Instructor:	Stefano Profumo
Office:	ISB, Room 325
Phone Number:	831-459-3039
Office Hours:	Tuesdays 4:00-5:00 PM (or by app.)
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Lectures:	Tuesdays and Thursdays 2:00-3:45 PM
Lecture Room:	ISB, Room 126

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 in beyond the Standard Model physics and particle astrophysics.

Course Outline

1. Introduction to the Standard Model
2. Symmetries and groups
3. Space-time 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. A Cosmology Primer
27. Thermal Relics from the Big Bang
28. Topics in Particle Astrophysics

Reference Textbooks (on reserve)

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

Other Textbooks

- *Introduction to High Energy Physics* by Donald H. Perkins
- *Introduction to Elementary Particle Physics* by Alessandro Bettini
- *The Higgs Hunter's Guide* by John F. Gunion, Howard H. Haber, Gordon Kane and Sally Dwason
- *Particle Astrophysics* by Donald H. Perkins
- *Cosmology and Particle Astrophysics* by Lars Bergstrom and Ariel Goobar
- *Very High Energy Cosmic Gamma Radiation* by Felix A. Aharonian
- *The Early Universe* by Edward W. Kolb and Michael S. Turner

Grading Policy

Grading will be based on 5 homework exercises (20% each). The first 4 homeworks will be problem sets, while the last one will be a 25 minute indvidual seminar on a topic chosen between a few suggested by the Instructor.