1-PSET-9
m271ccw-8.ds
2013

1. $|n;+\rangle = \cos\frac{\theta}{2}|+\rangle + \sin\frac{\theta}{2}e^{i\phi}|-\rangle$

$$\langle S_x\rangle\hat{x} = \frac{\hbar}{2}\left(\cos\theta/2 \quad \sin\theta/2\, e^{-i\phi}\right)\begin{pmatrix}0 & 1\\ 1 & 0\end{pmatrix}\begin{pmatrix}\cos\theta/2\\ \sin\theta/2\, e^{i\phi}\end{pmatrix}$$

$$= \frac{\hbar}{2}\sin\theta\cos\phi\,\hat{x}$$

similarly $\langle S_y\rangle\hat{y} = \frac{\hbar}{2}\sin\theta\sin\phi\,\hat{y}$

$\langle S_z\rangle\hat{z} = \frac{\hbar}{2}\cos\theta\,\hat{z}$

$$\Rightarrow \boxed{\langle S\rangle_n = \frac{\hbar}{2}\vec{n}}$$

$$\langle S\cdot n'\rangle_n = \langle S\rangle_n \cdot n' = \vec{n}\cdot\vec{n}'$$

$$\Rightarrow \boxed{\langle S\cdot n'\rangle_n = \vec{n}\cdot\vec{n}'}$$