## Quiz 01

## October 7, 2004

## Name:

- 1. Give a few examples of the following ingredients of Standard Model.
  - leptons:
  - quarks:
  - gauge bosons:
- 2. Explain the role of the gauge bosons in the Standard Model.

3. Total cross section of  $e^+e^- \rightarrow \mu^+\mu^-$  reaction is given by  $\frac{4\pi\alpha^2}{3s}$ . What's the cross section in nb at  $s = 223 \text{GeV}^2$ ? (Use  $\frac{4\pi\alpha^2}{3} \simeq 2.23 \times 10^{-4}$  and  $(\hbar c)^2 \simeq 0.389 \text{GeV}^2 \text{mb}$ )

4. When combining 3 quarks to form baryons, symmetry argument gives 3 ⊗ 3 ⊗ 3 = 10 ⊕ 8 ⊕ 8 ⊕ 1. Why only 10 and 1 are used to explain hadron spectrum? Why the two 8 configurations are not used?

5. Give a reason why we need a new quantum number of 3 colors?

6. When we try to separate out one individual quark, what happens?

7. When we have luminosity  $\mathcal{L} = 10^{33} \text{cm}^{-2} \text{s}^{-1}$ , what's the expected counting rates for a reaction with cross section of 10  $\mu$ b (1 b =  $10^{-24} \text{cm}^2$ )?

8. When electron scatters off the proton *elastically*, what's the value of the Bjorken variable *x*?

9. Why do physicists want to build new machines to achive high  $Q^2$  region?

10. We say that the size of the proton is on the order of 1 fm. How do we know this?

11. When we describe Deep Inelastic Scattering (DIS) process with parton model, what's the meaning of the Bjorken variable x?

12. The original parton model predicts the scaling behavior of the structure functions. In reality, it is violated as experiments show. What has been neglected in the original parton model which causes this violation of the scaling?

13. Protons are made of two u quarks and one d quarks. But we are talking parton distributions for s and c quarks in the proton. How can they exist in the proton?