

PHY 342 HW Ch.4a

Do problem 4.1 plus the following.

q4.0

A certain operator in given 2D Hilbert basis takes on the form $\sigma = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$. (a) Show that σ is Hermitian. (b) Find the eigenstates of σ (eigenvalues and eigenvectors).

q4.1

Verify that Y_{10} and Y_{20} are orthogonal.

q4.2

The angular wave function of a particle is given by $Y_{11}(\theta, \varphi)$. Calculate the probability of finding the particle in the solid angle $0 \leq \theta \leq \pi/4$ and $0 \leq \varphi \leq \pi/2$.

q4.3

For the particle in the 3D infinite spherical well, the wave function for $l = 0$ (s -state) is

$$\psi_{n00} = A \frac{\sin(n\pi r/a)}{r} Y_{00}.$$

Determine the normalization constant A .