Particle and Nuclear Physics
Homework-2
Due on October 3, 2012

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1. Given a particle's lifetime τ we can define the width Γ and a decay distance l by multiplying by the velocity of light. The mean decay length then equals $\gamma\beta l$, where β and γ are usual relativistic kinematic parameters.
   - a) The charged pion lifetime $\tau = 2.60 \times 10^{-8} sec.$ What are Γ and l for this particle?
   - The ω^0 meson decay width Γ=8.4 MeV. What are τ and l for this particle?
2. Consider the decay of an initial particle of mass m_{in} into two final particles of mass m_1 and m_2 Find energies of final state particles in the center of mass frame.
3. For $L = 1, S = 1, J = 2$ we have a meson, called $f_2(1270)$, which is made of $\frac{|u,\bar{u}\rangle + |d,\bar{d}\rangle}{\sqrt{2}}$
   - a) What are its quantum numbers?
   - b) Can it decay to $\gamma\pi^0$?
   - c) Can it decay to $\gamma\gamma$?