PHYS 724 - Homework #24

1. Diagonalize the Hamiltonian (in the B^0 and $\overline{B}^0$ basis)

$$H = \mathcal{M} - \frac{i}{2}\Gamma$$
$$= \begin{pmatrix} M & M_{12} \\ M_{12}^* & M \end{pmatrix} - \frac{i}{2}\begin{pmatrix} \Gamma & \Gamma_{12} \\ \Gamma_{12}^* & \Gamma \end{pmatrix}$$

and obtain the mass eigenstates ($|B_1\rangle$ and $|B_2\rangle$) and eigenvalues μ_1 and μ_2. Show that a state prepared at time $t = 0$ as a B^0 (or as a $\overline{B}^0$) will evolve with time as follows:

$$|B^0(t)\rangle = g_+(t)|B^0\rangle - \frac{q}{p}g_-(t)|\overline{B}^0\rangle,$$
$$|\overline{B}^0(t)\rangle = g_+(t)|\overline{B}^0\rangle - \frac{p}{q}g_-(t)|B^0\rangle,$$

where

$$g_\pm(t) = \frac{1}{2}[e^{-i\mu_1 t} \pm e^{-i\mu_2 t}]$$

and where

$$\frac{q}{p} = \sqrt{\frac{M_{12}^* - \frac{i}{2}\Gamma_{12}^*}{M_{12} - \frac{i}{2}\Gamma_{12}}}$$

and

$$|p|^2 + |q|^2 = 1$$