

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

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

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

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

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

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

$$\text{Prob (obtaining } |0\rangle) = \frac{1}{3}$$

$$\text{Prob (obtaining } |1\rangle) = \frac{2}{3}$$

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

Estimate α , β and ϕ .

