

Time Evolution Models – Problem 3

In class we investigated the time evolution of a symmetric TLS which at $t=0$ is prepared in the $|R\rangle$ state.

Now suppose the TLS is initially prepared in an arbitrary state $|\Psi_0\rangle$.

- (a) Calculate the time evolution in terms of the $|R\rangle, |L\rangle$ basis states. Express your result in terms of the TLS parameter Ω and the initial state $|\Psi_0\rangle$. Also calculate the survival amplitude.
- (b) Check your result for the survival amplitude by specializing to the case where the initial state is the ground eigenstate.
- (c) Now specialize to the case $|\Psi_0\rangle = |R\rangle$. Using the derived expression from part (a), give the TLS state at times equal to $\frac{1}{4}\tau, \frac{1}{2}\tau, \frac{3}{4}\tau, \tau, \frac{5}{4}\tau, \frac{3}{2}\tau, \frac{7}{4}\tau, 2\tau$ where $\tau = \pi / \Omega$. Also calculate the survival amplitude and survival probability at these times. Plot the survival probability at these times.
- (d) Finally, consider the initial condition $|\Psi_0\rangle = \frac{1}{2}|R\rangle + c_L|L\rangle$. Find c_L and calculate again the survival probability at the times given in part (b). Plot your results.