Physics 594 $\Bigg\{$ AU09 Exam #1 Notes

QM Postulates:

i) states represented by vectors $|\psi\rangle$

ii) measurements represented by operators

$$\hat{O}\,|a_n\rangle = a_n\,|a_n\rangle$$

iii) possible results are a_n

iv) $\mathcal{P}(a_n) = |\langle a_n|\psi(t)\rangle|^2$

v) if a_n at $t = t_0$, $|\psi(t_0)\rangle = |a_n\rangle$

vi) $i\hbar \frac{d}{dt}|\psi(t)\rangle = \hat{H}|\psi(t)\rangle$

wave $\longleftrightarrow$ particle: $p = \frac{h}{\lambda} = \hbar k$, $E = h\nu = \hbar\omega$

spin-½ $\quad S_i = \frac{\hbar}{2}\sigma_i$; $\sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ $\sigma_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$ $\sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

eigenvalue / operator	+1	−1
σ_x	$\|\uparrow_x\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ 1 \end{pmatrix}$	$\|\downarrow_x\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ -1 \end{pmatrix}$
σ_y	$\|\uparrow_y\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ i \end{pmatrix}$	$\|\downarrow_y\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ -i \end{pmatrix}$
σ_z	$\|\uparrow\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$	$\|\downarrow\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$