c³Design

MULTIDIMENSIONAL PROJECT

So often in quantum mechanics one can be overwhelmed by the mathematical rigor required for mastery of the subject; at times one can forget that it is the physical world that we are learning about, and these challenging concepts have implications that on our daily lives.

We will combat this effect by participating in student-led group projects. The focus of these projects is to demonstrate the impact and relevance of quantum mechanical effects in the everyday world of human experience—or future advances quantum mechanical effects could unlock. Below are a handful of topics groups can choose from:

- Quantum mechanics and our sun
- Quantum mechanics and plant life
- Quantum mechanics and the human body
- Quantum mechanics and everyday chemistry
- Quantum mechanics and computing
- Quantum mechanics and communications
- Quantum mechanics and the electrical grid

Other topics are of course possible—creativity is encouraged—but are only acceptable upon approval from me. Additionally, there can be no duplicate topics.

Groups will be determined on the first day of class. There will be 4 groups of 3-4 people. Topics must be chosen by the group and approved by me by 1 February. I recommend acting quickly, some topics are better than others.

There are multiple components of each project, so I suggest group members should be assigned roles and components they are responsible for. However, I further recommend all group members contribute to all components, to ensure a coherent product in the end.

Components of the projects are:

- Paper (25%)
- Presentation (25%)
- Poster (25%)
- Website (25%)

For the paper, we will use this as an opportunity to practice crafting a publication for a scholarly journal, as you will hopefully do many times as a professional scientist. Hence there is no minimum page number requirement, but instead a maximum: 4 pages total, including all text, figures, tables, bibliography. Four pages—however double column, minimal line spacing, 11 point font. I will provide you with an example that I would like you to follow. Make good use of this allowed space since it is precious - think of it as your only chance to communicate your ideas. Papers will need to convey the main points of the topic you are covering and must be professional in every way. Lastly, papers must be submitted in one of these electronic formats: .pdf, .doc, .ps. If these formats are unfamiliar to you, come see me and we can discuss. No hard copies are necessary; in fact, none will be accepted.

Similarly, the presentation component will be a chance to hone your skills at giving a talk of the style that are given at a major international conference. Most such talks are necessarily short—12 minutes maximum, with 3 minutes for questions. We will adhere to the same rules here, and I will be strict, as there are moderators at conferences. The talk must be professional in every way and should be prepared in electronic format (for example, PowerPoint, .ppt). If this software is unfamiliar to you, come see me and we can discuss. I will provide you with some example talks, good and bad, so you can see how better talks are prepared.

Poster sessions are also fairly common at conferences in the basic sciences, and so here too you will get some experience creating a scholarly poster. I will send you an example file that you can use to get an idea of what a good poster looks like. I also recommend using PowerPoint software for the poster. Groups will be expected to get the poster printed and ready for display.

Modern science is a global endeavor, so research groups must have a presence on the web to help communicate their work to colleagues around the world. Hence the final component of these projects will be to chronicle your report on a dedicated web site. The website must be completely professional in every way. It will be public, and so I will ask some scientists I collaborate with who reside off-Grounds to critique their content. Some web hosting is possible in the department although other options can be explored. More details on the hosting will follow.

This whole enterprise will culminate in late April in a “Quantum Mechanics Fair.” Guests will be invited to come and hear your talks, read your papers, evaluate your websites and examine your posters. The entire Physics Department will be invited, along with guests from across Grounds. The date and location for this event is not yet determined. It will, however, be safely in the semester, so there should be no problems with extended absences, travel, etc.

A final component is a project prospectus, which is basically a report in early March, midway to the April "Quantum Mechanics Fair," that states what progress your group has made since choosing your topic. In situations like these, it is tempting to do zero work until a week or so before the project is due. Projects executed in this way are typically unprofessional and unacceptable. Hence, we will have a halfway point "checkup" where you should report on your (hopefully frequent) group interactions, the roles each group member will be responsible for, what issues and challenges you have encountered and foresee. This prospectus, one submitted per group, is due on Friday 4 March 2011. Electronic submissions are expected to me via email.

Assessment and grading of the projects will have two facets:

1. Group component, common to all group members, determined by me. This portion is based on the overall completeness, clarity, and accuracy of your complete project. Credit will be subtracted for particularly unprofessional components. This is worth half of your project grade.
2. Individual component, determined by the other members of your group. Each group member will provide an assessment of the contributions for each other group member. These assessments will be anonymous to you but non-anonymous to me. This is done to guard against individuals who do not work as hard as their colleagues—presumably such individuals will get poor marks from their fellow group members. The point is that you are now a part of a collaboration; you have responsibilities and you must provide—or better yet, exceed—your expected contributions. This is worth half of your project grade.

This project is an important part of this class. Do not treat it lightly. I highly recommend meeting with your group regularly and working on it steadily from now until April. This is how research in the sciences is conducted—methodically over an extended period of time. You need to identify the necessary pieces, prioritize them and start pursuing them. This is how it will be in the professional world you will soon enter, in whatever discipline you ultimately choose. Now is the best time to get some practice.