

Instructor: Stefano Profumo
Office: ISB, Room 325
Phone Number: 831-459-3039
Office Hours: Mondays and Wednesdays 3:45-5:00 PM (or by app.)
E-mail: profumo@scipp.ucsc.edu

Course Description

This course is the first quarter of a 2-quarter graduate-level introduction to modern particle physics. The focus is on (1) hadron phenomenology, (2) weak interactions, (3) the electro-weak model and (4) a few selected topics beyond the Standard Model.

Course Outline

1. Introduction to the Standard Model
2. Symmetries and groups
3. Discrete and internal symmetries
4. Color potential and heavy quarks
5. Flavor SU(3); mesons and baryons
6. Constituent quark model, masses and magnetic moments of hadrons
7. Strong decays of hadrons, G-symmetry
8. Vector Meson Dominance
9. Introduction to weak interactions
10. Decays of muons and tau leptons
11. Charged weak currents for quarks
12. Charged pion decay
13. Strange currents and kaon decay
14. Decays of heavy quarks
15. Mixing and CP violation in the kaon and B systems
16. Neutrino masses and oscillations
17. Spontaneous symmetry breaking

18. The Higgs mechanism
19. Neutral weak currents
20. Phenomenology of EW gauge bosons
21. Weinberg-Salam Model
22. Generation of fermion masses
23. Neutrino mass models
24. Higgs mass and couplings
25. Higgs production and decay
26. Axions and the strong CP problem
27. Axions and cosmology
28. GUT's and proton decay
29. GUT's, monopoles and baryogenesis

Reference Textbooks (on reserve)

- *Particle Physics: A Comprehensive Introduction* by Abraham Seiden
- *Quarks & Leptons* by Francis Halzen and Alan D. Martin

Other Textbooks (on reserve)

- *Gauge Theory of elementary particle physics* by Ta-Pei Cheng and Ling-Fong Li
- *Dynamics of the Standard Model* by John F. Donoghue, Eugene Golowich and Barry R. Holstein
- *The Early Universe* by Edward W. Kolb and Michael S. Turner

Grading Policy

Grading will be based on 5 homework exercises (20% each).