The research project requirement of this course will allow you to actually conduct your own physics research. You will choose a topic for your research, decide how to go about your research and then actually do the research and analyze your data. Don’t worry — this is not as torturous as it might sound! This project is worth 15% of your final grade, or as much as a single exam.

It is important to note that this research will be your own. That means that you will:

Propose a question that asks “How?” or “Why?”
1. Collect your own data (e.g., times, lengths, masses, colors, etc.) pertaining to the natural phenomenon you’re considering.
2. Explain what you did and what it all means.

This project is not any of the following:
1. A report on research that has already been done, although you are free to refer to such if you desire.
2. An essay describing some physics, although this might also be incorporated into your research.
3. A description of a demonstration/application and how it works.

This project has two parts:

Proposal (10%): Before you begin your research, you should propose what you are going to study and how you intend to study it. This can probably be written within one paragraph, submitted online. Your proposal should be specific. For example, instead of stating that you want to study “how rocks fall,” you should propose what you will actually do with the rocks (drop them off the roof of your house), what you will measure (time how long it takes each rock to fall) and what factors you will vary (dimensions of each rock). These proposals will be “handed back” (usually online) to you with either a stamp of approval or with suggestions regarding how you might go about improving your study. If you decide to turn your proposal in early, you will have it returned early as well.

Research Report (90%): This report should contain the following pieces:

Introduction. You should describe your project briefly, explaining what you set out to study, and how you intended to actually do it. This will be about a page or less in length and will probably resemble your original proposal.

Procedure & Results. This will contain the bulk of your report. Here you should describe exactly what you did, and what results you came up with. This might include not only a written description of your experiments and observations, but also a table of data that you observed and/or a graph or chart that reflects your data. (How you present your results is left entirely up to you, although you should make sure that you are clear and complete. Note that your data is most reliable when it can be repeated consistently — you might want to show this.) Depending on your particular project, this portion of the report could be several pages.

Conclusion. You should summarize what you did, and what you figured out. (Often, you have to conclude that you can’t conclude anything from your study!) In other words, from your data, can you come up with any general rule? (e.g.: “The larger a rock, the more slowly it falls, unless it is made out of quartz.” (No, this isn’t really true.)) Also, you should add any concluding thoughts that you have about your study, any explanations for things that might have gone wrong, and any suggestions for future study.

An example of a written proposal and report will be placed on the course web page. This might give you a good idea of what a report and its corresponding research can look like. Remember, though, that this is just one example. A list of topics will also be created to give you the beginnings of ideas for your project.
One other note: You may work together in pairs or small groups on projects, so long as a two person project is two times as extensive as a single person project (three people would need to do something three times as extensive, etc.), and each member of the group must be willing to contribute and share a common grade. No group should be larger than four people.

**Grading rubric for projects**
The following table represents how your project will be scored when it is finally graded. You might want to look this over so that you know what the project’s expectations are, and so that you know what your score means when you get the graded report handed back to you.

<table>
<thead>
<tr>
<th>Description:</th>
<th>Score:</th>
<th>Grade equivalent:</th>
</tr>
</thead>
<tbody>
<tr>
<td>This project was completed with an extraordinary amount of effort. Not only were all aspects of the project completed accurately and completely, but this project showed extra insight and clarity. This score is received on a small minority of projects.</td>
<td>5</td>
<td>A+</td>
</tr>
<tr>
<td>This project was completed accurately and completely. Any errors in this project are mostly insignificant. Essentially, this score is reserved for projects which reflect total integrity and accuracy, and are generally more sophisticated than the average project. The research is thorough and well thought out, and the report is understandable. The student learned more from this project than most students in the class.</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>This is a good project. It was complete and generally accurate; and, though it might contain errors, the point of the project is well conceived. There may be a question or two remaining for the reader of this report, but the research is mostly well presented and understandable. This student put an adequate amount of work into the project and it is evident that s/he learned something from it.</td>
<td>3</td>
<td>B</td>
</tr>
<tr>
<td>This project is mostly complete, but it might be missing a major component of the assignment. This project might have some substantial errors in it, it may not be clear how some part of the project was designed, or there may be a question that was not thoroughly investigated. While the student completing this project probably learned something from it, s/he also may have missed some important points.</td>
<td>2</td>
<td>C</td>
</tr>
<tr>
<td>This project probably has some major flaws. This may be due to incorrectly completing the project, or just a large-scale lack of effort. This score is usually received by only a small minority of projects.</td>
<td>1</td>
<td>D</td>
</tr>
<tr>
<td>This project was not completed, or did not satisfy enough project requirements to receive credit.</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Some final words regarding the grading of projects:
- Remember, even though you are not being graded specifically on spelling, neatness, presentation, etc., these things can definitely make your report more credible and easy to understand.
- This report should be understandable to the average reader. Any reader should be able to picture exactly what you did in your study, why you did it, and what you figured out.
- Considering the previous two points, re-read your report and ask yourself the questions: “Does this make sense? Will someone who picks up my report off the sidewalk be able to picture what it was that I did, what results I came up with, and what it all means?” *This standard may be the single most important one when it comes to grading your report.*