

## **Modeling Motion Spring Project Information**

The last five weeks of lab time in spring quarter will be set aside for student projects. These projects will provide you with an opportunity for some independent study and a chance to explore some aspect of physics and programming in more detail than is possible in a single lab day.

Projects should include some opportunity for hands on experimental work relating to physics and for those people doing computing it should include a computer programming component. The projects are likely to be of the same level of complexity as the physics and computing labs we have done this quarter. The difference is that students will originate the ideas and design their own experiments and programs.

You may work alone or in pairs. Larger groups are inappropriate, unless the project proposal is for a big project that involves several separate experiments and computer programs that support and relate to each other. In which case your proposal should indicate who is doing which part of the experiment.

### **Examples of project ideas:**

- Motion in a viscous medium: measuring drag coefficients of spherical objects.
- Projectile distance: factors affecting the projected distance of a real projectile.
- Testing special relativity using beta decay.
- The motion of Coupled Pendulums or coupled oscillators.
- Jet Propulsion: Studying the trajectories of objects which change mass.
- Trajectories of electron beams in magnetic fields.
- The rolling motion of non spherical objects (eg eggs, or footballs).
- Dipping Faucets – the route to chaos.

### **Project Work and Time Line:**

Besides the actual lab work and programming that you do for your project you will be expected to complete the following: a tentative project idea, a formal project proposal, weekly progress reports, a final project paper and a final project presentation. The timeline and expectations for this work are given below. All of this work will be considered when assessing the success of the project.

#### **Tuesday Week 1:** Tentative project idea due

Submit a title and one or two paragraphs describing a project idea that you would like to discuss. You should describe how your idea lends itself to both computational analysis on the computer and experimental analysis in the lab. You are not committed to the idea you submit – indeed you may decide to pair up with someone who has different idea than you do. You may submit more than one tentative idea if you like.

#### **Tuesday Week 3:** Draft of project proposal due.

Submit a two to three page project proposal. The project proposal should include a title and a detailed explanation of the project. The project explanation should include the following:

1. An introduction to the project idea describing why you want to do the project and how it relates to the program themes.
2. A description of the physics experiment you propose to do in connection with your project idea. This description should include a research question and a quantitative hypotheses of the relationships between the variables you are investigating. You should also propose a method for how you will carry out the experiment. (If your project involves building something rather than conducting an experiment than you should include a labeled diagram and discuss the physical principles involved in your design)
3. A list of equipment you think you will need. This is very important, since we may need to hunt around for equipment that we do not have.
4. A description of the programming you propose to do in connection with the project idea. (if you are not enrolled in the programming part of the class this part is optional). Your description should include a general outline of what the program will do.
5. An annotated reference list of background reading you have done or propose to do to support your project. The list should be cited in the usual way (don't just list a website, but give its title, the full address, the author and the date you visited it). You should also include at least two references to physical books.

**Tuesday Week 5:** Final project proposal due:

**Tuesday Week 6:** Start your project.

Tuesday's will be dedicated to projects for the next four weeks. You should plan to use most of the day between 9 and 4 in the lab or programming. Barry, Peter and David will be around to help. On the first morning you will be gathering equipment and then conducting preliminary experiments so that in the following weeks you can refine or extend your project as needed. At the end of each lab day students must submit a progress report, indicating how much they have accomplished, how much time they spent and what their schedule is for the following week. A record of all lab work should be included in your lab notebook.

**Tuesday Week 7- 8:** Continue with your projects. Meet with Barry and David to discuss progress reports.

**Tuesday Week 9:** This will be the last official day for experimental work.

**Tuesday Week 10:** Formal project papers due.

Project papers should be five-ten pages long and should describe the experimental work you have conducted.

In the morning we will have lab clean up, then you will have a chance to prepare and practice your presentations.

**Wednesday and Thursday of Week 10:** Project presentations. You will each (either individually or in pairs) give 15 minute presentations of your work. More details will be posted closer to this time.