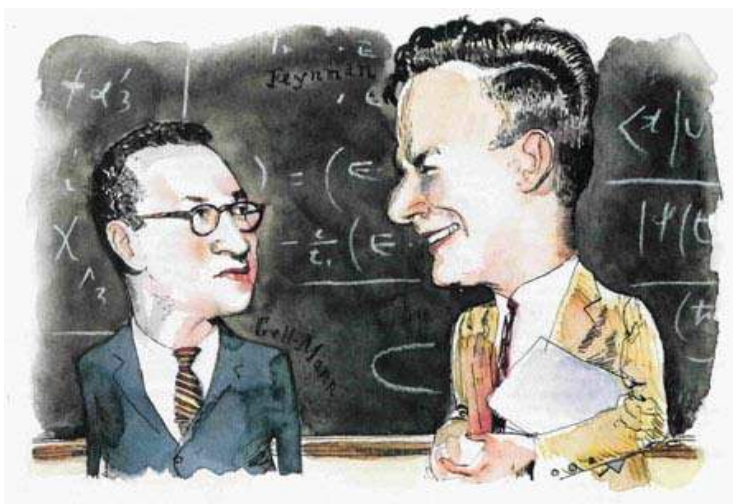


PHYS 490: Modern Physics

Spring 2017

Tom Browder



Modern Physics: High Energy Physics and Nuclear Physics

The course, which meets 13:30-14:20 MWF, follows the textbook of Alessandro Bettini, "Introduction to Elementary Particle Physics", 2nd Edition, Cambridge University Press.

Recommended Reading:

(Original papers) The Experimental Foundations of Particle Physics, ed. R. N. Cahn and G. Goldhaber (1995);

Introduction to Elementary Particles by D. Griffiths;

(Nuclear Physics) Introduction to Nuclear and Particle Physics, A. Das and T. Ferbel (2003) ;

(Graduate level textbooks) Quarks and Leptons by F. Halzen and A. D. Martin (1984);

Particle Physics, by D. Carlsmith (2013)

- Chapter 1: Preliminary Notions, (Special Relativity);
Exercises: 1.2, 1.5, 1.6, 1.7, 1.9, 1.10, 1.11, 1.14, 1.18
(Due Date: Friday January 20)
[Chapter 1, Lecture 3](#)
[Chapter 1, Lecture 4](#)
[Chapter 1, Lecture 5](#)
[Chapter 1, Lecture 6](#)
- Chapter 1: Preliminary Notions:
Passage of Radiation Through Matter, Sources and Detectors of High Energy Particles;
Exercises: 1.22, 1.24, 1.27, 1.28, 1.31, 1.38
(Due Date: Friday January 27)

- Chapter 2: Nucleons, Leptons and Mesons
Exercises: 2.2, 2.6, 2.7, 2.10, 2.13, 2.16 (Due Date: Friday February 3)
[Chapter 2, Lecture 1](#)
- Chapter 3: Symmetries
Exercises: 3.5, 3.10, 3.12, 3.15, 3.18, 3.24, 3.26 (Due Date: Friday February 10)
[Chapter 3, Lecture 1](#)
[Chapter 3, Lecture 2](#)
[Chapter 3, Lecture 3](#)
[Chapter 3, Lecture 4](#)
- Chapter 4: Hadrons (including the quark model)
Exercises: 4.6, 4.7, 4.9, 4.17, 4.24, 4.25, 4.30 (due date Feb 27, after the midterm)
[Chapter 4, Lecture 1](#)

[Practice Problems for the Midterm](#)

- Chapter 5: Quantum Electrodynamics
5.3, 5.6, 5.7, 5.11, 5.14, 5.16, 5.17 (Due Date: Friday March 10)

[Chapter 5, Lecture 1](#)
[Chapter 5, Lecture 2](#)
[Chapter 5, Lecture 3](#)
- Chapter 6: Quantum Chromodynamics (QCD),
Exercises 6.4, 6.6, 6.9, 6.13, 6.20, 6.24, 6.25 (Due Date: Friday March 17)

[Chapter 6, Lecture 1](#)
[Chapter 6, Lecture 2](#)
[Chapter 6, Lecture 3](#)
[Chapter 6, Lecture 4](#)
[Chapter 6, Lecture 5](#)

- Chapter 7: Weak Interactions
Exercises 7.6, 7.17, 7.19, 7.23, 7.26, 7.28, 7.31 (Due Date: April 7)

[Chapter 7, Lecture 1](#)
[Chapter 7, Lecture 2](#)
[Chapter 7, Lecture 3](#)
[Chapter 7, Lecture 4](#)
[Chapter 7, Lecture 5](#)

- Chapter 8: Oscillations of Neutral Mesons and CP violation
Exercises: 8.1, 8.2, 8.6, 8.7, 8.9, 8.12 (Due Date: April 28)

[Chapter 8, Lecture 1](#)
[Chapter 8, Lecture 2](#)

- Chapter 9: The Standard Model
Exercises: 9.7, 9.17, 9.22, 9.27, 9.30 (Due Date: April 28)

[Chapter 9, Lecture 1](#)

[Chapter 9, Lecture 2](#)

[Chapter 9, Lecture 3](#)

[Review of Practice problems](#)

There will be a midterm, final exam and 1 oral presentation.
For the midterm and final, a calculator and a notecard are allowed.
There are also regular mini-quizzes (closed book, but calculators are ok).

Grading weights:

Homework Problems (25%)

Midterm (20%)

Quizzes (15%)

Final (40%)

Midterm exam: Friday February 24
(Chapters 1-4, bring one standard size notecard and calculator)

[Practice Final](#) Use this to prepare for the final exam
The final will also include a few simple problems on drawing and calculating Feynman diagrams.

Final exam: Friday May 5 (1:30-3:30 pm), bring crib sheet and calculator

Scheduling items:

Jan 9-13, JPARC PAC, Dr Robert Morse will substitute

Jan 16, Martin Luther King Day (no class)

Jan 25-29, Memorial Service, New Jersey

Feb 3-15, Belle II General Meeting and BPAC review (Shawn Dubey, substitute)

Feb 20th, President's Day (no class)

~April 7-15, KEK, PNNL, SLAC (Shawn Dubey, substitute)

April 11, Belle II Roll-in

April 11-14, US Belle II review, PNNL, SLAC seminar

April 14, Good Friday (no class)

April 28, Presentations I: Tommy Lam (CPV in the B system); Makana Silva (discovery of the Higgs)

May 1, Presentations II: Anirvan Shukla(LHCb pentaquark); Tyler Trent (discovery of the top quark), James Ou (MWPC technology)

May 3, last class (Review)

Last modified: May 5, 2017

(Check frequently for updates)

Tom Browder / teb@phys.hawaii.edu