

Syllabus: PHY 480: Particle Physics Capstone

Course Title: PHY 480: Particle Physics Capstone

Semester: Fall 2024

Instructor: Dr. Robert Taylor

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Office Hours: Fridays 2:00-4:30 PM OR by appointment

Class Time & Place: Tuesday or Thursday 3:00-4:15 PM in SANCA 305

Course Description:

This capstone course focuses on exploring fundamental questions in particle physics through experiments or simulations. Students will design, conduct, and analyze an experiment or simulation that addresses a key question in the field. The course includes the development of a project proposal, experiment design, data analysis, and presentation of findings through a report and at the Innovation Showcase.

Course Objectives:

Design and conduct a particle physics experiment or simulation.

Analyze data from the experiment or simulation to draw conclusions.

Compare experimental results with theoretical predictions.

Effectively present the project at the Innovation Showcase.

Learning Outcomes:

Gain expertise in particle physics and experimental design.

Develop practical skills in data analysis and interpretation.

Improve communication skills through written reports and presentations.

Enhance the ability to manage particle physics projects from conception to completion.

Group Project and Required Subtasks:

The group project for this course will involve designing and conducting an experiment or simulation that explores a fundamental question in particle physics. The project will be broken down into the following subtasks:

1. **Project Proposal (Week 3):**

- Create a proposal outlining the particle physics question being addressed, the proposed experiment or simulation, and the anticipated outcomes. Include a timeline and assign roles to team members.

2. **Experiment Design and Simulation (Weeks 4-6):**

- Design the particle physics experiment or simulation. Develop and test simulations to predict the outcomes of the experiment.

3. **Experiment Implementation and Data Collection (Weeks 7-10):**

- Conduct the experiment or run simulations, collecting data on particle interactions, decay, or other phenomena. Analyze the data to identify patterns and validate hypotheses.

4. **Data Analysis and Interpretation (Weeks 11-12):**

- Interpret the data collected, compare the results with theoretical predictions, and refine the experiment or simulation based on the findings.

5. **Final Report and Presentation (Weeks 13-15):**

- Document the entire research process, including design decisions, challenges, and outcomes in a final report.

- Prepare a presentation and poster for the Innovation Showcase that highlights the key aspects of the project.

Groups are expected to collaborate closely, meeting regularly to discuss progress and resolve any issues. Instructor check-ins will be scheduled to provide guidance and feedback.

Evaluation:

Class meetings (5): 20 points

Individual meetings (3): 12 points

Project Proposal: 10 points

Experiment Design and Simulation: 15 points

Experiment Implementation and Data Collection: 18 points

Data Analysis and Interpretation: 10 points

Final Report: 10 points

Presentation: 5 points

Poster: 10 points

Total: 100 points

Course Policies:

Attendance and Participation: Regular attendance and active participation are crucial for success in this course. Students are expected to attend all scheduled class meetings and individual sessions. If a student is unable to attend a class, they should inform the instructor in advance and arrange to complete any missed work.

Academic Integrity: All students must adhere to ASU's academic integrity policy. Any form of academic dishonesty, including plagiarism, will be reported and may result in severe penalties, including a failing grade for the course.

Accommodations: Students with disabilities or special needs should contact the ASU Disability Resource Center to arrange appropriate accommodations and notify the instructor as soon as possible.

Important Dates:

Class Week 1: Introductions & Project Brainstorming (Aug 26)

Individual Meeting #1: Discuss Ideas and Readings (Sep 4)

Class Week 2: Proposal Presentation & Group Feedback (Sep 18)

Individual Meeting #2: Proposal Feedback & Methods Discussion (Oct 2)

Class Week 3: Revised Proposal Presentation & CERTT Tour (Oct 23)

Individual Meeting #3: Data Analysis & Progress Review (Nov 13)

Class Week 4: Professional Development & Project Discussion (Nov 27)

Innovation Showcase: Final Presentations & Poster Display (Dec 6)