Physics 115B – Future Physics Introduction to the Laboratories

Along with the lecture demonstrations, the labs in Physics 115B will show you actual phenomena with the goal of establishing contact between the more abstract concepts we will study and the real world. We also wish you to be surprised, intrigued, entertained, and, sometimes, even (temporarily) confused by the behavior of everyday and, occasionally, more exotic objects. In the lab, you will get to manipulate these objects yourself and experience the phenomena not as a spectator, but as the instigator, director, and interpreter.

Materials

***You will need a bound lab notebook with quadrille (graph) paper – spiral bound is fine. You will also need a calculator. It should be a “scientific” calculator, but nothing fancy is required. Bring it to every lab.

Structure

The labs will involve material from the lectures and the homework. Often they will illustrate material already covered, but sometimes they will introduce phenomena to be covered in class later. The lab sessions will be self-contained: they will require no specific preparation beyond the usual class reading and, if done satisfactorily, no follow-up work after you leave. All your work, including the reporting you will do in your lab notebook, will be completed during the 3-hour lab period, and your lab notebooks will remain in the lab room.

Each lab will start with a short (~15 min) introduction based on the previous week’s exit questions (see below). To avoid idle time at the start of lab and to facilitate everyone finishing on-time, all students need to arrive ON-TIME to lab. This will affect your
participation grade (see below).

A writeup with guideline for a given lab will be distributed at the beginning of that lab. You will work in small groups (no more than 3), moving from one lab station to another during the course of the lab. The instructors will circulate among the groups, helping to sort out issues while answering and asking questions. Feel free to ask general as well as specific questions. For example, if you are not sure why we are studying something, ask!

We do not require formal lab writeups. You should keep your notebook the way we keep ours, as a log of your speculations, actions, observations, and conclusions. Because the notebook will be graded, it has to be coherent enough for the AI to follow, but we do not expect or want a polished presentation. **Understandable diagrams, relevant tables of data, clear calculations, and specific observations are more useful than paragraphs.** It is reasonable to call over an AI when your group thinks it is done with a lab part. He can debrief the group a bit and decide if you should pursue it further or move on.

At the end of the lab session, each person will be asked to formulate an exit question related to the general topics covered that day. This will be written on a notecard and turned in before leaving. You will be given more explicit instruction in the first lab. Filling out this card (by hand) will take about 5 minutes.

**Expectations**

- We want you to engage. Your group should be actively pursuing understanding of the physical system at hand. This means lots of hands-on manipulation and discussion.
- We want you to play and try things as a way to explore the behavior of objects. Briefly describe any play that leads to deeper a understanding in your notebook.
- As a member of your group, you should take an active part in
all aspects of the lab. You should ask questions as well as try to answer them. You should suggest directions to pursue. *Part of your lab grade will be based on participation.*

- The lab writeups will often ask you specific questions. Answering these questions is only part of what we want from you in the lab, and a lab notebook that contains only a list of the answers to the questions in the writeup is not what we are after. An example: in some labs, a station will have objects with unexpected properties or behavior. The writeup may list some specific questions, or it may just suggest that you play with them. In any case, your notebook should contain more: *What is odd about the behavior? Does it appear to violate any physical law? How might the observations be reconciled with the laws of physics?*

### Grading

The AI’s will grade your lab notebook after each lab. We use a 5 point scale for grading. The grade will have two parts: notebook (3pts) and participation (2pts).

- **Notebook:** a “2” means you are doing fine, a “1” means that more effort is needed, and a “3” is for outstanding work that shows more than the usual effort (e.g. extra diagrams showing setup/behavior, briefly describing additional tests or observations, etc.). We expect that 3’s will be uncommon and 1’s very rare.

- **Participation:** The 2 points come from ½ *pnt for on-time arrival to lab*, ½ pnt for interacting during lab, and 1 pnt for your exit question. Any reasonable attempt at the latter two will count as full credit for that part – we do not expect you to constantly be asking questions for credit. If you will have difficulties arriving to lab on-time you should discuss this with instructor before lab that week.

Your average lab score will count as part of your Physics 115B
course grade, as described on the main Physics 115 website. Your midterm and final exams will also have questions based, directly and indirectly, on the labs. Beyond this numerical contribution to your grade, the AI’s will be asked specifically about students at the boundary between grades – if you were really engaged in the labs, we will push you up.

**Missing labs**

You must do all the labs in Physics 115B. If for any reason you must miss your regular lab session, you must do two things: (1) email Dr. Puchalla (puchalla@princeton.edu) **in advance**, and (2) make up the lab. Extracurricular sport and club conflicts are not considered valid excuses for missing a lab.

**Unless absolutely impossible, you will make up the lab during the same week at a mutually agreed time.**

In rare cases where we cannot arrange a make lab session in the same week, we will arrange a make-up as soon as possible. Though we don’t expect this to apply to any of you, if the term ends and you have any missing (not made up) labs, you will **automatically fail** Physics 115B and get no STL credit. (Sorry to put it so bluntly, but that’s what we mean by “you must do all the labs”.)