

Quiz 2a: Modern Physics**Date: 27 Feb. 2018**

1. (a) A qubit is described by the state,

$$|\psi_i\rangle = \frac{i}{\sqrt{3}}|0\rangle + \sqrt{\frac{2}{3}}|1\rangle.$$

What is the probability that the system is measured in the final state?

$$|\psi_f\rangle = \left(\frac{1+i}{\sqrt{3}}\right)|0\rangle + \sqrt{\frac{1}{3}}|1\rangle.$$

(b) Show $|\psi_f\rangle$ on Bloch sphere.

2. A state is represented by the wave function

$$|\psi\rangle = a|0\rangle + e^{i\phi}b|1\rangle,$$

where a and b are real and positive numbers. An experiment finds the probabilities of obtaining various states in the experiment on multiple copies.

$$\begin{aligned}\text{Prob (obtaining } |0\rangle) &= \frac{1}{2} \\ \text{Prob (obtaining } |1\rangle) &= \frac{1}{2} \\ \text{Prob \left(obtaining } \frac{|0\rangle + |1\rangle}{\sqrt{2}} \right) &= \frac{3}{4}.\end{aligned}$$

Estimate a , b and ϕ .

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