

Physics Integrative Exercise 2018-2019

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. 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 hone in on one of them and independently research it using existing literature.¹ You are required to make an hourlong presentation (details below) and write a 7500 word paper on your topic. Your audience for both these products is your fellow physics seniors. You are welcome to invite a general audience for your talk, but please aim the talk at your fellow majors.

You are also required to create an abstract written for a general audience that will be published in *Radiations*. Each student participating in comps will peer review another student's written paper twice during the process. Each student will also write two "reaction papers" analyzing the talks of two other students. Specific details of each of these components follow; and all deadlines are summarized on the final page. Note that there are no letter grades awarded for comps; you will either (a) pass comps with distinction, (b) pass comps, or (c) fail comps. It is crucial that you meet the deadlines for each of these things as you move through the comps process. Once the final schedule is set, it is extremely difficult to do any rearranging due to the complexity of interleaved multiple deadlines for numerous people within a finite timespan.

You will be evaluated on your performance on the talk, your paper, and your participation in comps overall (including meeting deadlines), and your grade will be assessed accordingly. It is entirely possible to fail comps because you miss crucial deadlines (as well as bad performance in other areas). If you fail comps, you will only be able to complete Carleton's graduation requirements by finishing comps out of residence after graduation. 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.

You have four primary points of contact for questions, concerns and general hand-holding during the process. These are the departmental comps czar (Arjendu Pattanayak this year), Trenne Fields, your primary faculty advisor (who will be assigned to you by Nov 6th), and your second faculty advisor, who comes into the picture at your talk.

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 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 outside the main Department Office (Olin 331) and in the Library. You might also check 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

¹In addition to the results of your library research, you may also include original experimental or theoretical work; it should be noted that this is quite rare and certainly not expected.

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 12th, 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. The second, due Thursday, October 25th, is a one page proposal for your specific topic.

The proposal should explain why you think this topic is interesting, how it is integrative, and list resources that you have identified. If you have formulated questions about the topic that you would like to answer during your comps, this is a very good place to list those. See §3.3 for details on preferences that you can request at these times. The third, to be done by November 14th (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 other’s 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.

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,² and the file should be named appropriately.³

The paper that you submit *at each stage* should be in “publication” form. The first version should be electronically submitted *in PDF format*³ three weeks before the talk to Trenne Fields, your faculty advisors, and your peer advisor. It should be a polished paper free of typos and grammar mistakes. Read and reread the first version and tweak appropriately. You are required to include the first version checklist (available on the comps website²) 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 advisor and peer advisor 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 is due *in PDF format*^{3,4} to Trenne Fields, your faculty advisors, and your peer advisors. Include the second version checklist. 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 advisor and peer advisor together (and in some cases, your second advisor) to receive feedback. The third and final version of your paper is due five weeks after your talk.^{3,4} Email this version *in PDF format* to Trenne Fields, your faculty advisors, and your peer advisor. 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. You are responsible for contacting your faculty and peer advisors to arrange the meetings a week after submission of your first and second versions.⁴

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 after leaving Carleton (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

²<https://apps.carleton.edu/curricular/physics/major/comps/>

³Name 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).

⁴Visit https://apps.carleton.edu/campus/library/help/libe_help/digital_comps/ for details on digital archiving.

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 and considered when assigning your final grade for comps. Note that “Peer Review” is not to be confused with “Reaction Paper.” (See §2.6 for the latter.)

2.4 General Publicity Abstract

An abstract \sim 250 words maximum, is due 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 Talk Follow-up

The most visible aspect of comps is a public oral presentation. You must earn the privilege of giving this talk by producing a complete First Version at a level appropriate for your comp’sing peers. Assuming you are allowed to give a talk, you should plan to talk for 30-50 minutes and leave 10 minutes for questions. 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 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 carefully 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 the white/black board and 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. Please note that Bruce Duffy is available to help you with the technical audiovisual aspects of projecting your talk from a computer, etc.

Plan some flexibility in your talk in case you find yourself about to go over or under time. Adherence to the 30-50 minute length parameters is part of the grading criteria (a talk that is too short – 25 minutes, for example – is as problematic as a talk that is too long - 60 minutes, or rushed). After the talk is done 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, where we will probe your mastery of the material. In order for your talk to be considered for distinction, your talk must be 50 minutes in addition to being presented clearly at the appropriate level for your senior physics major peers. A first version that is incomplete or significantly deficient in terms breadth, depth, and/or level, will result in a failing grade. Also, any talk that is less than 30 minutes will earn an automatic failing grade.

A tradition has evolved where the speaker provides a *modest* quantity of snacks at the talk. Your primary faculty advisor will bring hot drinks.

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.

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. Feedback is not attributed to particular individuals, in order to encourage frank comments on the reaction papers. 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 are due in Trenne Fields' inbox (emailed digital copy)⁵ within 24 hours of the talk⁶. 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 ten talks besides your own. You may attend talks 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.

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 second faculty advisor will attend your talk and provide feedback through your primary faculty advisor on your talk. They will also read the final versions of your paper to evaluate them.

In general, your primary advisor will be available for advice throughout the process. 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.

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. Comps talks may also spill into the beginning of Spring Term. If this happens, the Friday 6a option will *not* be available Spring Term due to conflicts with PHYS 123.

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 13th. 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 first paper will be due the first day of classes Winter Term, January 7th; the first talk will be January 28th.

By November 6th you will be assigned a date for your talk and your primary and secondary faculty advisors. 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. Register for your credits after the schedule has been announced.

⁵The file should be named <speaker first last> reaction from <reactor first last>; e.g., Joel Weisberg reaction from Trenne Fields.

⁶For Friday talks, please send the reaction paper not only to Trenne but also to your primary advisor to ensure its timely arrival.

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.
- 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, asking thoughtful questions at talks, and meeting deadlines.

To receive a passing grade both the talk and final paper must meet the minimum standards for passing and you must complete all of the other comps activities with reasonable quality and without hassle. To be considered for distinction, your talk must be 50 minutes long (not including the 10-minute question period), and both the talk and paper must be evaluated as outstanding.

3.6 Failure and subsequent options

Note that anyone who fails the comps process sketched above may pass it out of residence after graduation by either repeating the comps process or performing adequately on the Major Field Test from the Educational Testing Service (ETS). A student who completes one of these two options will technically leave Carleton without graduating. However, if permitted by the Academic Standing Committee, they might be able to ‘walk’ at graduation (albeit with an asterisk by their name). They can only get their degree after the Department certifies that they have passed comps via one of the above methods. It should be clear that neither of these options is an easy ‘exit’ option. Completing the comps process without the resources Carleton provides is challenging. Moreover, 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 completing comps out of residence 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.

3.7 Producing and formatting written work

You may use any text processing program that provides reasonable results 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.⁷

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.

Neither is giving a 30-50 minute talk a trivial task. 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 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.

⁷<https://wiki.carleton.edu/display/car1/Physics+LaTeX+Workshop>

It is very important that you 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 have to complete comps out of residence.

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.

Good luck!

FALL TERM 2018 DEADLINES

Friday, October 12	First Fall assignment is due: a brief description of at least three topics, submitted to Arjendu Pattanayak (arjendu@carleton.edu) via email. Indicate any preferences for advisor and time and date of your talk. (See §2.1 and §3.3.)
Thursday, October 25	Second Fall assignment is due: a one page proposal for your specific topic, submitted to Arjendu as a <i>PDF format</i> email attachment. This is your last chance to indicate preferences. (See §2.1 and §3.3.)
Tuesday November 6	You will be notified of your primary advisor, enrollment section, and presentation date.
By Wednesday, November 14	Meet with your advisor to discuss your progress, plan for the project and discuss any questions you have regarding academic integrity.

WINTER and SPRING 2018 TERM DEADLINES

Presentation - 3 weeks	First version of your paper to be emailed to Trenne Fields ^{3,4} in <i>PDF format</i> . Include the first version checklist. (See §2.2.)
Presentation - 2 weeks	Meet with primary and peer advisors to receive feedback on your first version.
Presentation - 1 week	Email general audience abstract to Trenne Fields ^{3,4} in <i>PDF format</i> . (See §2.4.)
Presentation	Your talk will occur sometime between January 24 and early Spring Term.
Presentation + 1 day	Email reaction paper to Trenne. ^{7,8} (See §2.6).
Presentation + 3 days	Conference with primary advisor to discuss oral presentation and your plan going forward.
Presentation + 2 weeks	Second version of your paper to be emailed to Trenne Fields ^{3,4} in <i>PDF format</i> . Include the second version checklist. (See §2.2.)
Presentation + 3 weeks	Meet with primary and peer advisors to receive feedback on your second version. In some cases, meet separately with your secondary advisor.
Presentation + 5 weeks	Final version of your paper to be submitted to Trenne Fields as a single PDF file. ^{3,4} (See §2.2.)
Before end of Spring Term	You will receive your final grade for comps. Digitally archive your comps at the library ⁵ , while Trenne will print your paper for binding.

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.