習題四

1. Ch. 10 10-1 For the eigenstate with higher eigenvalue, measure $S\_{z}$. What are (or is) the possible values? What are (or is) the corresponding probabilities?

Solution:



The possible values: $\pm \frac{1}{2}$. The corresponding probabilities are respectively: $\left|\frac{1}{\sqrt{2}}\right|^{2}=\frac{1}{2}$ and $\left|\frac{i}{\sqrt{2}}\right|^{2}=\frac{1}{2}$

1. Ch. 10 $\left|\left.α\right⟩\right.=\frac{1}{\sqrt{65}}\left(\begin{matrix}4\\7\end{matrix}\right)$，calculate the expectation value of $S\_{x}^{4}:\left⟨α\right⟩$.

Measure $S\_{x}$, what are (or is) the possible values? What are (or is) the corresponding probabilities?

Hint: The expansion components 分量 of $\left|\left.α\right⟩\right.$ along $\left|\left.x,\uparrow \right⟩\right.$ equals $\left⟨α\right⟩$.

Solutions:

$$\left⟨α\right⟩=\left(\frac{1}{\sqrt{65}}\right)^{2}\left(\frac{ℏ}{2}\right)^{4}\left(\begin{matrix}4&7\end{matrix}\right)\left(\begin{matrix}0&1\\1&0\end{matrix}\right)\left(\begin{matrix}0&1\\1&0\end{matrix}\right)\left(\begin{matrix}0&1\\1&0\end{matrix}\right)\left(\begin{matrix}0&1\\1&0\end{matrix}\right)\left(\begin{matrix}4\\7\end{matrix}\right)=\left(\frac{ℏ}{2}\right)^{4}$$

The possible values are again: $\pm \frac{1}{2}$. The corresponding probabilities are respectively: $\left|\left⟨α\right⟩\right|^{2}=\left|\frac{1}{\sqrt{65}}\frac{1}{\sqrt{2}}\left(\begin{matrix}1&1\end{matrix}\right)\left(\begin{matrix}4\\7\end{matrix}\right)\right|^{2}=\frac{121}{130}$

 and $\left|\left⟨α\right⟩\right|^{2}=\left|\frac{1}{\sqrt{65}}\frac{1}{\sqrt{2}}\left(\begin{matrix}1&-1\end{matrix}\right)\left(\begin{matrix}4\\7\end{matrix}\right)\right|^{2}=\frac{9}{130}$.