Photo: Alan Segar

2011 - 2012

Physics

BA Projects Handbook

2011-2012

Open Day in the foyer of the Martin Wood Complex

Contents

Contents Cont'd

Foreword

The BA project (laboratory or literature) is an important component of Part B and should be one of the most enjoyable parts of the course. For the last two years, you will have done some rather routine practicals, and a laboratory project may be your first attempt at solving a problem on your own. It may also be a first look at problems whose solution may well be unknown (and not just to the student!). A literature project offers the opportunity to research a topic that extends well beyond the syllabus and explain what you discover from your own perspective.

To get the most out of your project you must choose carefully and prepare well. Contact your project supervisor early and discuss preparation, both in background reading and computing techniques. You will find the project supervisors and the Assistant Heads of Teaching very willing to talk to you during the choosing and preparation stages so do not be afraid to come and see us. Tell us of the areas you feel you need help or training so that in Hilary Term you can hit the ground running.

The BA laboratory project report

Introduction

Laboratory projects are experimental or theoretical investigations rather than expositions of material that is already in the literature. If you opt to do a project, remember that the Examiners' assessment of the work on it will overwhelmingly depend on the clarity and completeness of your report; understanding or care that is not apparent in the report is unlikely to gain you credit. You must therefore strive to make your report the clearest piece of scientific writing possible.

Target audience

When writing it is always important to know what audience you are trying to reach. Your report should be aimed at a physicist who has not worked in the area of your project. For example, if your project is about high-energy physics, imagine that your reader works on laser physics; if your project is in condensed-matter physics, imagine that your reader is an astrophysicist. You won't go far wrong if you imagine that your report is being read by one of your abler contemporaries.

The genre

The report must be an entirely self-contained account of the investigation: examiners will in general not be familiar with either the apparatus or the manuscript of an experiment. Examiners will not read any appendices or source code that you attach to your report.

The report must be carefully structured along the same lines as a scientific paper: the Introduction should explain what is to be investigated, why it's an interesting topic, and what prior work is available; the sections that follow should describe, in order, methods, data, results and their interpretation. The final section should start by summarizing what has been learnt and then indicate what further work would be profitable. At the head of the report there should be an Abstract that gives an overview of the Report's contents; at the end (but before any appendices) there be should a list of sources cited.

When drawing on other material it is important to take care to secure yourself against a charge of plagiarism, which the Proctors consider a serious offence. In particular, take care to use quotation marks when 'recycling' text, and to cite the source of any figure you have not made yourself; if the figure is modelled on one published somewhere, you should put "after xxx" in the figure caption.

Figures

You should take great care choosing and structuring your figures. They are the most memorable part of a scientific document and strongly influence the document's impact. Things to think about include: Can I combine these two figures into one?

Is this figure too busy?

Are all the lines and data points clearly labelled?

Is the figure big enough?

Would the labels on the axes be clearly visible from the back of a lecture theatre when the figure was shown in a presentation?

Would plotting the data in an entirely different way make a stronger impact?

Citations and Plagiarism

Statements about prior work and results used must be supported by references to a bibliography, and the sources of any borrowed figures or tables must be cited. Acknowledgment of sources will protect you from a charge of plagiarism, which the Proctors consider a serious offence.

The University's Regulations state that: *No candidate shall present for an examination as his or her own work any part or the substance of any part of another person's work... passages quoted or closely paraphrased from another person's work must be identified as quotations or paraphrases, and the source of the quoted or paraphrased material must be clearly acknowledged.* (Proctors' and Assessor's Memorandum, Section 9.5 http://www.admin.ox.ac.uk/proctors/pam/index.shtml)

Your report would automatically be compared with a wide range of potential source material, and should any unacknowledged borrowing be detected, the matter will be referred to the Proctors, who not infrequently press charges. If you are unsure whether you need to acknowledge a source, discuss the problem with your supervisor. If you follow his/her advice, you won't be judged harshly even if that advice is later judged defective. "*Turnitin* is a tool that allows papers to be submitted electronically to find whether parts of a document match material which has been previously submitted .... This is very useful in training students in good citation practice when used in formative assessment in cases like tutorial work." [Ref: Oxford University Computing Service]

Joint projects

If you have conducted, shared and done the experimental aspects of your project with another student you must produce independent reports. Should it be necessary to make specific reference to this student, you must refer to them as your colleague.

It is also important that you make it quite clear in your report what your contribution has been. It is particularly important in very technical or theoretical projects that you distinguish between your own work and that of others, which you are only including to provide background.

The front page of the report

The front page of your report must have the following information only:
Candidate number: e.g. 76694
Project number : e.g. INT68
Project Title: e.g. A Project Report
The supervisor's name: e.g. Professor A Lecturer
Word count: 5452

Examples of a front page of a BA laboratory report can be found on pages 24 and 25.

Students are reminded that your name and/or college MUST NOT appear anywhere in the report.

Word limit

Scientists more often than not write to a restrictive page limit - for example Letters journals generally restrict papers to 3 - 5 pages (about 3,000 - 5,000 words), and the Case for Support in a research grant application is often of similar length even though it is asking for well over £100k of funding. Imposing a tight page limit not only saves paper and readers' time, but can also increases clarity by forcing the writer to focus on the key points and to present only the key data.

The word limit for a BA project report is **6000** words, excluding captions for diagrams. The bibliography and appendices are NOT included in the word count. Students should be aware that the Examiners will not normally read them.

Typesetting your report

An example of typesetting a report in MS Word can be found on page 19. An example of typesetting a report in LaTeX can be found at http://www.physics.ox.ac.uk/teach/exammatters.htm. It is preferable that you print your report on one side of the paper (single-sided).

Resource Checklist

Students are encouraged to complete the blank search checklist document on page 22. The checklist can be printed from http://www.physics.ox.ac.uk/teach/exammatters.htm and students to hand it in with your report. It is a useful tool for supervisors and assessors when checking if students have searched scientific resources for their project work.

Presentation of your report

You are required to provide three (3) paper copies of your report. Each report must be put in a separate plastic folder. Recycled (used) plastic folders are available, at no cost, from the Physics Teaching Faculty in Clarendon Laboratory, on a first come first served basis. For readability, students are advised to print their reports on one side of the paper (single-sided). You are also required to include a pdf file of your report with your submission.

University Policy on Intellectual Property Rights

The University of Oxford has in place arrangements governing the ownership and exploitation of intellectual property generated by students and researchers in the course of, or incidental to, their studies. See the *Physics Undergraduate Course Handbook* for details.

Draft BA project report

In week 9, students should hand in a draft (as complete as possible) of their BA report to their supervisor. You and your supervisor must complete and sign the *BA Project Report Full Draft Form* (see **Appendix B**) returning the form to the Assistant Head of Teaching (Academic) soon after.

The supervisor should advise the student by reading and criticising the report **ONCE** only.

Submitting your report at Examination Schools

The BA project report is a requirement for completion of Part B of the Physics Honour School (Finals). Students hand in their reports at the Examination Schools.

The following must be placed in one sealed envelope of A4 size or larger:
(i) **three** copies of the final report along with
(ii) **one** copy of the declaration of authorship (see **Appendix C**). Put this in a small envelope and put the small envelope inside the main one which contains the work and
(iii) **one** copy of the report in pdf format on a CD. **Your candidate number must be written on the CD.**

Your candidate number must be clearly written in the top right corner of the envelope. You can obtain your candidate number from your confirmation of entry, or online via student self service.

The envelope must be addressed to "The Chairman of the Examiners, Honour School of Physics".

Failure to include any of the above will deem your examination material INCOMPLETE.

Examination Schools

Go to the reception desk in the Examination Schools' main hall, and obtain a receipt form (candidates with dyslexia should obtain an additional cover sheet). Complete the receipt form (and any cover sheet), with details as specified. Hand the work (in its envelope) and the receipt form to Schools staff at the desk. Schools staff will add the date and time to the receipt form and sign it to confirm receipt. Schools staff will give a copy of the receipt form to the student.

The core opening hours of the Examination Schools building are 8.30 am to 5.00 pm, Monday to Friday; the reception desk is staffed throughout this period. When you hand in you report you will be handed a receipt. Outside these hours work cannot be receipted, since staff will not be present.

Monday 12 noon of 1st week of Trinity Term 2011 is the deadline for submission of your project.

Note: It is the responsibility of each candidate to ensure that he or she hands in all the material he or she wishes to be considered by the examiners and to comply with the regulations relating to the submissions of the written work such as dissertations, reports and project reports. Once a candidate has submitted a piece of written work he or she may not withdraw that piece of work and substitute a revised version in the same examination without Proctors' consent.

Penalties for late submission of work

The Proctors may impose financial and/or academic penalties for submission of work beyond the deadline of **Monday 12 noon of 1st week of Trinity Term 2012**. This may affect the classification of your degree.

Any application for late submission should be made by the candidate, **NOT** the supervisor, through the candidate's college.

Therefore if special factors make it likely that you will not make a deadline, you should ensure that well before the deadline you follow the procedure laid out in the *Examination Regulations* to seek Proctorial permission to submit late.

The BA literature project report

The literature report

This report is an exposition of work that is already in the literature, rather than an account of an experimental or theoretical investigation. The level of explanation can be pitched at one of two levels:
(a) it can be pitched so that any intelligent physics graduate can understand the article with ease - articles written at this level that you can study as models appear in every issue of Physics World and Physics Today;
(b) it can be pitched so that anyone with a general scientific education, such as an intelligent sixth-former or a medical practitioner can understand it - Scientific American publishes articles at this level.
The report should contain an introduction which should explain the topic and why it is interesting. The sections that follow should describe aspects of the topic and should end with a summary and a conclusion. The physics in the topic, e.g. 'What is causing global warming': should be clearly explained.

Editors responsible for such articles are always anxious to include striking figures that both draw the reader in and help explain the article's content. You should also take trouble over your figures.

A selection of bibliographic references should be given that would help a reader check statements made and delve deeper into the issue if s/he wants to know more. When drawing on other material it is important to take care to secure yourself against a charge of plagiarism, which the Proctors consider a serious offence. In particular, take care to use quotation marks when 'recycling text', and to cite the source of any figure you have not made yourself; if the figure is modelled on one published somewhere, you should put "after xxx" in the figure caption. Reports are limited to **6000** words, not including the bibliography and/ or appendices.

Citations and Plagiarism

Statements about prior work and results used must be supported by references to a bibliography, and the sources of any borrowed figures or tables must be cited. Acknowledgment of sources will protect you from a charge of plagiarism, which the Proctors consider a serious offence.

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If you have shared aspects of your report with another student you must produce independent reports. Should it be necessary to make specific reference to this student, you must refer to them as your colleague.

It is also important that you make it quite clear in your report what your contribution has been. It is particularly important in very technical or theoretical projects that you distinguish between your own work and that of others, which you are only including to provide background.

The front page of the report

The front page of your report must have the following information only:
Candidate number: e.g. 76694
Project number : e.g. RP68
Project Title: e.g. A Project Report
The supervisor's name: e.g. Professor A Lecturer
Word count: 5452
Examples of a front page of a literature report can be found on pages 26, 27 and 28. A separate front page can also include this information, should you wish to do so. **Students are reminded that your name and/or college MUST NOT appear anywhere in the report.**

Word limit

The word limit for the BA project report is **6000** words, excluding captions for diagrams. The bibliography and appendices are NOT included in the word count. Students should be aware that the Examiners will not normally read them.

Typesetting your report

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Draft BA report

In week 9, students should hand in a draft (as complete as possible) of their BA report to their supervisor. The supervisor should advise the student by reading and criticising the report **ONCE** only. "This statement should not be interpreted as precluding the supervisor from commenting on the outline of the report. In fact, the supervisor should do this. The Examiners are only anxious to avoid situations in which supervisors effectively write reports. Apart from commenting on the outline and one draft, exchanges at the weekly meetings should be oral: what ideas the student is working with, what he or she doesn't understand etc., what other sources he or she might look at." [ref: Examiners 2007]

You and your supervisor must complete and sign the *BA Project Report Draft Form* (see **Appendix B**), returning the form to the Assistant Head of Teaching (Academic) soon after.

Submitting your report at Examination Schools

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The following must be placed in one sealed envelope of size A4 or larger:

(i) **three** copies of the final report along with

(ii) **one** copy of the declaration of authorship (see **Appendix C**). Put this in a small envelope and put the small envelope inside the main one which contains the work and

(iii) **one** copy of the report in pdf format on a CD. **Your candidate number must be written on the CD.**

Your candidate number must be clearly written in the top right corner of the envelope. The envelope must be addressed to "The Chairman of the Examiners, Honour School of Physics". **Failure to include any of the above will deem your examination material INCOMPLETE**.

Examination Schools

Go to the reception desk in the Examination Schools' main hall, and obtain a receipt form (candidates with dyslexia should also obtain a cover sheet). Complete the receipt form (and any cover sheet) with details as specified. Hand the work (in its envelope) and the receipt form to Schools staff at the desk. Schools staff will add date and time to the receipt form and sign it to confirm receipt. Schools staff will give a copy of the receipt form to the student.

The core opening hours of the Examination Schools building are 8.30 am to 5.00 pm, Monday to Friday; the reception desk is staffed throughout this period. When you hand in you report you will be handed a receipt. Outside these hours work cannot be receipted, since staff will not be present.

Monday 12 noon of 1st week of Trinity Term 2012 is the deadline for submission of your report.

Note: It is the responsibility of each candidate to ensure that he or she hands in all the material he or she wishes to be considered by the examiners and to comply with the regulations relating to the submissions of the written work such as dissertations, reports and project reports. Once a candidate has submitted a piece of written work he or she may not withdraw that piece of work and substitute a revised version in the same examination without Proctors' consent.

Penalties for late submission of work

The Proctors may impose financial and/or academic penalties for submission of work beyond the deadline of **Monday 12 noon of 1st week of Trinity Term 2012.** This may affect the classification of your degree. Any application for late submission should be made by the candidate, **NOT** the supervisor, through the candidate's college. Therefore if special factors make it likely that you will not make a deadline, you should ensure that well before the deadline you follow the procedure laid out in the *Examination Regulations* to seek Proctorial permission to submit late.

Choosing your BA project

How to go about choosing a project

Around two thirds of the 3rd year students may expect to be allocated one of their choices of project. For the remaining third we try to allocate a project in a similar area of interest. Some projects are more popular than others, for instance, literature based reports were more popular than laboratory-based ones last year, but this does fluctuate year on year.

Perhaps there is a project that you would like to do, but the project is not listed in the handbook. If this is the case you may approach potential supervisors with your ideas. Please inform the Assistant Head of Teaching (Academic) of the topic, the title and the supervisor, if you have made your own arrangements. You are also encouraged to write a short statement on the back of the choice form if you have any particular strengths or experience relating to your choices, or if you are choosing a project with your future career in mind.

Although every effort is made to include all possible information about and on the BA projects offered, new projects may become available after the publication of this *BA Projects Handbook*, and infrequently a project may have to be withdrawn. All changes will be communicated by e-mail.

Project allocation

Projects are allocated by the Assistant Head of Teaching (Academic) using the students's choices on the *Project Allocation: CHOICE FORM*, see **Appendix A**.

For the allocation exercise, the student name and college are hidden to prevent any bias. All the project choice forms are entered into an access database. All eight choices are listed in order of preference and additional comments are recorded.

For very popular choices we use the following procedures:

(i) Supervisors are consulted as they may be contacted by prospective students about the projects they are offering, although this is not essential for the allocation of the project. Supervisor(s) input is essential in trying to match projects to students;

(ii) Should it still prove difficult to assign the project or report, each student who wishes to be allocated the specific project is assigned a number and then the winner drawn from a hat;

(iii) The PJCC (Physics Undergraduate Consultative Committee) is also consulted on an annual basis about the process. If you are not happy with the BA project or report you have been allocated, you are encouraged to discuss other possibilities with the Assistant Head of Teaching (Academic).

Project assessment

BA project reports will be independently graded by two Assessors.

One of these assessors is a Physics Finals Examiner, who will generally work in a different area of physics from the subject of the report or report. The other assessor is appointed by the relevant physics sub-departments, the Physics Department or less frequently from another department of the University.

The inherent nature of laboratory and literature projects differ significantly and they are therefore assessed differently. The *BA Laboratory Project Assessment form* is used to assess a laboratory project report and *BA Literature Project Report Assessment form* to assess an literature report.

These forms will be published on the Examination Matters webpage http://www.physics.ox.ac.uk/teach/exammatters. The precise details of how the final mark is calculated will be published in the Examination Conventions produced by the Examiners.

The Faculty of Physics may reform the project and report assessment which may replace the above guidelines. Any changes will be published on the Examination Matters webpage http://www.physics.ox.ac.uk/teach/exammatters before the beginning of Hilary Term 2012.

Weightings for the BA

The Examiners are responsible for the detailed weightings of papers and projects but guidance from the Physics Academic Committee suggests the following relative weightings for the papers in the different parts of the BA examination.

After Part B of the BA, candidates will be ranked on the basis of a total mark that is obtained by adding the scaled marks (0-50 for short options, 0-100 for the papers) of individual elements multiplied by the following weightings.

BA

Each Part A paper (3)	0.75
Part A Short Option	0.375
Part A Practicals*	0.75
Each Part B paper (4)	0.625
Part B Short Option	0.50
Part B Practicals or second Short Option	0.50
BA Project Report	0.75

*(or Part A half practicals 0.375 plus second short option 0.375)

BA Project Report prizes

The examiners may award a prize for the best BA laboratory and the best literature reports.

Examples of reports

Please note that from 2011-2012, essays have been renamed literature project reports. A limited selection of past BA projects and essays are available to look at from Assistant Head of Teaching (Academic) in the Physics Teaching Faculty Office, Clarendon Laboratory, toward the end of Hilary Term.

BA Project and Essay Prize winners 2010-2011

Phil Bellamy, New College, won the prize for the essay: "Rotary Molecular Motors" supervised by Dr Richard Berry.

Henry Carter, Mansfield College, won the prize for the project: "An Investigation into the Solution of Partial Differential Equations using Random Walks." supervised by Dr Jeff Tseng.

BA Project and Essay Prize winners 2009-2010

Claire E Love, Hertford College, won the prize for the essay: "Intermediate-mass black holes supervised by Dr John Magorrian.

Joseph E Barnard, Mansfield College, won the prize for the project: "Optical information processing" supervised by Prof Simon Hooker.

BA Project and Essay Prize winners 2008-2009

Thomas P Burkin, University College, won the prize for the essay: "Quantum Information Processing" supervised by Prof Christopher Foot.

Philip J Oldale, Somerville College, won the prize for the project: "Paramagnetic Resonance of embedded hydrogen atom" supervised by Dr Jonathon Hodby.

BA Project and Essay Prize winners 2007-2008

Harry R Kennard, Mansfield College, won the prize for the essay: "The emergence of Classical Physics: Decoherence and Quantum Darwinism" supervised by Prof Jonathan Jones.

Christopher E Powell, St Hugh's College, won the prize for the project: "Induced radioactivity using a neutron source" supervised by Dr Giles Barr.

BA Project and Essay Prize winners 2006-2007

Lydia F Prieg, Christ Church, won the prize for the essay: "Gravity currents in fluids" supervised by Prof David Andrews.

Andrzej K Nowojewski, Mansfield College, won the prize for the project: "Simple Expansion for Bound States of the Coloumb Potential Perturbed by a Power Series" supervised by Dr Jack Paton.

Timetable for students

Michaelmas Term 2011

Week 0	Distribution of the *BA Projects Handbook*	**Colleges**
Week	**Compulsory Safety Lecture** § Failure to attend means that the project cannot be started.	**Please consult the lecture list for details**

Michaelmas Term Weeks 1 and 2

Before deciding on a project students are encouraged to discuss any projects in which they are interested with supervisors, but there is no obligation to do so and allocation of projects does not depend on doing this.

Week 2 (Fri 3 pm)	Hand in *Project CHOICE FORM* **(see Appendix A)** **Late submission may result in a project or report being chosen for you**	**Physics Teaching Faculty**
Week 5 (Wed)	Publication of the Project Allocation List [e-mail notification and printed version]	**Denys Wilkinson Building**

Hilary Term 2012

Week 3 (Fri)	BA students must have met the supervisor by the end of this week.	
Weeks 4 - 8	BA projects (laboratory): Project work. BA project (literature) reports: Weekly report meetings. Talk to your college tutor about the progress of your project.	
Week 5*	'Writing a BA project report' lecture	**Please consult the lecture list for details**
Week 6	Risk Assessments **MUST** be completed and handed to the supervisor **before** starting the project. Return the completed form to the Physics Teaching Faculty.	
Weeks 8-9	BA projects: Writing up. First draft.	
Week 9 (Fri)	Hand in a draft (as complete as possible) of BA project report to your supervisor. You and your supervisor must complete and sign the *BA Draft Form* (**see Appendix B**).	
Week 10	Deadline for receiving comments from supervisor.	

Trinity Term 2012

Week 1 (Mon 12 noon)	BA reports handed in. Three copies of the reports & the Declaration of Authorship & a copy of the report in pdf format on a CD (One of these copies is given to the supervisor for their records).	**Examination Schools**
Week 1	Submit logbook (if applicable) to supervisor.	**Supervisor**

Timetable for supervisors

Early Michaelmas Term 2011

Students may contact you to learn more about your projects. They are not obliged to do this and the allocation of projects is not in any way dependent on them doing so.

Michaelmas Term 2011

Week 4	Draft project allocation sent to Physics college tutors and supervisors. **This is only a draft and the information should not be disclosed to students**.
Week 6	Project allocations announced.

Hilary Term 2012

Week 3	**Compulsory meeting with students allocated to your project(s)** Project preparation period if necessary.
Weeks 4 - 8	**BA project period:** during this period all of the experimental and theoretical work necessary for the project should be completed. You should meet the student regularly while the teaching labs are open for projects, if are supervising a literature project you must meet on a weekly basis to monitor progress. You must also leave your contact details so you can be reached. You should encourage the student to begin the project report as early as possible. If you have to leave Oxford during this period please ensure that you have a deputy to undertake project supervision in your absence.
Week 6	**BA students** should complete safety requirements and risk assessments, undertake any necessary computer training and preparatory reading. You send the the completed *Risk Assessment* form to the **Physics Teaching Faculty**.
Week 9 (Fri)	Full draft of BA report handed in by student to you and *BA Draft Form* (**see Appendix B**) stating that this has happened sent to **Physics Teaching Faculty** signed by both student and supervisor.
Week 10	Written comments by supervisor on first draft sent to student.

Trinity Term 2012

Week 1	BA student hands in copies of final report with a single copy of the Declaration of Authorship and a copy of report or report in pdf format on a CD to Examination Schools (Three copies, one of these copies is given to the supervisor for their records).
Week 1	Deadline for the return of Supervisor’s Report Students hand their logbook to you

Guidelines for BA project students

Student responsibilities

- Hand in *Project Allocation: CHOICE FORM* (see **Appendix A**) by Friday, week 2.
- To check the project/report allocation.
- To attend the Projects Safety lecture, if you are doing a project, and complete the *Risk Assessment form* with the supervisor. **Return the completed Risk Assessment form to the Physics Teaching Faculty.**
- To attend regular meetings with the supervisor For projects this is when the teaching laboratories are open and to contact the supervisor promptly should there be difficulties
  For reports it is crucial that you meet with your supervisor on a weekly basis.
- At your regular meetings, you will be asked about your logbook. It is important that it is sufficiently detailed and includes dates and times of day.
- To ensure that the supervisor has been given a draft of the project record according to the timetable.
- Hand in 3 (three) copies of BA project or report with one copy of the declaration of authorship and a CD copy of your project or report in pdf format to the Examination Schools on time.

Schedule

It is particularly important that you take note of the overall schedule. This has been established in conjunction with the Finals Examiners. Please read the notes below in conjunction with the timetables on pages 10 and 11.

Hilary Term (*Weeks 4 - 8*): Project work

This is a very concentrated period of work during which all experimental work should be completed and it is essential that the students are launched into the work from the beginning. ***[For example, the average time spent in a lab is 12.5 days.]***

All students must contact their supervisor and get started on preliminary work for the project early in Hilary Term. For experimental work, a *Risk Assessment form* (see page 29) must also be completed before starting the project.

Most experimental projects will take place in the Physics Teaching Laboratories, Denys Wilkinson Building. If this is not the case, make sure you know the location.

If you are doing an report, it is suggested that students and supervisors should meet a **minimum** of twice each week. Please discuss and make the necessary arrangements to accommodate both you and the supervisor.

Hilary Term (*Weeks 8 - 9*): Writing up

You will need to hand in your first draft (as complete as possible) of the report to your supervisor by 9th week so that you can get their comments before you submit your final report. Please allow sufficient time for your supervisor to respond. Your supervisor should advise you by reading the draft report and criticising it **once** only. This should be done before Friday of 10th week of Hilary Term. Guidelines for the presentation of the project is given in the *BA Projects Handbook* and in the *Practical Course Handbook*, Section 1.3.6.

Trinity Term (*Week 1*): Examination Schools

The final version of the BA project report is handed into Examination Schools on **Monday 12 noon** of **1st week of Trinity Term.**

Logbooks

Please remember to keep systematic and professional records in your logbook throughout the project. More details are given in *Practical Course Handbook*, Section 1.3.2. Please hand your logbook to your supervisor at the end of the project period.

Why three copies of your project report?

One copy is given to your supervisor for their own records with the other two copies retained for assessment purposes. Please note these reports are not returned to you after the publication of the results, as they are examinable material.

Students are strongly encouraged to make a copy for your own records.

Why a student declaration statement?

As you will see from the section on **Citation and Plagiarism**, we require students to make a statement regarding their project. Students will be expected have made a written statement before any formal assessment takes place.

Student feedback to the Department

At the end of the project, we would like to hear from you about your experiences while doing the project you have been allocated. Your contribution, in this way, provides useful feedback to the Department.

Guidelines for BA project supervisors

Teaching duties of BA supervisors

- To ensure that there is proper equipment and resources available to students during the project period.
- To arrange training for the students in any specialised techniques or IT packages if necessary.
- To inform the students fully of risks associated with the project, to complete the *Risk Assessment form* before the start of the project. **Return the completed Risk Assessment form to the Physics Teaching Faculty.**
- To have regular meetings with the student during the project period; for laboratory projects when the teaching labs are open and for literature projects these meetings should be weekly.
- At your regular meetings, you should check that the student's logbook is sufficiently detailed and includes dates and times of day.
- To read and comment constructively on the first draft of the project report.
- Complete a BA Supervisor Report form for each BA student.

BA examination entry

The BA Examination entry form will require the student to confirm the title of their project report and the name of the supervisor. If this is a project not listed in this *BA Projects Handbook* the student will need to obtain a letter via the Assistant Head of Teaching (Academic) by e-mail at c.leonard-mcintyre@physics.ox.ac.uk.stating that the topic and title are appropriate.

BA project report guidelines

The idea behind the reports is to get undergraduates to explore an area of physics and write an extended report on that topic. They will be expected to have read widely under the direction of their report supervisor and be able to give a critical view of what they have read (**Weekly meetings with the supervisor are compulsory**). We strong want to avoid regurgitation of collected material.

Some students view the report as an easy route compared to an experimentally based BA project. This would be the case without a supervisor explaining that the examiners will want to judge carefully the student's assessment of what he/she has read.

The supervisor should advise the student by reading and criticising the report **ONCE** only. "This statement should not be interpreted as precluding the supervisor from commenting on the outline of the report. In fact, the supervisor should do this. The Examiners are only anxious to avoid situations in which supervisors effectively write reports. Apart from commenting on the outline and one draft, exchanges at the weekly meetings should be oral: what ideas the student is working with, what he or she doesn't understand etc., what other sources he or she might look at." [ref: Examiners 2007]

BA experimental and computing projects

Descriptions of the practicals on which the projects are based are given in the *Practical Course Handbook*.

Guidelines for writing the literature report

The guidance given to students on the BA literature report or report can be found on pages 3-7.

Schedule

It is particularly important that you take note of the overall schedule. This has been established in conjunction with the Finals Examiners. Please read the notes below in conjunction with the timetables on pages 10 and 11.

Hilary Term (*Weeks 4 - 8*): Project work

This is a very concentrated period of work during which all experimental work should be completed and it is essential that the students are launched into the work from the beginning. ***[For example, the average time spent in a lab is 12.5 days.]***

All students must contact their supervisor and get started on preliminary work for the project early in 1st week. For experimental work, a *Risk Assessment form* must also be completed before starting the project.

Most experimental (laboratory) projects will take place in the Physics Teaching Laboratories, Denys Wilkinson Building. If this is not the case, make sure the student(s) know the location.

You should keep notes on the effort and achievement of project students as they proceed, as you will be asked to give an account to the Examiners.

Hilary Term (*Weeks 8 - 9*): Writing up

First draft of the report to be handed to the supervisor by the student. Your advice and interaction with the student on the content of the report is an important part of the project so please do allow sufficient time for this interaction. The specification of the form of the report is detailed in this *BA Projects Handbook*. The supervisor should advise the student by reading the report and criticising it **once** only. This should be done before Friday of 10th week.

Trinity Term (*Weeks 0 - 1*): Supervisor Report Form

Supervisors complete a supervisor report for each BA student they have supervised no later than 1st week in Trinity.

Logbooks

One of the essential habits we have tried to instil in students is keeping systematic records of their work. Please check that students are using their logbooks in a professional manner throughout the project. Encourage them to make a thorough record of all their investigations, including any problems they encounter. More details are given in *Practical Course Handbook*, Section 1.3.2.

Supervisor copy of the final project report

One copy of the final report or report handed in to Examination schools will be given to you for your records. Please emphasise to your student that they should make a copy for their own records, as the reports are not returned.

Supervisor feedback to the Department

At the end of the project as well as helping with the assessment we would very much like to hear from you on how the project ran from the supervisor's point of view. Please do tell us if the allocation process worked sensibly. We will be working with colleagues to ensure a good match but we would like to know your views on the matter.

BA laboratory projects

The experimental and computing projects available are mostly based on standard practicals with extensions. Some of these are described in the *Practical Course Handbook*.

A candidate may not offer a project based on a practical performed previously. The name of the Head of Laboratory is given in brackets; where possible the name of a potential supervisor is also listed. Candidates with their own ideas for a project should discuss it with a senior demonstrator before putting it forward.

Atomic Physics, spectroscopy and optics *

OP17 Optical information processing

OP18 Anomalous Zeeman Effect in mercury

OP23 Hyperfine structure of cadmium

OP27 The helium-neon laser

Electronics

EL12 Amplifier design

EL15 Measurement of transistor properties

EL40 Opamp design

Supervisor ***: Dr G Peskett*** Physics Tel No ***: 272883***
Email ***: g.peskett1@physics.ox.ac.uk***

Computing

Students interested in pursuing different computing projects, or variants of those below may contact the Assistant Head of Teaching (Academic) to discuss their ideas.

CO33 Soliton

CO34 Chaos

CO38 Ferromagnetism

Condensed Matter Physics

SS1601 X-ray Physics

SS1602 X-ray Physics

SS94 HeNe Laser

The properties of a HeNe laser will be investigated, including the emission energy, and cavity stability, together with the longitudinal modes of the system. This is a new project based on a newly purchased laser system.

SS98 Earth Field NMR

SS97 Quantum well spectroscopy

Supervisor ***: to be confirmed***

SS99 Paramagnetic Resonance of embedded hydrogen atom

Supervisor ***: Dr J Hodby*** Physics Tel No ***: 272200***
Email ***: j.hodby1@physics.ox.ac.uk***

Nuclear Physics*

There are a number of BA projects available using the apparatus in the nuclear physics laboratories. The projects are extensions of the measurements which are normally made in on of the 2-day third year practicals. The aim of the project is to see how far the accuracy of the measurements can be pushed using the apparatus available. Most of the measurements can be left running overnight. It is essential when doing one of these projects that you do **NOT** do the corresponding third year practical as part of the practical course during Michaelmas term.

NP23 (based on NP03, gamma ray spectroscopy)

The high resolution semiconductor detectors used in this experiment are excelent for picking out tiny levels of natural radioactivity in samples.

In the undergraduate experiment, this is used to investigate natural radioactivity in brazil nuts. In the project, there is the opportunity to either investigate other foodstuffs or to attempt to induce radioacivity with neutrons and investigate the subsequent decay.

NP28 (based on NP08, muon lifetime)

The scintillator detectors used to measure the muon lifetime are pre-tuned before the usual 2-day experiment, however in this project you will investigate and optimise the operating points of the photomultiplier counters yourself to find the best opertating point for measuring the muon lifetime.

NP29 (based on NP09, X-rays)

A 57-Cobalt gamma ray source can be used to induce X-ray emission and other activity when the gamma rays scatter off material. In the two-day practical, this is used to study X-ray emission from elements. Is it possible to use these effects to make a crude distinction between a light material or a heavy material which is concealed from view? In the project, we can use the high-resolution detectors which we have available to investigate the effects that a simpler, cheaper detector would observe, and how well it could be used to reveal the characteristics of concealed objects.

Supervisor : ***Dr G Barr*** Physics Tel No : ***273446***
Email : ***g.barr1@physics.ox.ac.uk***

* some of these projects may be withdrawn, subject to the demand on apparatus or equipment as both MPhys and BA projects are in the same term.

Physics projects

AS01B **Measuring the Distance to Globular Clusters using RR Lyrae Variables**

RR Lyrae variables are periodic variable stars slightly more massive than the Sun. The pulsate roughly once per day, but the exact period of pulsation is related to their mass and therefore there intrinsic brightness. Measuring the period of pulsation therefore gives us a method to measure the distance to these stars. RR Lyraes have played an important role in establishing the cosmic distance ladder through our galaxy and its neighbours. In particular, they are key to establishing the distances to the globular clusters in our galaxy.

In this BA project you will analyse data of at least one globular cluster to identify and measure RR Lyraes. You will then find the periods of the variables and put these on the period-luminosity relationship for RR Lyraes. You will then compare the observed brightness of the variables with the instrinsic brightness to calculate the distance to the globular cluster. If time permits, more than one cluster could be analysed.

The data have been previously obtained with the Philip Wetton telescope here in Oxford -- the project will not require you to use the telescope yourself, and won't be affected by adverse weather. You will use common professional astronomical software to analyse the images and measure the variables. Some previous familiarity with Unix/MacOS programming would be useful, but not necessary.

Supervisor : ***Dr F Clarke*** Physics Tel No : ***283140***
Email : ***fraser.clarke@physics.ox.ac.uk***

INT01B "Will this one work, Sir?"

Many people can remember some pretty cool experiments from school e.g. dropping a magnet down a copper pipe – simple and dramatic. But we also have memories of A-level physics lessons where the practical didn't work, or didn't seem related to the theory discussed previously. Your challenge is to try out and evaluate experiments in an area of physics.

For your project, you will be expected to do the following:

✓ Choose a suitable topic to investigate e.g.

• Demonstrating weightlessness
• Measuring g
• Demonstrating simple harmonic motion
• Using slinky springs

✓ Research the range of experiments available in this area.

✓ Try out as many different experimental set-ups as possible and take some measurements.

✓ Evaluate each set-up – how easy is it to get it to work? How reliable and accurate are the measurements? Which do you think would be the best one for physics teachers to use?

✓Your report must include a detailed explanation of the physics being demonstrated.

.Supervisor: ***Dr J Hillier***
Email: ***judith.hillier@education.ox.ac.uk***

BA literature projects

LR01: The Sunyaev-Zel'dovich effect

The largest clusters of galaxies have a total mass of up to 10^15 solar masses, which consists primarily of dark matter, a small part of intergalactic plasma, and only a tiny fraction of the total mass making up the galaxies themselves. The plasma, sitting in the deep potential well defined by the total mass, can reach temperatures of tens of millions of kelvin. This hot plasma interacts with cold photons of the Cosmic Microwave Background (CMB) by inverse-Compton scattering, with several observational consequences.

This process was first proposed by Sunyaev and Zel'dovich in the late 1960s, shortly after the discovery of the CMB, and was first imaged in the mid-1990's with sensitive radio telescopes. The purpose of this report is to describe the physics of the SZ effect and to review the observational results to date, summarizing the conclusions that have been made about the properties of galaxy clusters and the expansion of the Universe.

Introductory reading: see http://astro.uchicago.edu/sza/primer.html

Supervisor: ***Dr G Cotter*** Physics Tel No: ***273604***
Email: ***garret@astro.ox.ac.uk***

LR02: The Cherenkov Telescope Array

Very high-energy gamma rays (energies up to 10^15 eV) are produced by extreme physical conditions in astrophysical objects such as quasars, pulsars and supernova remnants. Observations of these gamma rays helps us model the relativistic jets and high-energy particle acceleration mechanisms in these objects.

To make these observations we look for the radiation emitted by the shower of secondary particles created when a gamma ray sticks an atomic nucleus high in the Earth's atmosphere. As the charged particles pass through the air at a speed faster than the speed of light in air, they emit radiation analogous to the sonic boom of an object travelling faster than the sound speed. This flash of Cherenkov radiation can be detected by large ground-based telescopes.

The next generation Cherenkov telescope is the Cherenkov Telescope Array (CTA), a global project of which Oxford is a member, to build an array of up to one hundred individual telescopes with a combined increase in sensitivity, resolution and survey speed of orders of magnitude ahead of the present generation of instruments. The purpose of this report is to review the history of Cherenkov astronomy and the astrophysics of very high-energy gamma rays and to describe the design and scientific prospects for the CTA.

Introductory reading: see http://www.cta-observatory.org/

Supervisor: ***Dr G Cotter*** Physics Tel No: ***273604***
Email: ***garret@astro.ox.ac.uk***

**LR03* tbc

Supervisors: ***Prof C Foot*** Physics Tel No: ***272256***
Email: ***c.foot1@physics.ox.ac.uk***

LR04 Quantum mechanics and cryptography

Quantum computing threatens to destroy many current cryptographic schemes, while quantum cryptography seems to offer the promise of unbreakable security. What is the future of cryptography in a world filled with quantum information technology?

References: Reviews of Modern Physics 74, 145 (2002);

Ross Anderson, Security Engineering, chapter 5

Supervisor : ***Prof J Jones*** Physics Tel No : ***272247***
Email : ***jonathan.jones@qubit.org***

LR05 Extrasolar planets

The last decade has witnessed the detection of over 350 exosolar planets, while satellites are currently monitoring thousands of stars to detect the effects of planets as they pass in front of their parent stars. The properties of the planets detected to date have challenged our understanding of planetary formation and will shed new light on our own solar system.

Supervisor : ***Prof P Roche*** Physics Tel No : ***273338***
Email : ***p.roche1@physics.ox.ac.uk***

LR06 Reversible computation

A computer could be viewed as an extremely expensive and complicated device for turning electrical energy into waste heat. Reversible computing offers the theoretical possibility of greatly reducing this waste. How far could we push this approach? And could we actually build one?

References: Feynman Lectures on Computation

Supervisor : ***Prof J Jones*** Physics Tel No : ***272247***
Email : ***jonathan.jones@qubit.org***

LR07 The Challenges and Promise of Nuclear Fusion for Our Energy Needs

Nuclear fusion offers the prospect of relatively clean and limitless energy at a time when our future energy reserves from sources such as fossil fuels are running out. However, despite nearly 50 years of research and $20 billion spent on investigating the promise and viability of nuclear fusion, we still do not have a working practical nuclear reactor to produce electrical power. With a new nuclear reactor prototype called ITER approved for construction by an international consortium including the UK, what are the challenges to and what is the promise for nuclear fusion research finally coming to fruition in the foreseeable future?

Supervisor: ***Dr J Ashbourn*** Tel No: ***278490***
Email: ***j.ashbourn1@physics.ox.ac.uk***

LR08 The influence of feedback from active galactic nuclei on galaxy formationc

More details from the supervisor.

Supervisor ***: Dr C Lintott*** Physics Tel No ***: 273638***
Email ***: cjl@astro.ox.ac.uk***

LR09 **Possible Solutions to the Solar Coronal Heating Problem**

The Sun's atmosphere consists of a series of layers, the surface of the Sun being at around 6000 degrees whilst the outermost layer called the solar corona is at a temperature of more than 1 million degrees. Despite this remarkable phenomenon having been discovered nearly 70 years ago, scientists still do not have a conclusive theory for why the solar corona is so much hotter than the Sun's surface. What is the latest research on possible mechanisms for the solar coronal heating problem and which are the most plausible candidates for a convincing theory?

Supervisor: ***Dr J Ashbourn*** Tel No: ***278490***
Email: ***j.ashbourn1@physics.ox.ac.uk***

LR10 &11 **Supermassive black holes**

The report will review the current state of knowledge of the occurrence and observational phenomena associated with supermassive (more than one million solar masses) black holes.

Supervisor : ***Prof L Miller*** Physics Tel No : ***273342***
Email : ***l.miller1@physics.ox.ac.uk***

LR12 **Rotary Molecular Motors**

Nature has invented the wheel at least 3 times. The bacterial flagellar motor is 50 nm across and spins at up to 1000 revs per second, driven by a current of ions across the membranes that surround living bacteria. Creationists believe it could not have evolved. Two more rotary molecular motors are found in ATP synthase, the molecule that makes most of the "energy currency of the cell", ATP. This report will focus on how these motors work, and how we know about them.

Supervisor : ***Dr R Berry*** Physics Tel No : ***272288***
Email : ***r.berry1@physics.ox***.

LR13 **Single-Molecule Biology**

Single molecules are no longer abstract concepts. Biophysicists now conduct a wide range of experiments that look at one molecule at a time, and watch it performing complicated biological functions. This report will allow you to discover these techniques and focus on why they are important, how they work and what they have told us about how to make machines on the nanometre scale.

Supervisor : ***Dr R Berry*** Physics Tel No : ***272288***
Email : ***r.berry1@physics.ox***.

LR14 **Exosolar Planets**

We presently live in a golden age for the discoveries of exosolar planets around stars like the Sun. Two current space missions (Kepler and CoRoT) are discovering 100s of new planets and planetary systems, ranging from Earth mass to brown-dwarf mass, including many exotic systems. The purpose of this report is to survey our present knowledge of exosolar planets, discovered by these space-based and other Earth-based surveys, summarize our physical understanding for the formation of the various types of planets and planetary systems, and to identify key open questions for planet-formation theories.

Supervisor : ***Prof P Podsiadlowski***
Physics Tel No : ***273343***
Email : ***podsi@astro.ox.ac.uk***

LR15 **Intermediate-mass black holes**

There is compelling observational evidence for two types of black holes in the universe. Stellar-mass black holes have long been anticipated as the endproducts of very massive stars, and have masses of order $10\,M_\odot$. Most reasonably luminous galaxies harbour a so-called "supermassive" black hole with mass in the range 10^6 to $10^9\,M_\odot$ whose origin remains a mystery.

In addition to these two reasonably well-established classes, there have been controversial claims that black holes exist with masses in the intermediate range 10^2 to $10^5\,M_\odot$, e.g., in globular clusters. The purpose of this report is to review critically both the observational evidence for such objects along with the theoretical arguments for their existence.

Supervisor ***: Dr J Magorrian*** Physics Tel No ***: 273993***
Email ***: j.magorrian@physics.ox.ac.uk***

LR16 **Formation of globular clusters**

Globular clusters are among the oldest stellar systems in the universe. They live in galaxy haloes, the largest galaxies hosting hundreds of clusters, and even the smallest dwarf galaxies hosting a few. Globulars have simple, pristine stellar poulations, which makes them ideal tracers of conditions at the time of their formation. In the past 10 years it has become widely appreciated that they provide unique constraints on how and when their host galaxies assembled.

After reviewing well-established properties of nearby globular clusters, this report will report on possible formation scenarios, with a critical comparison of theoretical models against recent observational results.

Further reading: Jean P. Brodie, Jay Strader, "Extragalactic globular clusters and galaxy formation", http://uk.arxiv.org/abs/astro-ph/0602601

Supervisor ***: Dr J Magorrian*** Physics Tel No ***: 273993***
Email ***: j.magorrian@physics.ox.ac.uk***

LR17 **Particle oscillation**

There are two entirely separate examples of how particles can change their characteristics as they move: (1) Neutrinos have been seen to change flavour as they move and (2) neutral mesons, e.g. the K0 are able to change into their antiparticles. The report has the scope to be a comprehensive guide to the different experiments which show these effects, to explain the theoretical aspects of particle mixing with some

simple(ish) quantum mechanical arguments, to contrast the two phenomena which differ in some not-so-subtle ways and to give an outlook for what other things can be done in the future, exploiting these phenomena.

Supervisor : ***Dr G Barr*** Physics Tel No : ***273446***
Email : ***g.barr1@physics.ox.ac.uk***

LR18 Joseph Rotblat and The Manhattan Project

Joseph Rotblat came to work with James Chadwick at Liverpool University in 1939 and did fundamental measurements on Uranium fission properties that demonstrated that a nuclear bomb was feasible. He joined the Manhattan Project at Los Alamos in early 1944, but walked out before the end of the year, the only scientist to do so. Rotblat's Archive is now becoming available at Churchill College Archives Centre, Cambridge. This Archive provides new Insights into his time at Los Alamos. In particular, there is a body of papers from his time at Los Alamos although, by his own account, all such papers were lost. There are also detailed Insights, from correspondence, into his relationship with Chadwick and his wife, Aileen.

Archive information is leading towards a reappraisal of some aspects of Rotblat's own accounts of key aspects of his life.

Supervisor: ***Dr M Underwood, Dr J Roche (History)* and *Prof N Jelley***
Email: ***dr.martin.underwood@hotmail.co.uk***

LR19 Joseph Rotblat and the development of nuclear physics in the UK post 1945

Joseph Rotblat joined James Chadwick's group at Liverpool University in 1939, making basic measurements on neutron interactions with uranium that helped demonstrate that the atomic bomb could be made. He joined the Manhattan Project in early 1944, leaving within the year as it became clear that Germany had abandoned efforts to produce such a weapon.

Rotblat returned to Liverpool University in early 1945. His Archive is now becoming available at Churchill Archives Centre, Churchill College, University of Cambridge. There is a body of new material that demonstrates the concern of the both James and Aileen Chadwick in his welfare and the fate of his wife (who was killed in a concentration camp) and other members of his family.

Supervisor: ***Dr M Underwood, Dr J Roche (History)*** and ***Prof N Jelley***
Email: ***dr.martin.underwood@hotmail.co.uk***

LR20 Joseph Rotblat and James Chadwick

Joseph Rotblat came to work with James Chadwick at Liverpool University in 1939 and did fundamental measurements on Uranium fission properties that demonstrated that a nuclear bomb was feasible. He joined the Manhattan Project at Los Alamos in early 1944, but walked out before the end of the year, the only scientist to do so. Rotblat's Archive is now becoming available at Churchill College Archives Centre, Cambridge. This Archive provides new insights into his time at Los Alamos. In particular, there is a body of papers from his time at Los Alamos although, by his own account, all such papers were lost. There are also detailed Insights, from correspondence, into his relationship with Chadwick and his wife, Aileen.

Archive information is leading towards a reappraisal of some aspects of Rotblat's own accounts of key aspects of his life.

Supervisor: ***Dr M Underwood, Dr J Roche (History)*** and ***Prof N Jelley***
Email: ***dr.martin.underwood@hotmail.co.uk***

LR21 Measurement of the Cosmic Microwave background Polarization

The cosmic microwave background (CMB) is an image of the universe when it was hot dense plasma 380,000 years after the Big Bang. By characterising the CMB we can learn about physical processes that operated in the early universe, long before the structure we see today formed. In particular, there is an ongoing effort to measure the

polarization of the CMB. A precise measurement of the angular polarization power spectra of the CMB will yield a collection of cosmological parameters and possibly the energy scale of inflation.

Polarization of the CMB is caused by scattering of CMB photons at the last scattering surface. The signal can be decomposed into two components; the E-mode which is generated mainly as a result of density perturbations and the B-mode signal which is generated entirely by primordial gravitational waves. While the E-mode signal has already been detected by several instruments (eg WMAP) no instrument has yet been able to detect the much weaker and yet much more interesting B-mode signal.

There are several ground-based and balloon-borne instruments that are now being constructed to make the first detection of the extremely faint B-mode polarization. This includes the USA instruments BICEP, QUIET and EBEX and Planck. Each of these instruments uses unique technology, frequency range and observation strategy

The aim of this project is to study the instrumentation and the method of measurement of the CMB polarization. The student can then compare the capabilities of the existing instruments and assess their chances of detecting the B-mode polarization.

Supervisor : ***Prof G Yassin*** Physics Tel No : ***273440***
Email : ***ghassan@astro.ox.ac.uk***
http://www-astro.physics.ox.ac.uk/research/expcosmology/

LR22 Modern bolometer detector in millimetre astronomy

I recent years there has been an intensive development of ultra-sensitive detectors in millimeter astronomy. Several types of superconducting detectors were therefore developed for a new generation of cosmology instruments that aimed at characterizing the Cosmic Microwave Background. In this report the student will investigate the principle of operation of theses detectors and compare their performances.

Supervisor : ***Prof G Yassin*** Physics Tel No : ***273440***
Email : ***ghassan@astro.ox.ac.uk***
http://www-astro.physics.ox.ac.uk/research/expcosmology/

LR23 **High energy violation of Lorentz invariance**

Lorentz invariance may reflect a low energy symmetry which is violated by quantum gravity effects at the Planck scale.

Astrophysical probes of this include anomalous dispersion in the signals from cosmologically distant gamma-ray bursts and decoherence of the quantum mechanical oscillations of high energy cosmic neutrinos. The report can be concerned with any aspect of this phenomenology.

Supervisor : ***Prof S Sarkar*** Physics Tel No : ***273962***
Email : ***s.sarkar1@physics.ox.ac.uk***

LR24 **The origin of cosmic rays**

Cosmic rays were discovered nearly a century ago but the origin of these particle remains unknown. Chief suspects are the remnants of galactic supernovae whose shock waves can accelerate particles by the Fermi mechanism. Recent advances in gamma-ray and neutrino astronomy make it likely that this long standing mystery will soon be solved. The report can be concerned with any aspect of cosmic ray phenomenology.

Supervisor : ***Prof S Sarkar*** Physics Tel No : ***273962***
Email : ***s.sarkar1@physics.ox.ac.uk***

LR25 **Eastward Deflection of a falling projectile**

One of Galileo's problems was that his faith in the rotation of the Earth was not backed up by any irrefutable evidence. One predicted effect of the Earth's rotation was the eastward deflection of a falling projectile, and such an effect was diligently searched for for several centuries, before being definitively measured in the early 20th century.

The report will

- give a physical account of the phenomenon, both in the rotating and non-rotating frame of reference
- review the historical record of attempts to measure the effect.

Requirements: the S7 Classical Mechanics short option would be an advantage.

Supervisors: ***Dr C Palmer*** Physics Tel No: ***272276***
Email: ***c.palmer1@physics.ox.ac.uk***

LR26 **Newton and the gravitational field**

Newton did not regard gravitational force as an 'attraction' by the Sun on the Earth. Indeed, he suspended judgement about the physical cause of gravity. However, he described gravity as an 'accelerative force' and as a 'certain efficacy diffused from the centre'. He also quantified this 'efficacy'.
* Study Newton's interpretation of the force of gravity.
* Examine the 18th and 19th century interpretation of gravity as an attraction at a distance.
* Study the history of 'Big G', and it impact of the formalism of gravitational theory.
*Analyse Maxwell's re-interpretation of Newton's gravitational 'accelerative force' as the 'intensity' of the gravitational 'field'
* To what extent is the interpretation of late 19th gravitational field theory derived from Newton's 'efficacy diffused' in space, or from an analogy with Faraday's theory of the magnetic field?
* Relevant literature will be provided, together with the methods for carrying out this research.

Supervisors: ***Dr C Palmer (Physics), Dr J Roche (History)***
Physics Tel No: ***272276***
Email: ***c.palmer1@physics.ox.ac.uk, john.roche@linacre.ox.ac.uk***

LR27 **Where is electromagnetic energy located?**

Conventionally, electromagnetic energy is located in the fields. However, since the studies of Heaviside and Lorentz, physics is uncertain whether the energy is located in the fields, or in the charges, or in the system as a whole. Although these three approaches are transformationally equivalent, they are very different formally, calculationally and in terms of physical interpretation. Your report involves the study of
* Helmholtz's and Kelvin's introduction of electromagnetic energy.
* Maxwell's theory according to which both electrostatic and magnetostatic energy is located in the fields.
* The minority tradition according to which electrostatic and magnetostatic energy is located in the charges, magnets or currents, and not in the fields.
* The criticisms by Mason, Weaver, Stratton and others of Maxwell's field location of electrostatic and magnetostatic energy.
* Feynman's theory of electrostatic energy, which criticises both the field and the charge interpretation, and supports a holistic interpretation.
* Compare these three interpretations. Which, if any, do you consider physically valid?
* To conclude, choose one of the following:
(a) How does your investigation relate to the self-energy of a charge?
(b) Can you apply an approach similar to Feynman's holistic interpretation of electrostatics to the mutual induction of two coils?
(c) How does your analysis apply to the free radiation field?
* Relevant literature will be provided, together with the methods for carrying out this research.

Supervisors: ***Dr C Palmer (Physics), Dr J Roche (History)***
Physics Tel No: ***272276***
Email: ***c.palmer1@physics.ox.ac.uk, john.roche@linacre.ox.ac.uk***

LR28 **Study the evolution of Newton's second law of motion, from classical mechanics to special relativity**

* Research Newton's original formulation of the second law.
* Research the 19th century derivative formulation, in terms of force, mass and acceleration.
* Study the second law as applied to special relativity, based on the researches of Lorentz and Abraham, and using their concept of relativistic inertia.
* Can you now formulate general expressions for Newton's second law valid for special relativity, relating it to momentum, and also relating it to force, inertia and acceleration?
* Relevant literature will be provided, together with the methods for carrying out this research.

Supervisors: ***Dr C Palmer (Physics), Dr J Roche (History)***
Physics Tel No: ***272276***
Email: ***c.palmer1@physics.ox.ac.uk, john.roche@linacre.ox.ac.uk***

An example of typsetting a project report

INT68: A Project Report

Supervisor: Professor A. Lecturer

Candidate Number: 76694

Word Count: 5452

The Abstract will provide a short summary of your work to enable others to judge quickly if it covers material which they consider important or are otherwise interested in reading.

This documents explains what the Examiners will look for in your project report, and how it should be written.

Introduction

The projects on offer inevitably differ greatly in their scientific potential, and any genuine research project can simply fail to work out: research is about probing the unknown, so unpleasant surprises can be encountered. Consequently, the Examiners cannot base their assessment of your report on the quality of the science that you do in your project. Rather they will assess the efforts you made to come to grips with a scientific problem, and the clarity and completeness of your exposition of the problem and what you have learned from it. It is through reading your report that they will make this assessment, so understanding that is not apparent in the report will gain you no credit. You must therefore strive to make the report the clearest piece of scientific writing possible.

Target audience

When writing it is always important to know what audience you are trying to reach. Your report should be aimed at a physicist who has not worked in the area of your project. For example, if your project is about high-energy physics, imagine that your reader works on laser physics, if your project is in condensed-matter physics, imagine that your reader is an astrophysicist. You won't go far wrong if you imagine that your report is being read by one of your abler contemporaries.

The genre

Although different fields and journals have slightly different styles, scientific papers nearly always conform to the following pattern. The Introduction describes the background to the problem that the paper addresses: what the problem is, how it came to the attention of the community, why the problem is interesting, what significant work has been done on it, and what questions remain open. Finally, the Introduction says how the paper advances the field and explains the paper's layout. The sections that follow describe, in order, methods, data, results and their interpretation. The final section starts by summarizing the paper's achievements and goes on to speculate on their significance for the wider field, and to indicate what further work would be profitable. The concluding section is invariably followed by a list of references, after which there may be one or more appendices, to which important but tedious details, or peripheral results, are relegated. The Abstract and figures are the most important parts of a paper, as they are the only parts many readers of a paper will look at. They help to draw readers in to the other sections. If the Abstract and figures are interesting, one often scans the Introduction, paying particular attention to the last part, and then moves to the first part of the Conclusions. The middle sections are often only read much later, if at all. Your report should be structured like a paper. Go into the RSL or online and browse through some journals such as *Physical Review Letters*, or *Monthly Notices of the Royal Astronomical Society* and study the structure of a few papers. Be aware, however, that many papers are targeted at quite narrow audiences so they tend to have much shorter Introductions than your report will require; the acid test is, will your target readership understand what the problem is, and why it's worth addressing? At the end of this document we list some classic, highly cited papers that are worth analyzing from a structural viewpoint.

Figures

You should take great care choosing and structuring your figures. They are the most memorable part of a paper, and the best help a paper can have to become a highly cited paper - the holy grail of scientific life - is to contain figures that reviewers choose to show at meetings and colloquia. Things to think about include: can I combine these two figures into one? is this figure too busy? are all the lines and data points clearly labelled? is the figure big enough? would the labels on the axes be clearly visible from the back of a lecture theatre when the figure was shown by a reviewer? would plotting the data in an entirely different way make a stronger impact?

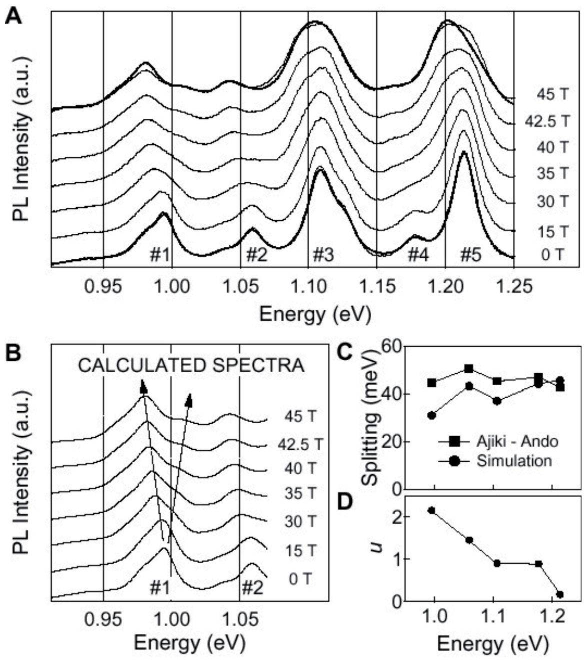

Figure 1: A complex figure which displays a substantial amount of information quite efficiently, but requires a long and well organised figure caption (Zaric et al., Science, **304** 5674 (2004)).

Citations

Statements about prior work and results used must be supported by references to a bibliography, and the sources of any borrowed figures or tables must be cited. Acknowledgment of sources will protect you from a charge of plagiarism, which the Proctors consider a serious offence.

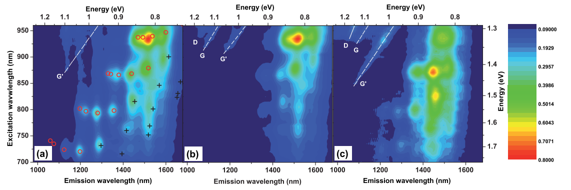

Figure 2: An overcomplicated figure which has been reduced to such an extent that it is no longer useful.

Page-limit

Scientists more often than not write to a restrictive page limit - for example Letters journals generally restrict papers to 3 - 5 pages, and the Case for Support in a research grant application is often of similar length even though it is asking for well over £100k of funding. Imposing a tight page limit not only saves paper and readers' time, but can also increase clarity by forcing the writer to focus on the key points and to present only the key data. Since the restriction is one of overall space, the writer is forced to consider the relative benefits of a figure, or a paragraph of text, or a table. The word limit for a BA report is **6000** words, excluding captions for diagrams. The bibliography and appendices are **NOT** included in the word count. Students should be aware that the Examiners will not normally read them. The report must be printed on A4 paper. You may use any word-processing package, but the LaTeX documentclass "proc" used in the document Typesetting a Report conforms to these when the report is approximately 10 pages long.

Assessment

The forms used to grade reports is published at http://www.physics.ox.ac.uk/teach/exammatters.htm

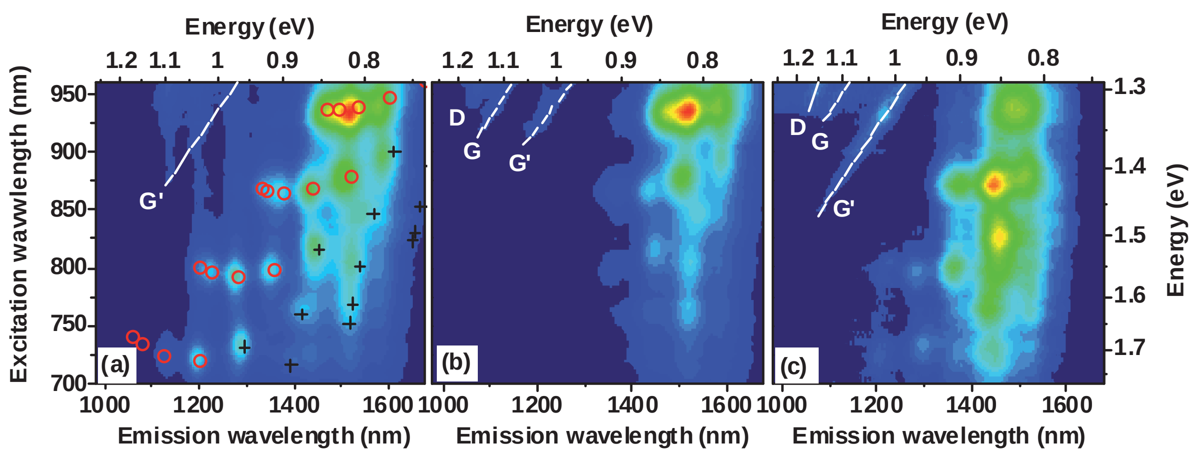

Figure 3: An improved version of Figure 2 which allows you to present a large amount of complex data in a relatively small area. Such a figure will need a substantial amount of explanation in both the figure caption and the text and would be almost meaningless if printed out on a black and white printer.

References

Some classic papers.

1) Bachilo, S.M, Strano, M.S., et al., 2002, *Structure-Assigned Optical Spectra of Single-Walled Carbon Nanotubes*, Science, 298, 2361

2) Davies, R.L., Efstathiou, G., Fall, S.M., Illingworth, G., & Schechter, P.L., 1983, *The Kinematic Properties of Faint Elliptical Galaxies*, ApJ, 266, 41.

3) Guth, A., 1980, *Inflationary Universe* ...., Phys.Rev.D, 23, 347

4) Press, W.H. & Schechter, P., 1973, *Formation of Galaxies* ...., ApJ, 187, 425

Check list for resources

This checklist should be used to document that you have searched **scientific sources** of information for your research project.

--PROJECT TITLE:
CANDIDATE NUMBER:
DATE:

RESEARCHING FOR YOUR PROJECT OR DISSERTATION

SEARCH CHECKLIST

Resource name	Period of time searched	Searched, Not searched, N/A	Search Results No of references
Core databases			
INSPEC			
Compendex EI (Engineering Index)			
Additional databases			
Chemical Abstracts –			
High Technology Research			
Solid State and Super-conductivity Abstracts (CSA)			
Energy Citations Database			
Geobase			
MathSciNet			
Metadex (CSA)			
Scopus – Elsevier Service			
Web of Knowledge –			
Electronic journals			
Oxford University e-journals			
DOAJ			
ArXiv.org			
ZETOC			
Dissertations			
Dissertation Abstracts Online			
Index to Theses			
Library Catalogues			
Internet Gateways			
AstroWeb			
Intute Physics Gateway			
High Energy Physics			

This checklist should be used to document that you have searched **scientific sources** of information for your research project.

Physics Web			
The PubChem Project-NCBI			
NIST National Institute for Standards and Technology			
PhysMathCentral			
Other sources			

SEARCH STRATEGY

Please provide the search strategy you used to search bibliographic databases. Describe your research topic using subject headings, controlled vocabulary terms, index terms, CAS number, and keywords.

No	***List of Keywords***	***Combined*** ***Not combined*** ***N/A***
1		
2		
3		
4		

Indicate how you combined keywords into a search strategy
(e.g using Boolean Operators AND, OR, NOT).

KEEPING YOUR REFERENCES

Indicate the method you used to keep your references:

Display			
Save			
E-mail			
Export to	RefWorks:	ENdNoteWeb:	EndNote:

Additional information:

Please use this space to describe inclusion or exclusion criteria you used when selecting articles for your bibliography; any observations related to type of publications, number of retrieved references, quality of research articles;

Examples of Front pages of BA Laboratory Project Reports

Example 1:

SS99: Paramagnetic Resonance of Embedded Hydrogen

Supervisor: [redacted]

Word count: 4431

Candidate number: [redacted]

The electron spin resonance of hydrogen atoms embedded in an interstitial position in a CaF_2 lattice is investigated. The absorption lines in the ESR spectra are assigned to various fluorine ion configurations. The following hyperfine parameters are obtained for the embedded hydrogen atoms: g=2.0149±0.0012 and A=1480±12.2 MHz. The electron-fluorine interaction is one of several physical phenomena that are sensitive to the spatial extent of the electron wavefunction; the interaction energy is found to be an order of magnitude larger than that predicted by the point-ion model of an ionic solid, thereby illustrating the limitations of the model.

1 Introduction

The interaction between the spin magnetic moment of an electron and an external magnetic field leads to splitting of the electron energy levels. In electron spin resonance (ESR) a perturbing signal excites transitions between these energy levels. Experimental details are considered in section 2, including the main elements of the ESR spectrometer that was used and aspects of sample preparation. The magnetic interaction between the unpaired hydrogen electron and the surrounding fluorine ions is found to be well-resolved in the spectra presented in section 3. The spectra obtained illustrate well the power of the ESR technique. The discussion in section 4 treats the following aspects in detail: (i) qualitative assignment of the absorption lines; (ii) determination of the modified hydrogen hyperfine parameters; (iii) quantitative comparison with the point-ion model. Conclusions are presented in section 5.

The ESR technique has a wide range of applications in physical and biological science: in the detection and identification of free radicals, for example. In recent decades considerable effort has been devoted to the application of ESR in studying the progress of chemical reactions involving free radicals.[1]

2 Experimental details

2.1 The EPR spectrometer

The sample was located in a microwave cavity situated in the pole gap of an electromagnet which produced fields up to 0.7T. A Gunn diode provided microwave radiation at a frequency locked to the centre of the cavity resonance.[2] Microwave power was absorbed by the sample when the microwave frequency corresponded to the Zeeman splitting in the sample. This resonant absorption produced a drop in the microwave power falling on a diode detector, consisting of a tungsten wire on a silicon crystal diode.[3] Less current was rectified by the detector; the resulting reduction in the voltage and hence the current across the junction constituted the ESR signal.

The diode detector is relatively noisy at low frequencies due to 1/f noise.[4] To minimise this noise a small amplitude, high-frequency (115 kHz) modulation was imposed on the magnetic field by wires protruding into the cavity. The signal information was carried at the higher frequency, allowing the low frequency noise to be filtered out.[5] The modulation also meant that it was the first derivative of

Example 2

NP23: Induced Radioactivity using a Neutron Source

Supervisor: [redacted]
Candidate Number [redacted]
Word Count: 4588

Abstract

This experiment investigates neutron capture of various materials, but predominately focuses on indium 115 and its subsequent beta decay. In particular the half life of the decay is calculated, along with the relative intensities of the gamma rays released. A moderator was used increase the capture cross section.

1 Background of Problem

The university has long had a very powerful 93GBq Americium-Beryllium [Am-Be] neutron source. This was used by undergraduates in their practical experiments to neutron activate silver which would beta decay to an excited state of palladium with the half life being 248 days. The excited state of palladium would then decay rapidly to the ground state though the emission of gamma rays. The energies of the gamma rays would then be measured in a lithium doped germanium [Ge(Li)] semi-conductor detector, enabling the calculation of the energies of the excited states of palladium along with the branching ratios of the gamma decays.

The long half life of the silver posed some problems: Firstly it would remain radioactive for a long period of time, and would have to be handled in a safe manner, records of its usage kept, and stored under lock and key; secondly the amount of radiation released during the duration of the undergraduate practical would only be a small percentage of the total released.

It was known that indium metal could be neutron activated to an excited state, which would beta decay to tin with a half life of 54 minutes, but this had not been done before using the university's neutron source. This would be more useful in the undergraduate practical, as most of the induced radiation would be released during the practical, and all remaining radiation would drop to background rates within a few days.

The 93GBq source was removed last year and a 370kBq Am-Be source replaced it. This releases neutrons at about 1/250000 the rate of the old source, and it was assumed that it would not be powerful enough to neutron activate indium sufficiently to produce results that would be detectable, and statistically significant by gamma ray spectroscopy.

The 93GBq Am-Be source had been housed in a stainless steel container inside a locked bunker. Due to the large neutron flux there was concern as to whether any of the surrounding materials of the container and the concrete bunker would be neutron activated, and become radioactive to the level that would be unsafe for human exposure. If these radioactive elements had long-half lives, the storage room could be unsuitable for people to enter for many years.

My project was to be in two parts:

1. To investigate whether indium could be neutron activated using the university's new neutron source, and if the gamma rays released would be in sufficient quantity to be detected. This is done in section 4 and section 5.
2. To do a preliminary investigation into the levels of radioactivity in the bunker which housed the old source, and to see if any of the radioactive elements, should any were present, could be identified. This is done in section 6.

2 Theory

An americium-beryllium neutron source produces neutrons via the following interactions:

$$^{241}\text{Am} \rightarrow {}^{237}\text{Np} + \alpha \tag{1}$$

and:

$$\alpha + {}^{9}\text{Be} \rightarrow {}^{12}\text{C} + n \tag{2}$$

The half life of ^{241}Am via α decay is 432 years, so the activity of a source is approximately constant through-out its useful lifespan. About 74

Examples of Front Pages of BA Literature Report

Example 1:

LR33: The free electron model based on the Drude and Sommerfeld approximations

Supervisor: [redacted]

Candidate Number: [redacted]

Word count: 5020

This [redacted] provides a discussion of the conducting behaviour of metals in the free electron models. The successes and failures of the classical and quantum – Drude and Sommerfeld – models are explored under the application of electric fields, magnetic fields and temperature gradients.

Introduction

Until the 1900s the conducting properties of metals were not well understood. In this essay we will explore the successes and failures of the Drude and Sommerfeld free electron models with respect to the electrical conduction properties of metals. Throughout this process we will examine the behaviour of a metal bar under the application of electric and magnetic fields and temperature gradients.

Models

Drude

In 1900, Paul Drude (1; 2) proposed a classical model that described the conducting properties of metals using kinetic theory. Drude's model, later developed by Lorentz (3; 4), treats metals as an ideal gas of free electrons contained within the surface of a metal. A 'free' electron is taken to be one which is not bound to a nucleus. The model is based on the assumptions of kinetic theory (5). To paraphrase Jiles (6): the only interactions are electron-electron collisions which are instantaneous and only lead to scattering; there are no other interactions; the mean free time between collisions is a constant for a given material, τ, and thermal equilibrium is achieved through collisions. Interactions with ions within the material are accounted for by a general resistive term, $\gamma \boldsymbol{v}$, which is proportional to the electron velocity and is dependent on τ. It is also assumed that only a certain number of electrons per atom are 'free'; these are the valence electrons. Positively charged ions are made up of nuclei and remaining electrons. They are assumed to be immobile and have no interaction with the electrons beyond the frictional term. Thus the equation of motion for a free electron under this regime is given by

$$m\frac{d\boldsymbol{v}}{dt} = Applied\ Force - \gamma \boldsymbol{v} \quad [1]$$

where m is the mass of an electron, $\boldsymbol{v}$ is it's velocity and γ is the resistive term.

Example 2:

[redacted] Were most elements produced under conditions of Thermodynamic Equilibrium, or not?

Supervisor: Professor W Allison

Candidate Number: [redacted]

The abundance of some elements and their stability are demonstrably correlated (for example, Helium, Oxygen, Calcium, Carbon, Iron, Silicon). This suggests these elements were produced under conditions of thermodynamic, or statistical, equilibrium sometime in the past. In this [redacted] we will explore this further using statistical mechanics.

Introduction

We would not be here today if it was not for carbon, nitrogen, oxygen and hydrogen; our DNA is made from protein which is a mixture of these organic substances. We breathe oxygen, the haemoglobin in our blood is composed of iron. In fact, the cells of the human body consist of up to 29 elements. Indeed, there are over 100 chemical elements that we know of.

From the abundances of the five nuclei which are radioactive (232Th, 40K, 235U and 238U) we can calculate the age of the universe to be on the order of 10^9 years. It would seem that we're all the products of nuclear reactions some 10^9 years ago!

To test our thesis we must consider how elements are built-up from their common component parts (protons and neutrons) - we must identify plausible build up processes

.

Background

<u>The Neutron Capture model</u>

We can assume a simple nuclear build up process thus:

$$[A_1, Z_1] + [A_2, Z_2] \Leftrightarrow$$
$$[A_1 + A_2, Z_1 + Z_2] + \Delta(Energy)$$

Where:

1)[A,Z] represents an element or isotope defined by the atomic number 'Z' and mass number 'A'.

2) $\Delta(Energy)$ is the mass-energy corresponding to the difference in masses of the reactants and product, which manifests itself as thermal energy of the products.

For A>56 (Fe), the Coulomb barrier would prevent the fusion of charged particles to make a heavier element; a neutron-capture process (unaffected by this Coulomb barrier) therefore seems reasonable:

$$[A-1, Z] + [1,0] \Leftrightarrow [A, Z] + \Delta(Energy)$$

The neutron [1, 0] here is in thermal equilibrium with the surroundings. The rates of the forward reaction is equal to that of the backward reaction.

An element with atomic number Z+1 is created through beta decay when the addition of neutrons to [A,Z] finally make that nuclei unstable – that is, when the number of neutrons for a given number of protons goes beyond the 'valley of stability' shown below (the addition of a neutron to 18O for example, creates an unstable 19O, which in turn beta-minus decays to 19F).

Example 3:

[redacted] The emergence of classical Physics: Decoherence and quantum Darwinism

Candidate number: [redacted]

Supervisor: [redacted]

Word count: 5210

[redacted]

Abstract

An introductory account of the transition between the quantum and classical realms is presented. Issues concerning the interpretation of quantum mechanics are examined, with special attention to the process of decoherence. A possible candidate for a mechanism which provides a universal quantum framework, quantum Darwinism, is outlined.

Quantum Preliminaries

> *"Out yonder there is this huge world, which exists independently of us human beings and which stands before us like a great, eternal riddle, at least partially accessible to our inspection"* **A. Einstein** [1]

Quantum mechanics is constructed upon the concept of the state. Often denoted by Ψ, textbook quantum mechanics tells us that the state encodes all physical information that can, at least in principle, be determined by an interacting system or observer. Furthermore, observation of a quantum mechanical system may change its state. This property highlights an obvious distinction from the classical mechanical state, which is in essence no more than a list of the system's physical characteristics, such as the angular momentum or position, that is in no way determined by the observer but irrefutable and concrete. The state inhabits the mathematical realm of Hilbert space – loosely the space in which a scalar product may be defined – and can be conceived of as a kind of vector, and as such may be expressed as a linear sum over possible basis states, just as a new co-ordinate system may be chosen for Euclidean vectors,

$$|\Psi\rangle = \sum_n c_n |\phi_n\rangle . \tag{1}$$

These states are normalised and typically orthogonal, such that $\langle \Phi_m|\Psi_n\rangle = \delta_{mn}$ and the coefficients c_n, the eigenvalues, are in general complex. Basis states may be defined in terms of position, momentum, spin or any other observable property of the system. The state obeys the famous Schrödinger wave equation

$$H |\Psi\rangle = i\hbar \frac{\partial |\Psi\rangle}{\partial t}. \tag{2}$$

This dictates unitary deterministic evolution of the state, provided the system is isolated and 'unmeasured', in a so-called 'closed' system. The equation is linear, the importance of which is difficult to overstate. As such, any linear sum of two or more states is also an admissible state, in accordance with (1). However, as soon as someone, or (as will be illustrated below) *something*, determines, through the process of measurement, some physical information about the system, the super-position state undergoes what is commonly called a 'collapse'. That is, it collapses onto one of the states corresponding

Risk Assessment Form (SPECIMEN)

UNIVERSITY OF OXFORD • DEPARTMENT OF PHYSICS

HEALTH AND SAFETY FORM FOR UNDERGRADUATE PROJECTS

Name ....…... **Area/Group/Project ....…………………......**
(Please print) **(incl. room nos, if appropriate)**

Supervisor .... **Sub Dept ....…………………......**

UNDERGRADUATE PROJECT SAFETY TALK

I have either i) attended the undergraduate project safety talk, or ☐
ii) watched the video of the undergraduate project safety talk. ☐
(please tick)

Signed...................................... Date.............................

LASER SAFETY AND EYE HEALTH DECLARATION
Please complete either section A (working with lasers) or section B (not working with lasers)

(A) All potential Laser users (see Work Hazard Checklist) must complete sections Ai, Aii, and Aiii,

i) I do not suffer from diabetes or glaucoma or have any past history of eye disease, eye damage or malfunction.
(Please contact the Laser Safety Supervisor if you are unable to sign this section).

Signed...................................... Date.............................

ii) I have read and agree to follow the safety principles laid down in the publications "Safety In Universities: Notes Of Guidance, Part 2:1 Lasers, Revised 1992" and University Guidance Note S3/04 "Laser Safety" (available from your Supervisor).

Signed...................................... Date.............................

iii) I have watched the Laser safety video and have read and understood the written information that accompanied it.

Signed...................................... Date.............................

(B) I shall not be using Lasers or working in a Laser designated area during the course of my work.

Signed...................................... Date.............................

continued

DECLARATION FOR WORKING WITH (OR NEAR) MAGNETIC FIELDS

I do not have i) a heart pacemaker ii) artificial heart valves or iii) surgically implanted metallic clips or pins.
(Please contact the Physics Area Safety Officer if you are unable to sign this section).

Signed...................................... Date............................

RADIATION PROTECTION DECLARATION

Please complete either section C (working with ionising radiation) or section D (not working with ionising radiation)

(C) My work is likely to involve the use of ionising radiation (see Work Hazard Checklist).
Please inform the Senior Radiation Protection Supervisor of this, on my behalf.

Signed...................................... Date.............................

(D) I shall not be using ionising radiation or working in a designated area for ionising radiation during the course of my work.

Signed...................................... Date.............................

HEALTH AND SAFETY HANDBOOK

I have read the "Department of Physics - Health and Safety Handbook" which includes the Statement of Safety Organisation (available from your Supervisor)

Signed...................................... Date.............................

RISK ASSESSMENT DECLARATION

My Supervisor has made available to me the written Risk Assessment(s)* relating to my work in the Department of Physics.
I understand that if, at any time, I am unclear on working procedures I must consult either my Supervisor, or the Department Safety Officer or the Physics Area Safety Officer.

Signed...................................... Date.............................

* Please give details of the Risk Assessment(s) for the work activities in which you will be involved:

Risk Assessment(s) ....…………………………...............
(Reference number, Title etc.)

continued

TO THE SUPERVISOR:

1) Work Hazard Checklist: Tick the hazards and/or work activities, listed below, that are likely to give rise to significant Health and Safety risks to the named person whilst performing his or her work. You must ensure that written risk assessments are prepared for those hazards that you tick, prior to the named person commencing work, in accordance with University Policy Statement S2/ 97-revised November 1998 (Risk Assessment).
NB. Model risk assessments are available for guidance for all hazards indicated by a single asterisk. Safety supervisors or assessors are to be consulted prior to commencing work with hazards indicated with a double asterisk.

- ☐ Pressure Systems*
- ☐ Compressed Gases and Gas Cylinders*
- ☐ Electrical or Electronic Equipment*
- ☐ Liquid Refrigerants*
- ☐ Ultra Violet Lamps*
- ☐ Glassware and Sharps*
- ☐ High Magnetic Fields*

Engineering Workshops*:
- ☐ Machine Tools / Metalworking Fluids / Lifting Equipment / Manual Handling*
- ☐ Abrasive Wheels*
- ☐ Hand Tools*
- ☐ Ladders*
- ☐ Welding/Cutting*
- ☐ Lift Trucks*
- ☐ Tower Scaffolding*
- ☐ Others (specify):

Woodworking Workshops*:
- ☐ General Assessment / Machine Tools / Manual Handling*
- ☐ Others (specify):

Chemicals:
- ☐ Toxic*
- ☐ Flammable*
- ☐ Corrosive*
- ☐ Reactive/Unstable*
- ☐ General, Not Laboratory Specific, Chemical Preparations (cleaning agents etc.)*
- ☐ Paints, Resins and Glues containing Isocyanates*
- ☐ General Painting*
- ☐ Electrophoresis Equipment*
- ☐ Lasers**
- ☐ Radioactive Substances**
- ☐ Particle Accelerators**/ Neutron Sources**
- ☐ X-Ray Generators**
- ☐ Noise**
- ☐ Personal Protective Equipment**
- ☐ Manual Handling**
- ☐ Display Screen Equipment** (eg. Computers)

- ☐ NONE OF THE ABOVE
- ☐ OTHERS (specify):

continued

2) Complete the table below by listing the work hazard(s) ticked above in (1) and defining the associated risk (categorised A to D) for the named person

A Work must not be undertaken unless the Supervisor named above is present.
B Work must not be undertaken unless another member of staff, nominated by the Supervisor named above, is present.
C Work must not be started without the advice of the Supervisor named above or his/her nominee.
D Work with risks, other than A, B and C above, where it is considered essential that workers are adequately trained and competent in the procedures involved.

Identified hazard from (1)	**Risk Category A, B, C or D**	**Person supervising when B or C risk categories have been identified**

DECLARATION OF SUPERVISOR:
I believe that the circumstances under which the work will be undertaken have been properly declared. I have
a) in accordance with University Policy Statement S2/97 (revised November 1998) ensured that written risk assessments, including methods of working to minimise risks, have been prepared and made available to personnel
b) indicated the category of risk and required level of supervision
c) named the person(s), other than myself, who will immediately supervise the work of risk category type B and C
d) ensured that work of sufficiently high risk undertaken outside the Department's normal working hours has adequate risk control measures in place and that adequate numbers of personnel are available to deal with any emergency that may arise (University Policy Statement S2/97-revised November 1998), and
e) wherever the work involves lasers, added the persons name to the list of authorised users on the relevant laser record forms and ensured that he/she has signed these forms, if required, to indicate that he/she has read and understood the contained information.

Signed: .... Date: ....

PLEASE RETAIN THE COMPLETED FORM FOR YOUR INFORMATION AND SEND A COPY TO MRS D THOMASON, PHYSICS AREA SAFETY OFFICER, DENYS WILKINSON BUILDING.

h&s08.UG

Index

A

B

C

F

H

J

M

P

R

S

U

Y

Appendix A

Project Allocation: CHOICE FORM

Please make your project and or report choices. It is important that you list your choices in order of preference, 1 being the highest and 8 lowest. Each project is listed using its own unique identifier, e.g. ***AS1***.

If you wish to add any further information to assist in the allocation process please add a **brief** comment to the back of this form. **You will be contacted by e-mail if you are required to make further choices.**

Return the form to the Physics Teaching Faculty, Clarendon Laboratory
Deadline: Friday 2nd week, 3.00 pm of Michaelmas Term 2011.

Name: ....

College: ....

BA Project

1. First Choice
Project Title: ....

.... Project Number: .... Supervisor: ....

2. Second Choice

Project Title: ....

.... Project Number: .... Supervisor: ....

3. Third Choice
Project Title: ....

.... Project Number: .... Supervisor: ....

4. Fourth Choice
Project Title: ....

.... Project Number: .... Supervisor: ....

5. Fifth Choice
Project Title: ....

.... Project Number: .... Supervisor: ....

6. Sixth Choice
Project Title: ....

.... Project Number: .... Supervisor: ....

7. Seventh Choice
Project Title: ....

.... Project Number: .... Supervisor: ....

8. Eighth Choice
Project Title: ....

.... Project Number: .... Supervisor: ....

BA Project Draft Form
2011 - 2012

The completed form confirms that your supervisor has **seen a draft** of your project report

To be completed by the student:

Name of student ....

College ....

Project Number (e.g. AS1) and **Title** of Project ....

....

....

....

Signed ....

Date ....

To be completed by the Supervisor:

Supervisor ....

Signed ....

Date ....

Please return this form after both you and your supervisor have completed it to the Physics Teaching Faculty, Clarendon Laboratory.

Appendix C

FINAL HONOUR SCHOOL OF PHYSICS

DECLARATION OF AUTHORSHIP

[This certificate should be completed and placed in a sealed envelope, bearing on the outside your examination number only, addressed to the Chairman of the Examiners, Honour School of Physics and taken by hand to the Examination Schools in the High Street **Monday 12.00 noon of 1st week of Trinity Term**]

Name (in capitals): **Candidate number:**

College (in capitals): **[Supervisor/Adviser:]**

Title of [project] (in capitals):

Word count: __________

Please tick to confirm the following:

I am aware of the University's disciplinary regulations concerning conduct in examinations and, in particular, of the regulations on plagiarism. ☐

The [project] I am submitting is entirely my own work except where otherwise indicated. ☐

It has not been submitted, either wholly or substantially, for another Honour School or degree of this University, or for a degree at any other institution. ☐

I have clearly signalled the presence of quoted or paraphrased material and referenced all sources. ☐

I have acknowledged appropriately any assistance I have received in addition to that provided by my [supervisor/adviser]. ☐

I have not sought assistance from any professional agency. ☐

The report conforms to the requirements defined in the *BA Projects Handbook 2011-2012.* ☐

I have had regular meetings with my supervisor or deputy during the project period. ☐

A draft of my project has been seen by my supervisor. ☐

I am submitting my report in electronic and in hard copy. Both the electronic and hard copies of the report are identical. I agree to my work being checked using 'Turnitin' software for plagiarism and to confirm my word count.

Candidate's signature: …………………………………………….. *Date* …………………………