

Phys 301 Modern Physics: Final Paper

Special relativity and quantum mechanics are two of the most transformative ideas in our understanding of the entire universe around us. Are there topics that we covered in class that really piqued your interest? Are there other related topics that we did not cover, but you'd like to investigate? Choose one topic, conduct additional research, and write a 2–5-page (single spaced) essay. The essay should be written at a level accessible to another Phys 301 student and include at least one figure.

This is meant to be an exploration of a topic beyond our discussions in class, or in the readings, so you will cite **at least two sources** that are not among the assigned readings from this course. Wikipedia and the like do NOT count as a legitimate source.

Summary of Due Dates: All submissions are to be e-mailed to your instructor.

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|---------------------------|------------------------------------|--|
| Topic Submission | Tues. Nov. 14 th , 10PM | A brief description of your topic. |
| Optional Draft Submission | Tues. Nov. 28 th , 10PM | Optional. I will provide suggestions for improvement for anyone who turns in a draft of their paper at least one week ahead of time. |
| Final Paper Submission | Tues. Dec. 5 th , 10PM | Late submissions not accepted. |

Possible Topics: You may choose from this list, or come up with your own topic, but be sure to get approval ahead of time (either at the due date for topic submission, or beforehand).

- A famous experiment in Special Relativity or Quantum Mechanics. Be sure to explain the experimental setup as well as the historical significance of the discovery.
 - Michelson-Morley experiment
 - Kennedy-Thorndike experiment
 - Deflection of light by the Sun during total solar eclipse (General Relativity)
 - Young's Double-Slit Experiment
 - Thomson's cathode ray tube experiments
 - The Photoelectric Effect
 - Millikan's oil-drop experiment
 - Rutherford's gold foil experiment
 - Stern-Gerlach experiment
 - Davisson-Germer experiment
- A concept, either covered in class or not, such as:
 - Twin Paradox
 - Heisenberg's Uncertainty Principle
 - Wave-Particle Duality
 - The Bohr-Einstein Debates
 - Decoherence
 - Copenhagen or Many Worlds Interpretations
 - Quantum Computing (check out Scientific American)
 - Quantum Cryptography (check out Scientific American)
 - Quantum Teleportation

- Science and culture – be sure to cite scientific sources.
 - Quantum mechanics in popular culture (be specific)
 - Quantum mechanics and philosophical thought (be specific)

A few more details:

- It is highly recommended that you schedule an appointment with the [Writing Center](#) at some point in your writing process.
- There is no single preferred style of citation in physics. Choose one style and use it consistently. Some standard styles in academia include: APA, Harvard, or MLA. You may also choose to use the style required by the journals of the American Physical Society or the American Institute of Physics. You may choose to use Zotero to help you collect and cite your research sources. Zotero can automatically export references in the aforementioned styles. Ask a librarian for help using this tool.

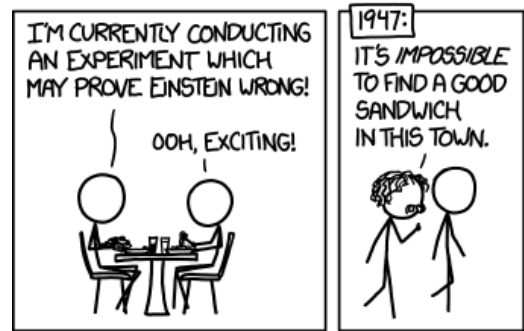


Figure 1. A comic illustrating Einstein’s fallibility. A scientific graphic would probably require more explanation. This caption is written in a text box “grouped” in Word with the image above. From xkcd by Randall Munroe.¹

- At least one figure is required, but you may choose to include more. Each figure must be labeled and numbered, include a descriptive caption, and a citation if you did not create the figure. Reference the figures in text like this: Figure 1 demonstrates the concept of humor.
- Equations are not required, but if they are used, each must be centered, numbered, and in the correct format (e.g. use the Equation Editor in Word, not simple text). Reference the equations in text like this: Equation 1 is the first kinematic equation.

$$x = x_1 + v_1t + \frac{1}{2}at^2 \tag{1}$$

Grading Rubric: See next page.

References

¹ R. Munroe, xkcd: Einstein. <https://xkcd.com/1206>

Phys 301 Modern Physics: Final Paper Rubric

Total assignment out of 80 points.

Content, Focus, and Purpose (20 points)

- Essay has a clear, informative purpose and focus aimed at building understanding of the topic.
- Content builds upon Phys 301 course material, and extends beyond the classroom work.
- Topic is well-developed with appropriate level of details for a fellow Phys 301 student.

Style, Organization, Clarity (20 points)

- Paper is structured effectively with strong beginning, middle, and end, clear transitions, and focused closure.
- Ideas are stated clearly and directly; wordiness is avoided.
- Ideas are related within paragraphs, and from paragraph to paragraph.

Reference Material (20 points)

- At least 2 references outside of assigned course readings are cited.
- References are appropriate for a scientific paper.
- Clear effort was made to research and synthesize materials beyond the classroom.
- Cited material enhances reader's understanding of the topic.

Figure(s) (10 points)

- At least one numbered, captioned figure is included and referenced in the text.
- Figure enhances the reader's understanding of the topic.
- Writer chose effective details from the figure to highlight the figure's purpose.

Grammar, Usage, Mechanics (10 points)

- Clear pronoun references, standard English inflections, appropriate word choices.
- Correct punctuation, spelling, and capitalization.
- If equations are included, equations are numbered, centered, and with appropriate formatting.