

**Problem 3:** Show the standard model predicts trilinear  $H^0 W^+ W^-$  and quadrilinear  $H^0 H^0 W^+ W^-$  Higgs boson Couplings with strengths:

$$ig M_W \text{ and } \frac{i}{4} g^2$$

respectively.

**Problem 4:** Show that the Standard model predicts that the Higgs couples to two photons only via heavy charged particle loops. What is the strength of the couplings involved ?

**Problem 5:** Show that the muon decay,  $\mu^- \rightarrow e^- \bar{\nu}_e \nu_\mu$ , rate is given by:

$$\Gamma_\mu = G^2 m_\mu^5 / 192 \pi^3$$

**Problem 5:** Show that the pion decay,  $\pi^- \rightarrow \mu^- \bar{\nu}_\mu$ , rate is given by:

$$\Gamma_\pi = \frac{1}{\tau} = \frac{G^2}{8\pi} \int_0^2 m_\pi m_\mu^2 \left(1 - \frac{m_\mu^2}{m_\pi^2}\right)^2$$