PHYS379 Theoretical Physics Group Project

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Contents

1. Introduction

A. Background

These notes are about theoretical physics group projects PHYS379. This is a 20 credit module, assessed solely by coursework. There is no examination.

B. Handbook entry

The academic aims of the module, as listed in the handbook are:

- to prepare students to enable them to undertake fourth year theoretical physics projects.
- to give students experience in team activity and in open-ended project work.
- to develop information retrieval skills.
- to enhance existing problem solving skills.
- to further develop skills in report writing and presentation.

On successful completion of this module students will be able to:

- tackle open ended projects.
- keep a log-book.
- retrieve and digest scientific information from various sources.
- manage a number of different tasks successful.
- write a scientific report.
- establish co-operative working practices with colleagues.
- give a verbal presentation about their research.

C. The philosophy of open-ended projects

The project involves an open-ended investigation of a Theoretical Physics-based problem. There is no set syllabus and the problem - in very general terms - will be defined by the lecturer. Typically, this may be done either by stating the broad requirements of a solution within certain constraints or by posing an open-ended question related to a physical phenomenom. The project will not be tightly restrained by defined limits, allowing for adaption and many different solutions to a given problem. Projects vary from year to year. Students will work as part of a team (typically 4-5) and will submit a group report. There is no manual telling you how what methods to use and how to do the investigation. It is up to you to run your project. It will also be up to you and your team to define the measurable targets for the output of the project (the deliverables), to plan, schedule and execute the work. Note that you may be unable to fully "solve" a certain problem within the timescale given. The important point is not that you solve the problem (which may not be possible/feasible in the time available) but how you go about attempting to solve the problem.

D. Work load

This module is worth 20 credits, equivalent to two standard five-week lecture modules and worth 1/6th of your 3rd year. The rating of 20 credits equates to 200 hours, spread over 10 weeks, i.e. 20 hours per week on average.

2. Practicalities

A. Timing

Week 11	- Introduction to the module and project descriptions - Guidance on project management, planning, meetings - Selection of teams and projects
Weeks 11-12	- Develop roles within the teams - Initial investigations/exploring of the problem and potential solutions - Prepare research plans and presentation
Week 14	Submit research plan for informal feedback
Week 14	Group presentation to the class - research plans (non-assessed)
Weeks 13-17	Execute project - including weekly team meetings
Week 17	Submit plan of the report for informal feedback
Weeks 18-20	Write report - including weekly team meetings
Weeks 20	Group presentation to the class - research results (non-assessed)
Week 20	Submit report
Post exams	Individual presentation at the PLACE conference

An overview of the timing for the module is given in the table. At the beginning, the lecturer will introduce the module and briefly describe the potential projects. Guidance on project management, planning and meetings will also be given. Then, the teams will be chosen and the projects will be assigned to the teams. Each team will consist of 4-5 students. You should spend the rest of the first week and the second week planning the project: organising your team and the roles of the team members, performing initial research into the problem in order to better define it, and identifying possible routes to solutions. In weeks 13 or 14 you will be required to give a presentation - as a team - to the rest of the class in which you should describe the plan of your work for the project. The actual research should be done in weeks 13-17. At the end of the project you will be expected to write a report as a group in weeks 18-20. The report should be submitted at the end of week 20. In weeks 19 or 20 you will be required to give a presentation - as a team - to the rest of the class in which you should describe the results of the project.

In every week of the project you should have a team meeting and the meetings should be described in written minutes. A copy of your project plan and minutes of weekly meetings should be included in the report (in appendices). You will be required to give an individual talk at the mini-conference (in week 27 of the university year), although the mini-conference presentation can be about work conducted *either* during the independent study *or* the group project.

B. Assessment

Report	50%	Written and assessed as a group

Log book	15%	Written and assessed individually
Peer assessment	20%	An individual mark allocated by your teammates
PLACE conference	15%	An individual mark based on presentation after the exams

Report (50%)

Each group should submit a single report at the end of week 20, and every group member will receive the same mark for the report. The report should be prepared according to Departmental guidelines; these can be found at Report Writing Guidelines. The report should be a coherent document, and should introduce the problem as well as describing how the project was managed, the work undertaken within the project, any results obtained, analysis and discussion, conclusions and further work etc. Your report will be second marked by a member of academic staff who may not have been involved with the project work in any way whatsoever. Marking of reports will be unseen double marked subject to moderation, and the marks will be given according to the following categories: Presentation (20%), Project Motivation and Purpose (10%), Content (40%), Understanding (30%). The penalty for work submitted late is an automatic reduction of one full grade (e.g. A+ to B+) for up to three days late and a mark of zero thereafter. Any requests for extensions should be made prior to the submission deadline and be properly justified; they will be considered in consultation with your Academic Advisor. Note that reports are also subject to maximum length restrictions. The recommended length for group project reports is 15 to 20 pages, with a penalty of a reduction of one letter grade for exceeding 25 pages. For further details, please see the Report Writing Guidelines. The project plan and minutes of weekly meetings should be included in appendices (they are not included in the page count).

Additional guidance for typesetting reports:

- To see good examples of typesetting, please see Physical Review journals (e.g. Physical Review Letters). An example is shown in this paper.
- Text should be left justified or fully justified (do not centre text, not even the abstract).
- Equations (including those in displaymode) are part of a sentence. There should be no indent in the text immediately after an equation unless you really want to start a new paragraph. Generally, it's not usual to refer to an equation by its number until after the equation.
- Check for typos. Do not put an apostrophe into possessive its (see example in the last bullet point).
- Figure captions should be self-contained explanations of what's in the figure, not just a title.
- If you use a figure from another source (i.e. you didn't make it yourself), you must give the explicit reference in the figure caption.
- The font size in figures should be the same as the main text (not tiny!).
- In the main text, use a numbered system of citing references. They should be in numerical order, i.e. [1] is the first reference, [2] is the second, etc.

- In the list of references, use a consistent style. e.g. for research papers: author initial, author surname, journal title, volume number (in bold), page/article number, year (in parenthesis).

Log book (15%)

During the project, you should complete an individual log book to give a contemporaneous account of your own work within the group. Keeping a proper log book is a key aspect of project work. A log book does not need to be neat, and should not be a "best version" written up afterwards, but it does need to be a contemporaneous account of your work during the project. At the end of the project, the log book which will be marked by letter grade, giving an individual contribution to the overall mark.

You will have your own "Individual Logbook" in OneNote on the PHYS379 Teams page. This is your own private space, it can't be seen by other classmates, but it can be seen by the lecturer. The lecturer will sign and date your logbook every week. Please read the departmental guidelines on [Logbooks and OneNote](#).

Peer assessment (20%)

You will be asked to submit individual marks for each of your teammates, reflecting their relative contribution to the project. These peer-assessment marks are confidential, and will not be seen by your teammates. However, they may be viewed by lecturers and examiners, and may be subject to moderation. The peer assessment works as follows:

- Each student will allocate a mark between -6 and +6 to every other student in their team, where one mark corresponds to one sub-letter grade. Each mark should be accompanied by a brief justification. Students will not be asked to assign a grade to themselves. The marks are not required to average to zero when submitted, but will be normalised in this way by subtracting the average from each mark.
- After the marks have been submitted, each student will have a normalised mark from every other student in their team. These marks will in turn be averaged and rounded to the nearest integer.
- The overall grade from peer assessment is given by the report grade incremented by the average peer mark, where one mark corresponds to one sub-letter grade.

Example: Suppose that the group report received a grade of B. A student in this group receives normalised marks of +1.2, -0.3, +1.5, +0.0 from their peers. The average of this set of marks is (1.2-0.3+1.5+0.0)/4 = +0.6, which is rounded to +1. The student therefore receives a grade of B+ for their peer assessment.

The PLACE conference (15%)

All 3rd and 4th year physics majors are required to participate in the annual Physics student conference which is usually held in week 27. The conference is worth 3 credits, it is 15% of PHYS379. The conference work is done individually and it can be about work conducted **either** during the independent study *or* the group project. You are required to submit a short lay summary (30%) and to give a short talk (70%). An introductory lecture, teaching session and workshop will be given to the whole year group in the Summer Term.

C. Library resources

It is likely that your project will be in an area of which you have little knowledge and doing some background research could save you from wasting a tremendous amount of time. The University library has a vast amount of information at its disposal, including in electronic format, including a number of databases such as Web of Science. Please see the library's Physics subject guide.

3. Management Structure and Project Planning

A. The importance of good project management

Good management can easily make the difference between success and failure in a project, large or small. In essence good management means well-defined procedures, roles, tasks, targets. In other words, at any time, everyone should know who is supposed to be doing what when, and what they will deliver. The approach to project management described here is used (with slight variation) throughout academia and industry.

B. Management structure

The management structure of any project will be made up of the individual elements described below. Some of them will always be present, but some may depend on the size of the project. The analogous political body is also indicated to illustrate the point. You should describe your management structure in the presentation to the class in weeks 13/14, and also specify the roles of the team members. Your structure should include all the elements that are listed as needed "always" below. Team members may have more than one role. The point is that everyone should be clear about what the roles are, and that the workload in the project should be evenly distributed.

Coordinator (always): The coordinator or leader has the task of ensuring the successful overall running of the project. (Political equivalent: Prime Minister).

Secretary/administrator (always): This person's job is to ensure effective communication within the project, arrange meetings, take and circulate minutes. Large projects may have a team of such people. (Political equivalent: Cabinet secretary, civil servant etc.)

Committee (always): A "reasonable size" group of people who discuss any issues. In a small project, such as yours, this committee will normally have one (voting) representative per member/partner/organisation in the project and will make all the (major) decisions, but in larger projects with many members decisions are officially approved by an assembly. (Political equivalent: Cabinet).

Assembly (sometimes): In very large projects it is not practical to have all partners/members on the committee. In this case there is an executive committee who discuss any issues and recommend a decision which is then voted on in the assembly. (Political equivalent: Parliament).

Work-package leader (always): Activities within a project are always broken up into a number of work packages, each of which have a leader or chair. (Political equivalent: Minister).

Advisory committee(s) (sometimes): This is a committee of (outside) experts whose job is to advise the project, but which does not have any decision-making powers. (Political equivalent: e.g. Scientific advisory committee, such as the Committee on Climate Change).

Client/customer (always): This is the person/organisation that pays. They will need to be informed and consulted, e.g. by reports. Note that reports are always required from projects, even when they are entirely contained within a single organisation. For the group project, you can consider the customer to be the lecturer. (Political equivalent: Us).

Decision-making process (always): A project needs a well-defined decision-making process. Consensus is, in general, good practice for small projects, but even then a formal (voting) process is needed when consensus can't be reached. Large projects will typically vote on all (major) decisions. (Political equivalent: Constitution).

Plan (always): Successful operation of the project will depend on everyone involved knowing what needs to be done when, who is responsible for doing it, and what the rules are. This information will be contained in one or more (binding) documents. (Political equivalent: Written constitution, manifesto).

C. Project planning

Good planning is vital for the success of a project, and should ensure that the work is carried out in a timely and efficient manner. When planning a project the following elements are used:

- **Work package:** A work package (WP) is a coherent set of activities (tasks, see below) that work together towards a common sub-goal or goal in the project. Work packages have a well-defined start and duration and well-defined measureable outputs (deliverables, see below).
- **Task:** A task is a single, well-defined activity. It will have a well-defined start and duration, but may not always have a formal deliverable, although it must always have some output. Note that management and similar activities may also be tasks and included in their own WP. Your projects are small, so you may decide WPs are not necessary.
- **Deliverables:** A deliverable is a well-defined quantifiable (measureable) output from a WP/task. It could be a physical device, a part of a larger system, a piece of code, a measurement, a calculation, a report etc. As the name implies, deliverables are the return on the investment for the client.
- **Milestones:** Milestones are named after milestones in the road that tell you how far you have come and/or how much further there is to go: they are points in the project where progress can be assessed. Milestones may be decision points, i.e. where you decide to choose one particular approach (path) over another. Milestones may come in the form of deliverables, but deliverables aren't always milestones.
- **SMART** is a commonly-used mnemonic which describes the key characteristics of well-formulated objectives, milestones or deliverables etc. S = Specific: the objective should be well-defined, not vague; M = Measurable: the objective should be quantifiable; A = Attainable: the objective should realistic; R = Relevant: the objective should have some significance in the project (it should matter); T = Timely: the timescale for achieving the objective should be appropriate.
- **Gantt chart:** This is the master plan for the timing of the project. It should specify the timing of all the Tasks and WPs. It may also show the timing of the milestones and deliverables as well as the interaction between tasks. However, the Gantt chart should also be practical, and making it very complex may not achieve this. Milestones and deliverables will always be listed separately anyway. A crude

example of a Gantt chart is shown in Figure 1. Special software is available for generating Gantt charts, but using any reasonable method (e.g. Excel) is fine.

- **Resources:** Resources needed to complete the project should be identified at the start. Insufficient resources may mean that the project fails, or somebody has to pay more, neither of which are good outcomes! Clients will also want value for money, so the resources required should not be exaggerated either. Generally, resources might include personnel costs, equipment, consumables and travel. You don't have most of these to worry about but you do have a fixed number of hours to work on the project, and this should be taken into account in your planning, i.e. specified in your planning.
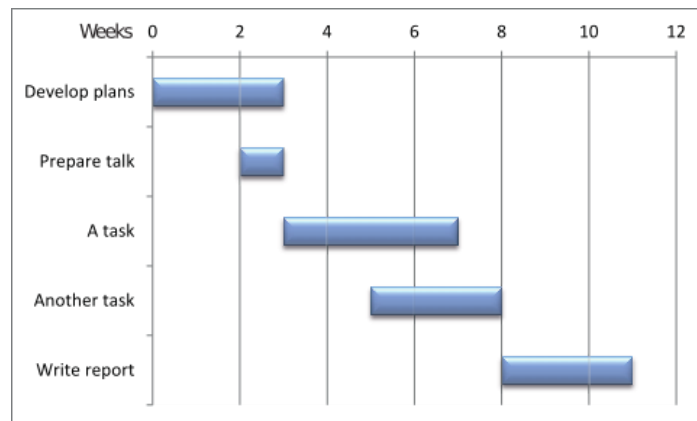
Figure 1 A crude example of a Gantt chart, created using Excel.

4. Meetings and Minutes

Just as with project management and planning, a formal procedure backed up by documentation helps to avoid misunderstandings and disputes about what was agreed and who is responsible for taking any action. Also a well-defined structure helps meetings to run smoothly.

A. Roles within a meeting

In a well-run and useful meeting all participants should be able to contribute and/or learn something from the meeting, but any formal meeting will always have people taking on the following specific roles.

Chair: The person in charge of the meeting. The Chair should not dominate the discussion, but manage it. Indeed, the Chair may not be one of the principal contributors to the discussion, which may come from different members with specialist expertise. Note that keeping a meeting to time, whilst also keeping the peace can be a difficult job.

Secretary: The person who takes the minutes. The Chair and the Secretary may be the same person, but doing both jobs at the same time may not be effective.

For the group project you may want to try rotating these roles within your group, but this is not compulsory.

B. Agenda and minutes

Meetings are governed by two crucial documents, the agenda and the minutes.

Agenda: The agenda should be available prior to the meeting, so that the participants can come prepared. They should also have the opportunity to contribute items to the agenda (in advance). The first item on the agenda is typically "Apologies for absence", which is followed by a review of the minutes of the previous meeting. This has two purposes. The first is to check that everyone agrees that they are a true record of the previous meeting. The second is to discuss any items that were not resolved at the previous meeting, requiring someone to go away and take some "action". This part of the process is formally considered to be a different process from the approval of the minutes and appears as a separate item on the agenda as "Matters arising". This is then followed by any number of meeting-specific items, although there may be "standing" items which appear on the agenda every time. The meeting (and agenda) is rounded off by "Any other business", which is a chance to raise matters that did not make it on to the formal agenda, and often finished by setting the date for the following meeting.

Minutes: These should accurately document the meeting. They do not need to be in fine detail or record verbatim everything that was said, just the main points discussed, any decisions taken and noting any actions. Since the minutes are a chronological record of the meeting, the format is very similar to the agenda. They will typically start with an attendance list, and record any apologies for absence which were notified. Note that those who neither attended nor submitted apologies are not mentioned. It will then state whether the minutes of the previous meeting were approved or if there were amendments, which are also recorded. This is then followed by the "Matters arising" item, where the actions that were taken after the previous meeting (and reported at the meeting) are

documented. Next, meeting-specific items are recorded, followed by "Any other business" and the date of the next meeting (if this was discussed).