

Problem Set 4 - Final

Physics 445

Due June 1

Some abbreviations: P&S - Peskin & Schroeder

Please work alone on this problem set.

You are free to use any reference materials you like.

1. Supersymmetric extensions of the Standard Model typically contain two or more Higgs doublets. With this motivation, work out P&S 20.5.
2. What would be the classical spectrum of gauge bosons if the Standard Model gauge symmetry were broken by a real triplet of $SU(2)$ instead of a complex doublet?
3. The Standard Model has a global baryon number symmetry and a global lepton number symmetry.
 - (i) Compute the anomalies of the associated currents in the Standard Model.
 - (ii) Are there any non-anomalous, continuous global symmetries in the Standard Model?
 - (iii) Ignoring anomalies now, it is also interesting to ask which higher dimension operators can violate baryon or lepton number in the Standard Model. Such interactions might be induced in a more complete grand unified theory which contains the Standard Model. With this in mind, see if you can find a dimension 5 operator which violates lepton number. Can you construct one that violates baryon number? How about for dimension 6 operators? Make sure that the operators you construct are gauge invariant and Lorentz invariant.