

Problem Set 3

Physics 363
Apr. 16, 2008

Spring Quarter 2008
Due in class Wed. Apr. 23.

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Note change in class time and room - Wednesday, April 23 from 3:30-4:50 P.M., in Room KPTC 105

Reading: Perkins Chapters 2 and 4 (4th Edition). If you are interested in fields involving any field theory, I strongly recommend also buying and reading Feynman's Theory of Fundamental Processes. Chapters 15 to the end provide a succinct body of knowledge that's a very good start for simple folks (read experimentalists).

Problems:

1. **SR practice** At CERN and Fermilab there is an enormous effort searching for the Higgs boson, the existence of which would provide a mechanism for generating masses of the elementary particles. Consider a Higgs boson of mass 120 GeV (just above the LEP limit) that decays into a pair of b-quarks. Find the momenta of the b-quarks (take the b-quark mass to be 5 GeV).
2. **More SR practice** If the Higgs mass is larger than twice the W-boson mass, it can decay to a pair of W's. If the Higgs mass is 165 GeV, find the momenta of the W's (the W mass is measured to be 80.4 GeV).
3. **Even more SR practice** The W decays into the weak iso-doublets with equal coupling strength (i.e. $e\nu_e$, $\mu\nu_\mu$, $\tau\nu_\tau$, $u\bar{d}$, and $c\bar{s}$ are all equally coupled to the W). Find the maximum and minimum transverse momentum of an electron from a W decay product of a 165-GeV Higgs. (transverse momentum is the component of momentum perpendicular to the incoming beam direction).
4. Perkins Chapter 2, Problem 2.1
5. Perkins Chapter 2, Problem 2.4
6. Perkins Chapter 2, Problem 2.5
7. Perkins Chapter 4, Problem 4.1
8. Perkins Chapter 4, Problem 4.4
9. Perkins Chapter 4, Problem 4.5