1 Overview

The Physics Integrative Exercise, a.k.a. Comps, is the culmination of all the hard work you have done during your time at Carleton. Ultimately, we wish to see that you, as a graduating senior, leave Carleton with a working knowledge of a broad range of subfields within physics as well as an understanding of various techniques and processes for studying, investigating, researching, learning, and communicating that knowledge. To demonstrate your ability to do these things, you will write a paper and then present that paper in a talk. This document will serve as your reference manual for the exercise. It includes descriptions of all elements of your project and the deadlines associated with them.

The first part of your assignment for comps is to choose three possible topics within (or related to) physics, that will meet the College and Department requirements for the integrative exercise. You will then focus on one of them and independently research it using existing literature. The required talk is expected to be a 50 minute presentation, and the requisite paper on your topic has a 7500 word maximum. Your audience for both these products is your fellow physics seniors. You are welcome to invite a general audience for your talk, but we expect you to aim the talk at a level appropriate for your fellow majors.

In addition to the two major products mentioned above, there are four other tasks you must complete. You are required to write a 1-2 paragraph abstract for a general audience that will be published in Radiations. You will act as a peer reviewer for another student’s written paper twice during the process. You will write two “reaction papers” analyzing the talks of two other students. Finally you must attend at least nine of your peers’ talks. Specific details of each of these components are in Section §2 and their deadlines are summarized on the final page. It is crucial that you meet all deadlines as you move through the comps process. Once the final schedule is set, it is extremely difficult to make changes.

Successful completion of all components of the comps process is required to pass comps. You will be evaluated on your performance on your talk, your paper, and your participation in comps overall (including meeting deadlines), and your grade will be assessed accordingly. You have four primary points of contact for questions, concerns and general hand-holding during the process. These are the departmental comps czar (Marty Baylor this year), Trenne Fields, who will handle scheduling and all your submissions, your primary faculty advisor (who will be assigned to you by Nov 12th), and your secondary faculty advisor, who will be assigned shortly thereafter.

While we expect that you will successfully complete your comps project, it is entirely possible to fail comps because of poor performance on any of the required components including missing crucial deadlines. See Section §3.6 for details.

2 Assignments

2.1 Fall Assignments: Choosing a Topic and Meeting With Your Advisor

The first step in a successful comps project is the selection of a good topic. First and foremost, the topic should be of interest to you. Comps requires a significant amount of work on your part, and you will have more motivation to complete that work if you are interested in learning about the topic. Your topic needs to be narrow enough that you can address it with adequate depth, but at the same time broad enough that it includes a range of themes from the standard physics curriculum (E&M, quantum mechanics, thermodynamics, classical mechanics, optics, etc.). Think about this balance when considering potential topics. If your topic is too narrow, it will likely not be integrative. If your topic is too broad, you will likely not be able to present your topic at the level expected of a senior physics major within the length constraints of the paper. To get a feel for this balance and to see what people have done in the past, consult the final written papers of previous students. These are available in the bookshelf in the Anderson Hall basement Physics Student Lounge area. You might also share your ideas with faculty members for their comments on whether the topic has the potential to be sufficiently integrative.

Current areas of physics research, physics applied to outside or everyday things, historical aspects of physics, and physics applied to societal issues are all areas where people have drawn ideas for topics. If you
are having trouble finding a focus for an idea, think of asking a question that your comps will answer. For example, ‘What role do phonons play in superconductivity?’ As you consider topics, discuss your ideas with at least two faculty members.

There are three assignments during Fall Term. The first, due Friday, October 18th, is a list of a minimum of three topics which you are considering. Even if you have a topic you have decided upon, you must submit a minimum of three topics. For each topic, state why you would like to investigate this topic and any questions you would like to answer related to this topic.

The second, due Thursday, October 31st, is a one-page proposal for the specific topic you would like to focus on for your comps. The proposal should explain why you think this topic is interesting, how it is integrative (i.e., what areas of physics it touches on), and list specific resources that you have identified. If you have formulated questions about the topic that you would like to answer during your comps, list those as well. See §3.3 for details on preferences that you can request at these times.

The third, to be done by November 20th (the last day of classes), is to meet with your advisor to discuss your project and plans. Before this meeting, please consult go.carleton.edu/integrity to review Carleton’s Academic Integrity policy. Be sure you understand what plagiarism is and how to correctly cite others' work. This meeting with your advisor would be a good time to address any questions you may have about academic integrity in this context and any other questions you may have about the comps process, comps timing, appropriate resources, etc.

2.2 Main Paper

The main text of the paper is to be no more than 7500 words. You must include a word count when you submit each version of your paper. The word count does not include captions, footnotes, appendices, the bibliography and similar items. All appendices together must be five pages or less. The form of the paper should follow the guidelines on the “Style Manual” portion of the comps website and the file should be named as specified in this footnote. All versions of the paper that you submit at each stage should be in “publication” form, that is complete, formatted properly, and free of typos and grammatical mistakes.

The first version should be electronically submitted to Trenne Fields and all advisors (primary, secondary, and peer) in PDF format three weeks before the talk. It should be complete and polished. You are required to include the first version checklist (available on the comps website) when you submit your paper. Your paper will not be accepted unless you have completed all items on the checklist. Your primary and peer advisors will read the first version of your paper. Within a week of submitting your paper, you should arrange a single joint meeting with your primary and peer advisors only to receive feedback on your paper. Following this meeting you should discuss your plan for your talk with your advisor.

Two weeks after your talk, your second version of the paper and the associated checklist are due in PDF format to Trenne Fields and all advisors (primary, secondary, and peer). The second version of the paper should incorporate suggestions and comments from your primary and peer advisors and be a very refined piece of work. A week after submitting your second version you will meet with your primary and peer advisor together to receive feedback. Your primary advisor will decide whether you should also meet with your secondary advisor at this point for additional input.

The third and final version of your paper is due five weeks after your talk. Email this version in PDF format to Trenne Fields and and your primary and secondary advisors only. This version should be of “archival” quality. It will be evaluated by your faculty advisors, and bound into a volume for the department and you will electronically archive it at the library. The final version must include an annotated bibliography. This is invaluable as a tool for us to understand how you used your sources, as well as a way for future readers to retrace your intellectual steps. This is not just an appendage, but an honest summary of how useful you found the various sources—something 'normal' bibliographies sadly do not do very well. Resources on annotated bibliographies are provided in the footnotes.

1. https://apps.carleton.edu/curricular/physics/major/comps/
2. Name the file <First Last> First Version Comps, <First Last> Second Version Comps, or <First Last> Abstract, <First Last> Final Comps (e.g., Trenne Fields Final Comps).
4. For a concise description of an annotated bibliography, visit https://guides.library.cornell.edu/annotatedbibliography.
5. For examples of different types of annotated bibliographies, visit https://writing.wisc.edu/handbook/assignments/annotatedbibliography/.
It is crucial that you honor the deadlines for your paper. This is necessary to give your readers adequate time to provide thoughtful feedback as well as keeping you on track to finish on schedule. If you submit any version of your paper late, there will be a decrement to your grade for comps. This could potentially mean not receiving distinction in comps or even failure in comps, leading to your needing to complete comps out of residence (see §3.6 for more details).

2.3 Peer Review
Each person participating in comps will be assigned to peer review the first and second paper versions of another student. You should read these papers carefully and be prepared to provide constructive feedback to the author of the paper. You will meet with the author at the same time as they meet with their primary faculty advisor. Being a peer reviewer is part of the comps process and your performance will be evaluated on the thoroughness and thoughtfulness of your feedback. Note that “Peer Review” is not to be confused with “Reaction Paper.” (See §2.6 for the latter.)

2.4 General Publicity Abstract
You must submit an abstract, maximum word count of ∼ 250, to Trenne Fields a week before your talk. This abstract should be accessible to a student in an introductory physics class. The abstract will be published in Radiations, posted on the Comps bulletin board outside the main department office, and sent to all Comps students.

2.5 The Talk and its Immediate Aftermath
The most public portion of comps is an oral presentation. This presentation is designed to be a 50-minute talk (with 10 minutes for questions) that serves as the centerpiece of the comps process. Your talk should have a logical narrative that your audience can follow. It is your job as a speaker to keep them engaged in this narrative while clearly communicating content. The level of your talk should be aimed at your fellow senior physics majors who have a solid foundation in physics (i.e., the same core courses as you), but are not experts in your exact topic. Others in the audience should be able to follow some of your talk, but it is OK if they do not absorb all of the physics.

The point of the talk is to clearly and effectively communicate your topic. This requires careful planning and practice. A common mistake is to cover too much material. Your talk will likely cover less than your paper. Carefully plan your use of powerpoint, the white board, demos, and/or visual aids. You should also practice giving your talk to an audience of sympathetic listeners, such as your fellow comps students. This will give you a sense of the length of your talk and how to improve clarity. Bruce Duffy is available to help you with the technical audiovisual aspects of projecting your talk from a computer, etc.

Although the goal of the talk is 50-minutes, the talk can be in the range of 30-50 minutes to pass. The faculty have found that when a student prepares a 50-minute talk, then that student is in a better position to significantly improve their paper. Moreover, it is an excellent opportunity to practice honing a presentation to a pre-determined time limit. Thus, we strongly recommend that you prepare a 50-minute talk. Moreover, only talks that are within a few minutes of 50 minutes will be considered for distinction. After the talk, regardless of length, and audience questions have been answered, you will stay with your advisors and possibly other faculty to answer some questions in private about your comps. During this time they will probe your mastery of the material. This is a wonderful learning opportunity that can provide feedback that informs your second version of your paper. Additionally this is a chance for an engaging discussion depending on the time remaining in the hour allotted your presentation. Any talk that is shorter than 30 minutes will earn an automatic failing grade.

The department will provide modest snacks for your talk. (Note this is a change from previous years.) Your primary faculty advisor will be responsible for bringing the snacks and hot drinks to your talk.

You should reach out to your primary advisor immediately after your talk to arrange a time to discuss reactions to your talk and to consider future versions of your paper. This meeting should take place within three working days of your talk.
2.6 Reaction Papers

Each person participating in comps will be assigned to write a short two-page double-spaced reaction paper in response to the talks of two peers. The paper should provide careful, thoughtful, sensitive, constructive commentary on your experience as an audience member at the talk. Discuss the strength and weaknesses of the talk, what you liked, what you didn’t like, what could be improved in the paper version and how, etc. The reaction papers are used by faculty members to judge the efficacy of the talk for the speaker’s peers. A paper which unconvincingly praises or complains about the presentation without showing thought is not helpful. You will be evaluated on the thoughtfulness of your feedback on the strengths and weaknesses of the talk.

Following the talk the speaker will meet with their primary advisor to receive feedback on the talk. Reaction papers contribute to the feedback that a speaker receives from their advisor. In order to encourage frank comments in the reaction papers, feedback is not attributed to particular individuals. Since this meeting occurs within a few days of the talk, it is crucial that reaction papers be submitted in a timely manner. Reaction papers must be emailed to Trenne Fields and the presenter’s primary advisor in the format provided in the footnote within 24 hours of the talk. Note that “Reaction Paper” is not to be confused with “Peer Review.” (See § 2.3 for the latter.)

2.7 Talk Attendance

You are required to attend at least nine talks besides your own and these talks can be in any section. Attendance sheets will be passed around during each talk and the onus is on you to sign the attendance sheets so we can record that you attended the required number of talks. If you do not sign the attendance sheet, you will not receive credit for attending the talk. You cannot pass comps if you don’t attend the required number of talks. Moreover, it is a violation of academic honesty to sign into a talk for which you did not attend the entire talk, or to have another student sign in for you if you do not attend.

3 Logistics

3.1 Faculty Advisors

You will be assigned one primary and one secondary faculty advisor. The primary advisor will be your main point of contact throughout the process. Your principal advisor will read your first and second versions of your paper and provide feedback. Your secondary faculty advisor will attend your talk and provide feedback through your primary faculty advisor on your talk. Both your primary advisor and secondary advisor will read your final version and evaluate it in consultation with the rest of the faculty.

In general, your primary advisor will be available for advice throughout the process, and you can consult them for advice on things such as preparing an outline and planning your talk among other things. After your talk, your second advisor will likewise be up to speed and available at all further stages. If there are significant concerns related to the content of your second version, your primary advisor may suggest a meeting with your secondary advisor in addition to the meeting you will have with your primary and peer advisors.

3.2 Meeting Times for Oral Presentations

The talks will take place on Mondays at 1A (8:30 – 9:40) and on Wednesdays and Fridays at 6A (W 3:10 – 4:20, F 3:30 – 4:40) during weeks four through ten of Winter Term. You will be assigned to one of these three different comps sections based on the day of the week you present your talk, but you are encouraged to attend talks in any of the other sections in addition to your own.

### Footnote

6 The file should be named <speaker first last>reaction from <reactor first last>; e.g., Joel Weisberg reaction from Trenne Fields.
3.3 Indicating Your Preferences

You have the opportunity to indicate preferences for an advisor, a talk date, and 6A versus 1A. If you have preferences you must indicate them in one of the assignments submitted during Fall Term, preferably the first assignment due October 18th. If you are unable to participate in the 1A or 6A sections you must explicitly explain why (e.g. athletics during 6A or you are taking a 1A course during Winter Term). The earliest possible talk date January 27th, would lead to the first paper being due the first day of classes Winter Term, January 6th.

By November 12th you will be assigned a date for your talk and your primary advisor. Your secondary faculty advisor will be assigned soon thereafter. We will do our best to accommodate all requests, but in the end it is likely that not everyone will receive their top choices.

3.4 Registration and Credits

Comps is a six credit class. You may either take all six credits during Winter Term, three credits during Winter and three credits during Spring, or all six credits during Spring. The distribution of credits over Spring and Winter Term should approximately reflect when most of the work is done. For example, if the final version of your paper is due during Winter Term you should take all six credits during Winter Term. You should register for your credits after the presentation schedule has been announced.

3.5 Evaluation

You will be assigned one of three final grades: pass with distinction, pass, or fail. You will be evaluated on the following:

- Your ability to construct a cohesive narrative in your talk and final paper, which is integrative and presented at an appropriate level and length.
- Your command and understanding of your topic.
- Your general written and oral communication skills.
- Your adherence to deadlines.
- Your participation in the comps process as a whole. This includes peer review, reaction papers, talk attendance, and asking thoughtful questions at talks.

To receive a passing grade both the talk and final paper must meet the minimum standards for passing and you must complete all the other comps activities with reasonable quality and without hassle. To be considered for distinction: 1) Your talk must be 50 minutes long (not including the 10-minute question period), 2) both your talk and paper must be evaluated as outstanding, and 3) you must complete all the other comps activities with reasonable quality and without hassle. You will be notified within several weeks of submitting your final version whether you passed comps. The designation of distinction to select comps will not be made until after the final version of all comps has been submitted.

3.6 Failure and Subsequent Options

Anyone who fails the comps process sketched above may pass it over the summer or in subsequent years by one of two options. Option 1 is completing the remaining portions of comps from the fail point on a longer time scale. Depending on the fail condition, this could require starting the comps process from the beginning. Option 2 is taking and performing adequately on the Major Field Test from the Educational Testing Service (ETS). It should be clear that this is not an easy ‘exit’ option. The test is a cumulative test over all areas of undergraduate physics that will take a substantial amount of studying to pass. More information about the logistics of this test will be provided to you if and as you need it, particularly since the specifics may change from year to year after you leave Carleton. The earliest a student can take this test is over the summer. Thus, both Option 1 and Option 2 will require completing comps out of residence. Therefore you will not complete all the requirements for the Carleton degree before graduation.
this situation will technically leave Carleton not having graduated. However, if permitted by the Academic Standing Committee, they might be able to ‘walk’ at graduation (albeit with an asterisk by their name), but can only get their degree after the Department certifies that they have passed one of these two options. Special note for double majors: Double majors are not allowed to complete comps for a second major after their 12th term, so failure would mean failure to earn a physics major.

3.7 Producing and Formatting Written Work

You may use any text processing program that provides a reasonably professional output and that can provide the required PDF format documents for sharing. Many students use the \LaTeX\ package or variants thereof, but we emphasize that its use is not mandatory! For those who wish to use it, we have collected hints and templates useful for physicists in general and also for comps students in particular.

4 Final Comments

Writing a 7500-word paper is not a trivial task and will require significant time and effort to complete. Be sure to allow plenty of time to complete and polish your paper at each step. If writing does not come easily to you, do not hesitate to seek help early in the process. The Writing Center is a great resource and they are eager to help you with all aspects of your paper.

Giving an hour talk is not a trivial task either. You must equivalently make sure you give plenty of time to practice and adjust your talk for length and ease of understanding by your target audience of physics seniors. Please practice with your peers, and reach out to your advisor for feedback early in the process. Don’t forget that the Academic Support Center also has support for speech coaching.

You MUST meet all deadlines in this process. The deadlines are designed to provide sufficient time to complete tasks and receive evaluation on that work. If you do not meet the deadlines you may not receive adequate feedback or have time to incorporate that feedback into an acceptable result. If this happens, the quality of your final product will suffer, and, in the worst case, you will fail the standard comps process and will need to pursue one of the two failure options.

In almost all cases, students find comps to be a worthwhile, interesting, and satisfying undertaking. The faculty agree with this and enjoy seeing the successful result of your work, which often goes beyond the specified requirements of the project. We encourage you to give comps your best effort and discover that you are capable of independently becoming the local expert on your topic.

We look forward to supporting your success. Good luck!

\footnote{https://wiki.carleton.edu/display/carl/Physics+LaTeX+Workshop}
### FALL TERM 2019 DEADLINES

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
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<tbody>
<tr>
<td>Friday, October 18</td>
<td>First Fall assignment is due: a brief description of at least three topics, submitted to Marty (<a href="mailto:mbaylor@carleton.edu">mbaylor@carleton.edu</a>) via email. Indicate any preferences for advisor and time and date of your talk. (See §2.1 and §3.3)</td>
</tr>
<tr>
<td>Thursday, October 31</td>
<td>Second Fall assignment is due: a one page proposal for your specific topic, submitted to Marty as a PDF formatted email attachment. This is your last chance to indicate preferences. (See §2.1 and §3.3)</td>
</tr>
<tr>
<td>Tuesday November 12</td>
<td>You will be notified of your primary advisor, enrollment section, and presentation date.</td>
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<tr>
<td>By Wednesday, November 20</td>
<td>Meet with your advisor to discuss your progress, plan for the project and discuss any questions you have regarding academic integrity.</td>
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### WINTER and SPRING 2020 TERM DEADLINES

<table>
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<tr>
<th>Deadline</th>
<th>Description</th>
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<tr>
<td>Presentation - 3 weeks</td>
<td>First version of your paper and 1st version checklist to be emailed to Trenne Fields, both faculty advisors, and your peer advisor in PDF format. Include the first version checklist. (See §2.2)</td>
</tr>
<tr>
<td>Presentation - 2 weeks</td>
<td>Meet with primary and peer advisors to receive feedback on your first version.</td>
</tr>
<tr>
<td>Presentation - 1 week</td>
<td>Email general audience abstract to Trenne Fields in PDF format. (See §2.4).</td>
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<tr>
<td>Presentation</td>
<td>Your talk will occur sometime between January 27 and the end of Winter Term.</td>
</tr>
<tr>
<td>Presentation + 1 day</td>
<td>Email reaction paper to Trenne and the presenter’s primary advisor.</td>
</tr>
<tr>
<td>Presentation + 3 days</td>
<td>Conference with primary advisor to discuss oral presentation and your plan going forward.</td>
</tr>
<tr>
<td>Presentation + 2 weeks</td>
<td>Second version of your paper and 2nd version checklist to be emailed to Trenne Fields, both faculty advisors, and your peer advisor in PDF format. Include the second version checklist. (See §2.2)</td>
</tr>
<tr>
<td>Presentation + 3 weeks</td>
<td>Meet with primary and peer advisors to receive feedback on your second version. In some cases, meet separately with your secondary advisor.</td>
</tr>
<tr>
<td>Presentation + 5 weeks</td>
<td>Final version of your paper to be submitted to Trenne Fields and both faculty advisors as a single PDF file. (See §2.2)</td>
</tr>
<tr>
<td>Before end of Spring Term</td>
<td>You will receive your final grade for comps. Digitally archive your comps at the library, while Trenne will print your paper for binding.</td>
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</tbody>
</table>

NOTE: Spring Break is not counted in the official comps schedule. If Spring Break falls in your comps schedule, you have a little flexibility in your schedule. Talk to your comps advisor.

**Be sure to meet all deadlines.**