PSET-3

1. a) state: $(1+i)|+\rangle - (1+i\sqrt{3})|-\rangle$

$$: \sqrt{2}\, e^{i\pi/4} |+\rangle - 2 e^{i\pi/3} |-\rangle$$

$$: -\frac{1}{\sqrt{3}} e^{-i\pi/12} |+\rangle + \frac{2}{\sqrt{6}} |-\rangle$$

$\Rightarrow$ it is a $|n,-\rangle$ with $\phi = \pi/12$

and $\tan \theta/2 = 1/\sqrt{2} \Rightarrow \theta = \cos^{-1}(1/3)$

b) i) $|z,+\rangle$ states are retained from F_1

ii) for $\hat{S}_{\vec{n}}$, $\cos\frac{\theta}{2}|+\rangle + \sin\frac{\theta}{2}|-\rangle$ has eigenvalue $\hbar/2$

$\sin\frac{\theta}{2}|+\rangle - \cos\frac{\theta}{2}|-\rangle$ has eigenvalue $-\frac{\hbar}{2}$

$$|z,+\rangle = \cos\frac{\theta}{2}|n,+\rangle + \sin\frac{\theta}{2}|n,-\rangle$$

$\Rightarrow$ on average $\cos^2\frac{\theta}{2}$ fraction will pass through F_2

iii) The states coming out from F_2 are

$\cos\theta/2\,|+\rangle + \sin\theta/2\,|-\rangle$

Thus, after passing through F_3, $\cos^2\frac{\theta}{2}$ will have eigenvalue $+\hbar/2$, $\sin^2\theta/2$ will have $-\hbar/2$ (($\cos^4\theta/2$, $\cos^2\theta/2 \sin^2\theta/2$) of input to F_1)

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$\cos^4 \theta/2$ are found in $|+\rangle$ by F_3 out of those who entered F_2

$\sin^2\theta/2 \cos^2\theta/2$ found in $|-\rangle$

$\sin^2\theta/2$ never made to F_3

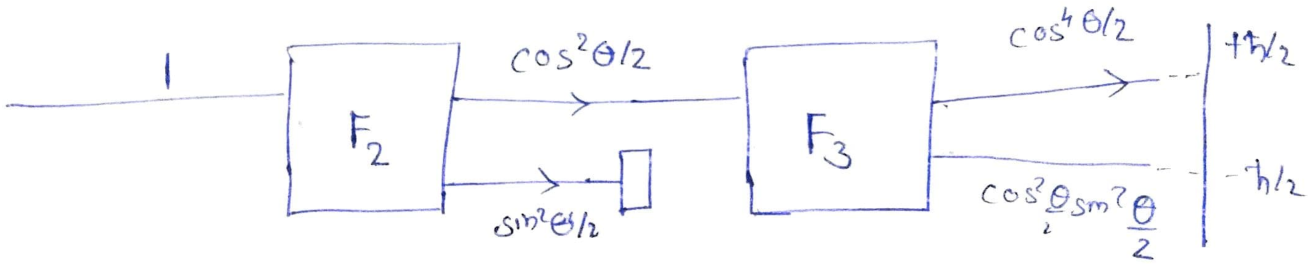
for $\theta = 0$, $F_2 = \hat{S}_z$, in case all atoms pass from F_3

$\cos^4 \theta/2 = 1$ for $\theta = 0$

for $\theta = \pi/2$, $1/2$ pass through F_2, $1/4$ in $|+\rangle$ and $1/4$ in $|-\rangle$

for $\theta = \pi$, no atom passes through F_2

for all three cases, our formula makes sense



Intensity of beams