

אוניברסיטת תל אביב

מבוא לחלקיקים ולגרעין

מרצה: אבנר סופר
מתרגלת: עדי אשכנזי

Syllabus:

- Symmetry in particle and nuclear physics.
- Discovery of radioactivity, properties of nuclei, mass, isospin.
- The electromagnetic, strong, and weak interactions.
- Particle accelerators and detectors.
- Discoveries in particle physics, leptons and hadrons.
- Quantum relativistic equations, introduction to quantum field theory, gauge interactions, and the Higgs mechanism.
- Particle physics phenomenology.
- Physics beyond the standard model and current research topics.

Textbooks:

There are many textbooks on these topics, with somewhat different emphases:

- For much of the course we will use Griffiths: "Introduction to Elementary Particles." The newest edition is from 2008, but the old ones are fine for most of what we need.
- Halzen and Martin: "Quarks and Leptons" is similar to Griffiths, but more technical.
- Perkins: "Introduction to Elementary Particles" is similar as well.
- Thomson: "Modern Particle Physics" has a similar approach to Halzen and Martin, but is new so incorporates some of the latest discoveries.
- Das and Ferbel: "Introduction to Nuclear and Particle Physics" provides a more thorough and enlightening treatment nuclear physics.
- Cahn and Goldhaber: "The Experimental Foundations of Particle Physics" is a unique resource on the important experiments that led to breakthroughs in the field, with commentary explaining the topic and the significance of the discovery.
- Quigg: "Gauge Theories of the Strong, Weak, and Electromagnetic Interactions" gives an advanced overview of the standard model and especially the importance of the gauge principle.
- There are many other books on the standard model or on nuclear and particle physics in the library.

ציון הקורס:

90% מציון הקורס יהיה ציון הבחינה, ו-10% ציון תרגילי הבית, כך שמי שלא יגיש תרגילי בית כלל יקבל ציון מקסימלי של 90.

תרגילי בית:

חלק חשוב מהפיתוחים המתמטיים ותרגילי ההבנה יהיו בתרגילי הבית. לכן, לתרגילים אלה חשיבות בהבנת הקורס ובהכנה לבחינה. תרגילים שיוגשו בזמן (שבוע לאחר שיחולקו) יזכו בניקוד של 1% אם יופגן בהם מאמץ משמעותי לפתור נכון את כל השאלות (גם אם תהינה טעויות פה ושם), ו-0.5% אם רק חלק מהשאלות פתורות או אם הפתרונות אינם משביעים רצון. הדרישה היא להגיש 10 תרגילים (שיהוו 10% מהציון הכולל) מתוך 12, כך שלא תהיה התחשבות במקרים ספציפיים בהם לא תוכלו להגיש תרגיל בשל סיבה זו או אחרת. עם זאת, מומלץ מאוד להגיש את כל התרגילים, בשל הסיבות לעיל.

Resources for homework problems:

For some of the homework problems you will need to read journal articles and obtain information about various particles. There are several ways to get this information:

- <http://inspirehep.net> is a useful place to search for articles in particle physics. For example, type “find a [which stands for author] Feynman, R and t [=title] properties of quark jets and date after 1975” or “find cn [=collaboration] ATLAS and t Higgs and j [=journal] PRL [=Physical Review Letters]”
- For each published paper, <http://inspirehep.net> gives you a link to the journal. In order to view the paper on the journal web site, you need to be connected to the university Ethernet system (since the university library pays journal subscriptions). But most papers written since the mid-1990s (and all papers nowadays) are also posted on the free <http://arxiv.org>, and <http://inspirehep.net> provides a link to that free posting, which you can get from anywhere.
- <http://arxiv.org> has its own article search, and you can also subscribe to daily or weekly updates of all papers in a given topic (there are also smartphone apps for arxiv). Reading the titles and some of the abstracts and papers every day is a good way to stay up-to-date on developments in the field.
- The Particle Data Group (PDG) collaboration publishes the Review of Particle Physics (RPP, also often called PDG), which is a compilation of most experimental results in particle physics and many review articles that serve as a quick and useful reference. The online version is at <http://pdg.lbl.gov>, with links to many PDF files containing the relevant information. The “PDGLive” (<http://pdglive.lbl.gov>) section provides access to information on specific particles without having to download the entire PDF, and also has linkable access to the relevant papers. If you wish, you can also order the (very large) book that is published every two years, at http://library.web.cern.ch/services/order/PDG_publication.