Assignment 9

OPTI 570 Quantum Mechanics

University of Arizona

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November 5, 2025
Total time: 8 hours

Problem I

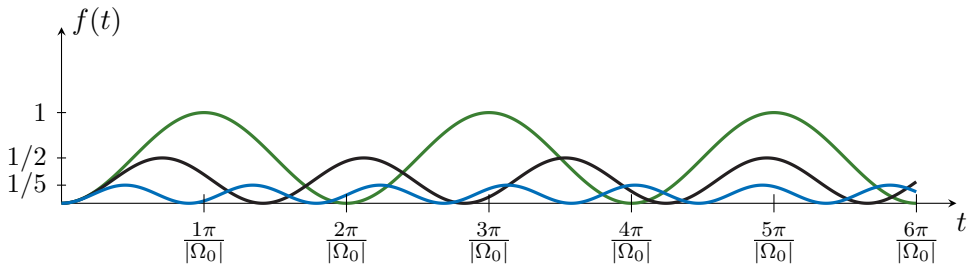
a) The general expression for the transition probability is:

$$P_{|+\rangle\to|-\rangle}(t) = \left|\frac{\Omega_0}{\Omega}\right|^2 \sin^2\frac{\Omega t}{2}, \quad \Omega = \sqrt{\Omega_0^2 + \Delta^2}.$$

By evaluating the different detuning given, we have:

$$\begin{aligned}
\Delta = 0: &\qquad \Omega = \Omega_0 \Longrightarrow P_{|+\rangle\to|-\rangle}(t) = \sin^2\frac{\Omega_0 t}{2} \\
\Delta = |\Omega_0|: &\qquad \Omega = \sqrt{2}\Omega_0 \Longrightarrow P_{|+\rangle\to|-\rangle}(t) = \frac{1}{2}\sin^2\frac{\sqrt{2}\Omega_0 t}{2} \\
\Delta = 2|\Omega_0|: &\qquad \Omega = \sqrt{5}\Omega_0 \Longrightarrow P_{|+\rangle\to|-\rangle}(t) = \frac{1}{5}\sin^2\frac{\sqrt{5}\Omega_0 t}{2}
\end{aligned}$$

For visualization, we will set $\Omega_0 = 1$.



Problem II

Problem III

Problem IV