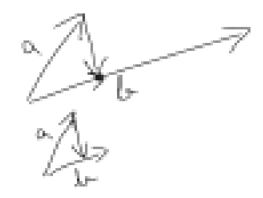
$P_r[|+\rangle] = |\frac{1}{\sqrt{2}}|^2 = \frac{1}{2}$

$\langle\psi| = |\psi\rangle^{+}$

$P_r[\psi] = |\langle\psi|1\rangle|^2$

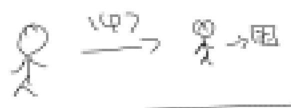
$P_r[|+\rangle] = |\langle +|1\rangle|^2 = |\frac{1}{\sqrt{2}}(1\ 1)\binom{1}{0}|^2 = |\frac{1}{\sqrt{2}}|^2 = \frac{1}{2}$





$|\varphi\rangle = \alpha|0\rangle + \beta|1\rangle$

$\alpha = 0.0101011 0\dots$



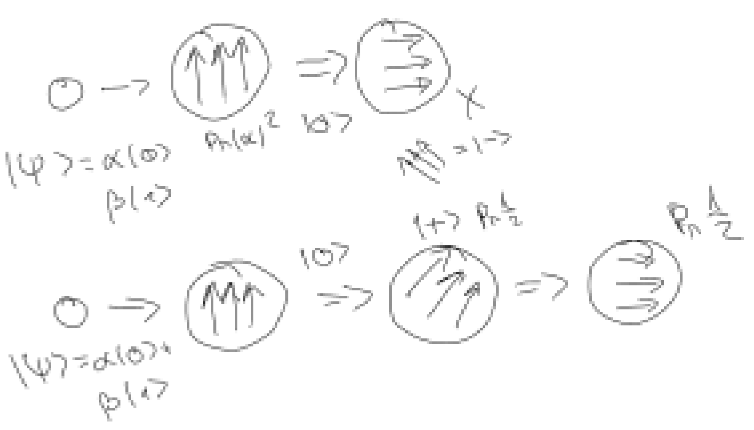
$\alpha|\uparrow\rangle + \beta|\rightarrow\rangle$

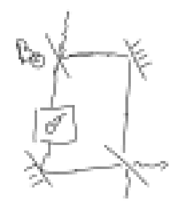
$|\uparrow\rangle = |0\rangle$

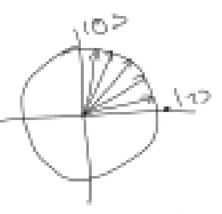
$|\rightarrow\rangle = |1\rangle$

$|\uparrow\rangle$

if outcome of meas is $|0\rangle$ then photon
else no photon







$B_\theta M B_\theta M \dots$

$B_\theta = \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}\begin{pmatrix} 0 \\ 1 \end{pmatrix}$

$B_\theta B_\theta \begin{pmatrix} c & -s \\ s & c \end{pmatrix}\begin{pmatrix} c & -s \\ s & c \end{pmatrix} = \begin{pmatrix} \overset{\cos 2\theta}{c^2 - s^2} & \overset{-\sin 2\theta}{-cs - sc} \\ sc + cs & -s^2 + c^2 \end{pmatrix} = B_{2\theta}$

if there is no bomb:

$\theta = \frac{\pi}{2n}$

$\underbrace{B_\theta B_\theta B_\theta \dots}_{n \text{ times}} = B_{\frac{\pi}{2}}$

if no bomb $|1\rangle \to |0\rangle$

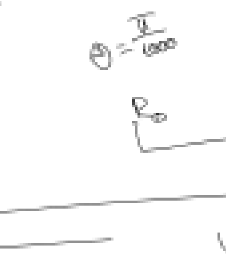
if there is a bomb

$\underbrace{B_\theta \to \text{meas} \to B_\theta}_{n \text{ times}}$

$B_\theta|1\rangle = \begin{pmatrix} -\sin\theta \\ \cos\theta \end{pmatrix}$

$P_r[\text{boom}] = |-\sin\theta|^2 = \sin^2\theta = 1 - \cos^2\theta$

$P_r[\text{missing}] = \cos^2\theta$ PMS: $|1\rangle$

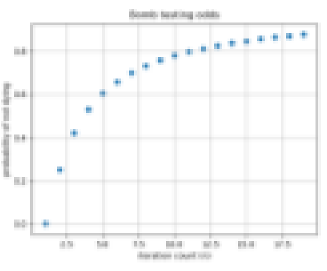


$P_r[\text{missed}] = (\cos^2\theta)^n$

$n = 10$

$\theta = \frac{\pi}{20}$

$\left(\cos^2\left(\frac{\pi}{20}\right)\right)^{20}$



Quantum Zeno effect, $1s = \frac{1}{1000}s$ rotation speed: π/s $\quad \alpha|0\rangle + \beta|1\rangle$

$\theta = \frac{\pi}{1000}$

$\underbrace{R_\theta \dots R_\theta}_{1000}|0\rangle$

$\sin 60^\circ = \frac{\sqrt{3}}{2}$

$\cos 60^\circ = \frac{1}{2}$

$\left(\begin{array}{cc|cc} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ \hline 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{array}\right)$

$\left(\begin{array}{cc|cc} \cos 60 & 0 & -\sin 60 & 0 \\ 0 & \cos 60 & 0 & -\sin 60 \\ \hline \sin 60 & 0 & \cos 60 & 0 \\ 0 & \sin 60 & 0 & \cos 60 \end{array}\right)$

$|\psi_1\rangle = \frac{1}{2}\begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$

$\frac{1}{2}\begin{pmatrix} \cos 60 - \sin 60 \\ \cos 60 - \sin 60 \\ \sin 60 + \cos 60 \\ \sin 60 + \cos 60 \end{pmatrix} = \frac{1}{2}\begin{pmatrix} \frac{1-\sqrt{3}}{2} \\ \frac{1-\sqrt{3}}{2} \\ \frac{1+\sqrt{3}}{2} \\ \frac{1+\sqrt{3}}{2} \end{pmatrix} = \frac{1}{4}\begin{pmatrix} 1-\sqrt{3} \\ 1-\sqrt{3} \\ 1+\sqrt{3} \\ 1+\sqrt{3} \end{pmatrix}$

$|+\rangle \otimes |+\rangle$

$\overset{A}{\begin{pmatrix} A_{11} & A_{12} \dots \\ A_{21} & \dots \end{pmatrix}} \overset{B}{B} = \begin{pmatrix} \boxed{A_{11}B} & A_{12}B \\ A_{21}B & \end{pmatrix}$

$UU^+ = U^+U = I$

$R_{60} \otimes I$

$(R_{60} \otimes I)\ |+\rangle \otimes |+\rangle = (R_{60}\underset{\frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)}{|+\rangle}) \otimes |+\rangle$