

SYLLABUS

PHZ 7357, ELEMENTARY PARTICLE PHYSICS 2

Lectures : M | Period 9 (4:05 PM - 4:55 PM) [NPB 2165](#)
W,F | Period 9 (4:05 PM - 4:55 PM) [NPB 1200](#)

Instructor: Prof. Guenakh Mitselmakher, Office: NPB 2021.

Preferred communication: in class, or during office hours, or by Email: mitselmakher@phys.ufl.edu. You may also phone 352-392-5703.

Office hours: after classes, or by appointment

This two-semester course is designed to give an introduction to the ideas, basic experimental and theoretical concepts, and major experimental discoveries, that emerged from the ultimate quest for understanding the most fundamental constituents of matter, and the primary forces of nature.

Prerequisite to PHZ 7357 is Particle PHZ 6355 (see below)

The first part, PHZ 6355, ELEMENTARY PARTICLE PHYSICS 1 (given e.g. in Fall 2019), was an introductory overview of the subject. The second part, PHZ 7357 ELEMENTARY PARTICLE PHYSICS 2 (to be given this semester), present the subject in more details and depth.

Topics to be covered in PHZ 7357: (may be somewhat modified and discusses in more details, depending on the interests of the students and available time):

- Leptons and the weak interaction
- Neutrino Masses, Neutrino Mixing and Neutrino oscillations
- Lepton numbers revisited
- Parity and parity non-conservation, discovery
- V-A theory. Helicity of neutrinos (theory and experiment)
- Color charges and confinement.
- Heavy quarks, charmonium and bottomonium
- QCD, strong coupling constant
- Screening, anti-screening and asymptotic freedom
- The quark-gluon plasma

- Electron-positron annihilation, 3-jet events and gluons
- The total cross section of electron-positron annihilation
- Inelastic electron and muon scattering
- Bjorken scaling, parton model, scaling violations
- Inelastic neutrino scattering
- Lepton-quark symmetry
- Top-quark, discovery and studies
- Neutral currents and electroweak interactions
- The unification condition, W and Z masses
- Gauge invariance and the Higgs field
- Higgs boson discovery and studies
- P, C and CP violation (discovery) , K and B decays
- CPT conservation and tests
- CKM and PMNS matrixes
- Beyond the Standard Model Particle Physics
- Grand Unification and searches
- Supersymmetry and searches. Strings?
- Particle physics and cosmology
- Dark Matter and Dark Energy.
- WIMPS, Axions and the strong CP-problem
- Matter-Antimatter asymmetry and CP-violation
- Dirac or Majorana neutrinos? Double beta decay

Recommended textbook: Particle Physics, B.R. Martin & G. Shaw, 4nd edition, John Wiley & Sons
 ISBN-13: 978-1118912164
 or ISBN-10: 1118912160 (both ISBN numbers work)

The discussion will be largely similar to the material in the recommended textbook. Sample HW problems can be found in the textbook. The HWs may include these problems, as well as additional problems.

GRADING. Grades will be based on your homework assignments (one HW every two-three weeks), two partial tests (one in the middle of the semester, one in the end) and quick quizzes in class. The tests will be 20% of your grade each, the homework 50%, and in class quick quizzes 10%.

There will be bonus questions in the HWs and tests.

Late homework:

- -50% (within 7 days)
- homework overdue by more than one week will not be graded and no makeups will be possible except extraordinary circumstances

Your final grades will be based on the percentage from the maximum possible total score:

A	80% of max
A-	75% of the max
B+	70% of max
B	65% of max
B-	60% of max
C+	50% of max
C	40% of max
D	20% of max

For additional details regarding grading policies see e.g. the university web site, e.g. here:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Requirements for Class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Students are expected to provide feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course

evaluation results are available to students
at <https://gatorevals.aa.ufl.edu/public-results/>.

UF students are bound by The Student Honor Code and Student Conduct Code <https://sccr.dso.ufl.edu/process/student-conduct-code/>

Campus resources:

If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit umatter.ufl.edu/ to refer or report a concern and a team member will reach out to the student in distress.

Counseling and Wellness Center: Visit counseling.ufl.edu/ or call 352-392-1575 for information on crisis services as well as non-crisis services.

Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit shcc.ufl.edu/.

University Police Department: Visit police.ufl.edu/ or call 352-392-1111 (or 9-1-1 for emergencies).

UF Health Shands Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; ufhealth.org/emergency-room-trauma-center.