Modern Physics: High Energy Physics and Nuclear Physics
The course will meet Tu-Th 1:30-2:45 pm, WAT113, and follows the textbook of Alessandro Bettini, "Introduction to Elementary Particle Physics", 2nd Edition, Cambridge University Press with selections from Griffiths, Peskin.

Recommended Reading:
Concepts of Elementary Particle Physics, Michael Peskin (2019);
Particle Physics (B.R. Martin, G. Shaw) (2008)
Introduction to Elementary Particles by D. Griffiths (1987);
(Original papers) The Experimental Foundations of Particle Physics, ed. R. N. Cahn and G. Goldhaber (1995);
(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)

- Tuesday, Jan 10; Chapter 1: "Folk History" of Particle Physics, Preliminary Notions, Special Relativity;
- Thursday, Jan 12; Chapter 1: Special Relativity (Fixed target and colliding beams), cross-section, branching fractions
- Tuesday Jan 17; Chapter 1: Rutherford scattering, Fermi's Golden Rule, Passage of Radiation Through Matter
- Thursday Jan 19; Chapter 1: Sources and Detectors of High Energy Particles
- Tuesday Jan 24; Chapter 2: Nucleons, Leptons and Mesons
- Thursday Jan 26; Leptons and Mesons (cont'd)
- Tuesday January 31, Chapter 3: Symmetries
- Thursday Feb 2, Symmetries (cont'd)
• Tuesday Feb 7: Chapter 4: Hadrons (including the quark model)

• Thursday Feb 9: Hadrons (including the quark model)

• Tuesday Feb 14: Hadrons + QED

• Thursday Feb 17: Chapter 5: Quantum Electrodynamics (QED)  
  to be updated, 5.3, 5.6, 5.7, 5.11, 5.14, 5.16, 5.17 (Due Date: TBA)

• Tuesday Feb 21, Review for the Midterm  
  Practice Problems for the Midterm

• Thursday Feb 23, Midterm 1

• Tuesday March 1, QED, Chapter 6: Quantum Chromodynamics (QCD),  
  Exercises: to be updated, 6.4, 6.6, 6.9, 6.13, 6.20, 6.24, 6.25 (Due Date: TBA)

• Thursday, March 2 QCD

• Tuesday, March 7, QCD

• Thursday, March 9, QCD

• March 13-17, Spring Break

• Tuesday March 21, Chapter 7: Weak Interactions  
  Exercises to be updated 7.6, 7.17, 7.19, 7.23, 7.26, 7.28, 7.31 (Due Date: TBA)

• Thursday March 24, Weak Interactions

• Tuesday March 29, Weak Interactions

• Thursday, March 31, Chapter 8: Oscillations of Neutral Mesons and CP violation  
  Exercises: to be updated, 8.1, 8.2, 8.5 8.6, 8.7, 8.9, 8.12 (Due Date: TBA)

• Tuesday April 4, Mixing and CP violation

• Thursday April 6, Chapter 9: The Standard Model  
  Exercises: to be updated, 9.7, 9.17, 9.22, 9.27, 9.30 (Due Date: TBA)

• Tuesday April 11, The Standard Model Part I

• Thursday April 13, The Standard Model Part I

• Tuesday April 18, The Standard Model Part I

• Thursday April 20, The Standard Model Part II

• Tuesday April 25, The Standard Model Part II

• Thursday April 27, The Standard Model Part II

• Thursday April 27, The Standard Model Part II
• Tuesday May 2, Student Presentations
• Thursday May 4, Student Presentations

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: TBA
(Chapters 1-4, bring one standard size notecard and calculator)

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

Final exam: Bring crib sheet and calculator

Last modified: Jan 10, 2023

(Check frequently for updates)

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