

PHYS-4303 Course Project Instructions

This project is worth 15% of your grade for the course. It will be a presentation based on reading from the Review of Particle Physics.

General Instructions

- You will read a specified selection from the Review of Particle Physics and present it to the class. The graded part of the project will consist of an in-class presentation of 10-13 minutes in length (followed by a 2 minute question period). The presentation will include projected slides written using PowerPoint (or similar software) or L^AT_EX (with the beamer package or similar). You will submit the slides following the instructions below. In the presentation and slides, you do not need to include every step of mathematics, but you should explain what you are doing and where any equations come from. The grading rubric is below.
- The project is due **Mon 4 Dec**. The presentation will be held **in the class lecture period**, and slide submission is due at **10:59PM**.
- You **must** submit your presentation slides as PDF files. PDF slides prepared with L^AT_EX are acceptable as-is. If you prepare your slides with PowerPoint (or similar presentation software), you must use an equation editor for any mathematics and export your presentation to PDF to submit. Make sure that any slide overlays or transitions do not interfere with reading the slide content once you export to PDF! I need to be able to read all your writing and view all figures. Label your filenames with your first initial, last name, and “project” (for example AFrey_project.pdf); if you need to break your solution into multiple parts, label them in order with page numbers (AFrey_project1.pdf, AFrey_project2.pdf, etc). See the homework submission instructions on the course outline. Upload your submissions to <https://uwcloud.uwinnipeg.ca/s/dcYrc2Yys2jsSrz>. **This is the same link as for homework.**
- There are 3 possible project choices below; you must confirm your choice of project with me via email by **Weds 15 Nov**. Only one student may choose a given project, and the project will be assigned to the first student who chooses it. You may alternately choose your own reading and topic but must consult with me to specify the project (by the same deadline). Confirming your project by the deadline is worth **10% of the project grade**.
- *Please make an appointment to discuss your project with me if you have questions or need help.* A lot of the material in the reading is quite advanced. Learning is more important than figuring it all out yourself. If the reading is too much or too difficult, we can refine the topic as necessary.
- **Illness policy:** If I am ill on 4 Dec, we will hold all presentations on zoom. If you are ill on that date, you will present on zoom from home (if necessary, you will submit your slides early, and I will share them). If you are too ill to present live, we may reschedule your presentation to 6 Dec but will otherwise give marks out of 75% based only on the slides (ignoring the marks for Delivery and Questions) if that is not possible. I will only give extensions on the slide submission deadline in extreme circumstances.

Rubric

This rubric roughly follows the grading structure for honours project public presentations in our department (percentages somewhat modified).

- **Choice of topic:** Confirming your project by the deadline is worth **10% of the project grade**.
- **Structure:** Is the presentation organized logically? This is worth **10% of the project grade**.
- **Content:** Giving a clear and complete description of the topic is worth **40% of the project grade**. Terms should be clearly defined for the class. Physics information presented should be accurate.
- **Presentation:** The in-class presentation appearance will be **15% of the project grade**. The images and text should be easy to understand and read, and there should be helpful visual aids (figures, etc).
- **Delivery:** Pace should be even, and the presentation should be well-rehearsed. You should make eye contact and connect with the class. This is worth **15% of the project grade**.
- **Questions:** Are you able to answer questions? What is your knowledge beyond what is written on your slides? Worth **10% of the project grade**.

Option 1: Neutrino Oscillation Measurements

From the chapter *Neutrino Masses, Mixing, and Oscillations*, read section 14.6 about the experimental study of neutrino oscillations and describe the four types of neutrino oscillation experiments discussed in that section. You may need to read some of section 14.4 as introductory material. This is a lot of material, so please discuss with me if we need to cut it down.

Option 2: Big Bang Nucleosynthesis

Read sections 22.3.1-3 on *Big Bang Cosmology* and sections 24.1-3 and 24.5 on *Big Bang Nucleosynthesis*. Summarize the thermodynamics of the early universe, when a given type of particle can stay in thermal equilibrium, and how that applies to the formation of the elements. This is probably easier if you are comfortable with statistical mechanics.

Option 3: Dark Matter

Read sections 27.1-2,5, 27.6.2,3, and 27.7 from the chapter on *Dark Matter*. Describe evidence for the existence of dark matter, its required properties, some models, and how we can detect it.

Option 4: Choose Your Own

Find a review topic in the RPP and discuss it with me. Examples might be about the origin of dark matter or more advanced topics (possibly difficult) about searches for extra dimensions, axions, dark energy, etc.