Exercise Class 3

Exercise 1

Consider an operator $\hat{O}$ with truth table:

Input state $\|\psi_{in}\rangle$	Output state $\|\psi_{out}\rangle$
$\|0\rangle$	$\|-\rangle$
$\|1\rangle$	$\|+\rangle$

Calculate the angles ϕ, θ, λ to implement $\hat{O}$ with two rotations around $\vec{z}$ and one rotation around $\vec{y}$.

Exercise 2

Consider an electron subject to a magnetic field $B = 2\,T$ directed along $\vec{z}$. Determine the position of the energy levels $|0\rangle$, $|1\rangle$, the qubit frequency ω_0 and the maximum operation temperature.

Exercise 3

Consider an electron subject to a magnetic field $B = 2\,T$ directed along $\vec{z}$. Determine the Larmor frequency ω_L and the time t_1 for which the magnetic field must be applied to operate a gate $\hat{S}$.

Exercise 4

An electron is prepared in a state $|\psi_0\rangle$ with $\theta = 45°$, $\phi = 0°$ and immersed in a static magnetic field $B = 1\,T$ directed along $\vec{z}$. Draw a quoted plot of the probability of measuring the $|0\rangle$ and $|+\rangle$ state along time.

Exercise 5

An electron is immersed in a static magnetic field $B = 1\,T$ directed along $\vec{z}$. Calculate the timing accuracy of a control system to provide a rotation angle accuracy $\Delta\theta = \frac{\pi}{1000}$.