Winter 2012
UCSD: Physics 121; 2012

Course Goals

- Bestow upon you the skills you will use in practical lab settings
- Let’s say you want to participate in physics research at UCSD...
- You will be asked: what can you do?
  - program?
  - electronics?
  - mechanical design?
  - optical design?
  - vacuum systems
- What will your answer be?

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Course Content

- Mechanical Design
  - designing/machining parts, mechanical flexure
- Thermal Design
  - understanding heat flow
- Optics
  - geometrical optics/raytracing
- Vacuum and Cryogenics
  - requirements and techniques
- Analog Electronics
  - power supplies, op-amps, LEDs
- Computer Interface
  - serial, parallel ports; D/A converter, mag-swipe; C-programming

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Why should you work hard in this class?

- You can get shortchanged by going to a research university
  - professors are primarily interested in research
- How to offset: participate in research!
- But there’s a barrier: experience
- This class can provide some of this needed experience
  - but only an initial exposure
  - realistically, a one-quarter course can’t do it all
- So you win big if you put a lot in
- And aside from research, mastering these skills makes you an asset to employers
My Background

• Why is this relevant?
  – it influences the type of exposure I can offer in this course
• Amateur Astronomer (high school, mainly)
  – built telescope, did astrophotography
• Co-op student at Naval Research Lab
  – worked on lasers, optics, interfacing equipment, telescopes
  – learned to machine, use a theodolite, many optical tools
• Grad student in physics/infrared astronomy
  – built infrared spectrograph for Palomar 200-inch telescope
  • tons of machining
  • some cryogenic exposure
• Postdoc at UW
  – began building lunar laser ranging apparatus
  – diversity of optics, mechanics, electronics, thermal

Invitation to Explore

• The labs/projects will not be as "cookbook" as many you have experienced
  – partly because real experimentation is not cookbook
  – partly because the best learning comes when you write the recipe
• Allow your natural curiosity to guide you
  – if the lab inspires a question, think of ways to answer the question
  – what could you measure?; how would you measure it?
  – little side-projects may be more valuable to your learning than the "main" task at hand
  – seek help on how to explore further
• Please offer feedback: we want you to learn!

Failure mode

• The downside is that I'm trying to cram stuff I learned over years into a single quarter
• For me, learning all this stuff was a lot of fun
  – no substitute for pursuing on your own
• Within class structure, it is unlikely to be as fun for you as it was for me
  – hard to formulate a class without "cookbook" flavor
  – but this is partly up to the individual
  – and we'll try to be careful about this
• At least you'll get an intro to things that you can learn more thoroughly on your own in the future
  – and hopefully the intro will make the eventual process easier

Grading Scheme

• What's important is how much you learn: how much you understand; how much you can do
  – this is more important than the grade (really!)
• Grades based 80% on labs/projects:
  – completion, success, demonstrated verbal understanding
  – some supporting calculations accompany each project
  – write-up describing the point, the critical concepts, data/results, and what you learned from the experience
  – less structured than cookbook lab reports
  – but clear communication is very important: do a good job!
• 20% in final exam (exam is academic requirement)
• So: must stay plugged in throughout course
  – late labs (up to a week) only count HALF credit
**Course Intro**

**Resources**
- **Professor:**
  - Tom Murphy; SERF 336; 534-1844; tmurphy@physics.ucsd.edu
  - Office hours Monday 4–5 PM, or by appointment
- **Teaching Assistant:**
  - Travis Wong; tjw006@ucsd.edu
  - Office hours Mon. 10–11 AM AND Tue. 3:30–4:30 PM
- **Lab Partner:**
  - work cooperatively on lab portion
  - discuss write-up, but must be your own words/effort
  - copying text/sections will result in grading penalty
- **The Lab (MHA 3544/3574):**
  - available throughout quarter with ID card access

**Lab Access**
- The lab hours are officially 2–6 PM Wed.
  - Travis and I will be present during these times
  - Useful Intro, tips, etc. at beginning of each session
  - Previous week’s lab also due by 2PM sharp
- But you may spend as much time as you like/need to get the job done
  - please coordinate with partner, otherwise problems
- Will borrow ID cards in first lab session to establish access
- Please do not remove equipment from the lab
  - tempting as it is!
  - accidental damage/loss could cause problems

**Website**
- The course website is at:
  - http://physics.ucsd.edu/~tmurphy/phys121/
- The website resources contain:
  - course syllabus and related course info
  - lectures (PowerPoint and PDF), typically prior to class time
  - information on labs (procedures, write-ups, requirements)
    - supplemental info like datasheets, etc.

**Text**
- **Building Scientific Apparatus, 3rd or 4th edition**
  - by Moore, Davis, Coplan
  - I will specify reading assignments in both editions
- **As good a match as one might hope for this class**
  - but not perfect overlap, of course
- **Decent resource for physics experimentation**
  - a wide range of topics, and good pointers to additional resources

**Questions???