

# Introduction to Nuclear Physics

## Physics 625 – Fall 2023

Lectures: [MPHY 109](#), Tues, Thur, 11:10 am – 12:25 pm  
Instructor: Dr. Dan Melconian  
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Office: Cyclotron Institute, Room 331  
Office hours: Just drop by any time, or set up an appointment  
Textbook: None mandatory; we will roughly follow Chapters 1–10 of *Introductory Nuclear Physics*, by K.S. Krane (John Wiley & Sons, ISBN: 978-0-471-80553-3), with extra topics to be determined by the interest of the class.  
Course webpage: [cyclotron.tamu.edu/tamutrap/phys625/](http://cyclotron.tamu.edu/tamutrap/phys625/)

**Prerequisite:** PHYS 606 or equivalent, or approval of the instructor.

**Course Description:** Introduction to nuclear and subatomic phenomena, including nuclear forces and structure, nuclear instability and decay processes, symmetries and conservation laws, and applications.

**Learning Outcomes:** On completion of the course, students will:

1. be able to explain basic properties of the nucleus and the nucleon-nucleon force.
2. be able to use simple macroscopic models to explain nuclear masses and binding energies.
3. understand radioactivity and the processes of  $\alpha$ ,  $\beta$  and  $\gamma$  decay.
4. be familiar with experimental techniques used by nuclear physicists.
5. be able to apply nuclear phenomena to other fields, particularly to understand some astrophysical observations.

**Course Topics:** The basic properties of nuclei, the forces between nucleons and nuclear models; radioactivity and decay processes ( $\alpha$ ,  $\beta$  and  $\gamma$  decay); symmetries/conservation laws and the standard model; techniques in nuclear physics; applications and connections with other fields.

**Course Evaluation and Grading Policies:** There will be homework, a take-home final exam, and an oral presentation. Grading for the course will be based on: homework (50%), a presentation (20%) and the take-home final (30%). Classroom participation may earn up to 5% extra credit. Late homework will be accepted with a penalty (unless the reason is an officially excused absence).

**Academic Integrity Statement:** The Aggie Honour Code is “An Aggie does not lie, cheat or steal, or tolerate those who do.”

“Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one’s work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case” ([Section 20.1.2.3, Student Rule 20](#)).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at [aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

**Americans with Disabilities Act (ADA) Policy Statement:** The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Room B118 of Cain Hall, or call 979-845-1637. All information and documentation concerning disability is kept confidential.

**Title IX and Statement on Limits to Confidentiality** Texas A&M University and the College of Science are committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws provide guidance for achieving such an environment. Although class materials are generally considered confidential pursuant to student record policies and laws, University employees – including instructors – cannot maintain confidentiality when it conflicts with their responsibility to report certain issues that jeopardize the health and safety of our community. As the instructor, we must report (per Texas A&M System Regulation 08.01.01) the following information to other University offices if you share it with us, even if you do not want the disclosed information to be shared:

- Allegations of sexual assault, sexual discrimination, or sexual harassment when they involve TAMU students, faculty, or staff, or third parties visiting campus.

These reports may trigger contact from a campus official who will want to talk with you about the incident that you have shared. In many cases, it will be your decision whether or not you wish to speak with that individual. If you would like to talk about these events in a more confidential setting, you are encouraged to make an appointment with the Student Counseling Service ([scs.tamu.edu](http://scs.tamu.edu)). Students and faculty can report non-emergency behavior that causes them to be concerned at ([tellsomebody.tamu.edu](http://tellsomebody.tamu.edu)).