The life of a physics graduate student, or what I do

• My undergraduate thesis was on ultra high energy neutrinos in Super-Kamiokande
• The summer after graduation, I looked at the capture rate of $\mu^-$ in MiniBooNE
• I spent 9 months in Japan working on K2K (hardware, modeling neutrino/nucleon cross sections)
• Now, I’m working on MiniBooNE and a future reactor experiment called Braidwood
Part II: Graduate school

• Graduate schools look for:
  – Students with good research potential!
  – Students who are able and likely to accomplish their program

• Do you WANT to go to graduate school?
  – Research is a big thing schools look for, and is a good way to see if you want to continue in physics
  – Do research in the summer (w/ professors, REU, national lab programs)
Applying to graduate school

• **First, decide **WHEN you want to go
  – Consider taking time off, if there’s something you want to do (Peace Corps, travel, research)
  – I took off 9 months to do research and I’m very glad I did it

• **A word about deferment**
  – Some schools defer, many don’t but will admit you a second time
  – Ask for recommendations now, when people remember you
Applying to graduate school (II)

• Next, decide **WHERE** you want to apply
  – Talk to your professors about who might be good to work with, and what schools they think are good
  – Surf the web, what work/experiments interest you?
  – Contact professors who do interesting work and talk to them about it (email, phone)
  – If possible, attend colloquiums to get a feel for what’s out there.
  – Think about where you will be living as well
Applying to graduate school (III)

• **Apply to 5-8 schools** (pick 30-40% schools well known for for multiple branches of physics, and the remainder good schools in your field of interest)

• **If you find a professor you click with, apply there!** But apply to places that also have more than one topic of interest for you

• **Talk to graduate students**— are they happy with funding/health care/ life at their school? What is the average time to graduate, and how soon do students start research?

• **Another way to gauge a school is by the other admittees**— who might be your future classmates. **Are they likable?**
Fellowships

• Having a fellowship makes you attractive to graduate schools– they don’t have to pay for you
• Search the web for graduate fellowships and ask your professors if they know of any
• Some to consider:
  – National Science Foundation (NSF)
  – Hertz
  – Department of Defense
  – Department of Energy
Application

• Application parts
  – Letters of recommendation
  – Grades
  – GRE scores (general and physics tests)
  – Personal statement

• Inconsistencies in application are a red flag
• Admissions are subjective
• If interested in experiment, say so
• Specific interest can help (if they want you) or hurt (if they don’t have what you want to do)
Graduate school: the first two years

• Take classes

• Teaching assistantship/Research assistantship
  – All students are fully supported in Ph.D programs by the school or an outside fellowship
  – Tuition is waived/covered and stipend ~20,000$
  – Not the case in Master’s programs

• Research over the summer
  – Very important! Gives you a chance to try out a group and see if you like them
A word on qualifying exams

• Many schools have some kind of qualifying exam for the Ph.D program
  – Written tests on all you ever learned in physics
  – Oral exam (possibly on research interest)
  – Examples:
    • Princeton, really nasty test, no courses
    • Colorado no qualifying exam, only required courses

• It may seem scary, but don’t worry!
  – You learn a lot, especially if you study in a group
  – Most schools want you to pass (look out for schools with mandatory fail rates or high failure rates)
Choosing a research group

• What do you want to research?
  – Theory or Experiment?
  – What area of physics are you interested in?
  – Do you prefer a large or small group/collaboration?
  – Is there travel or relocation involved?

• Be open minded, you may find a new interest

• You will be working for this group for a few years, so choose a group where you can work well.
  – Talk to the older students in the group about their experiences

• For the first few months of research, set up an orientation for you in your group (e.g. a regular meeting with a senior graduate student, a journal club)
Advisors

• Choosing an advisor
  – Find someone you are comfortable with
  – Find out what they expect out of student/advisor relationship and state your expectations

• Once you find one…
  – Set aside a fixed time each week to discuss your work
  – Ask them how they want you to contact them
  – Be honest: let them know if they are doing something well, or if you are dissatisfied
Full time research

• Starts when coursework is finished (spring semester or summer after)
• First year of research is mostly non thesis
  – Experiment: hardware or software, taking shifts
  – Theorists: lots of reading
• The next 2-3 years is working on a thesis topic
  – Professors usually have ideas of what you might do, and so you work with them to pick and develop it
Summary

• A degree in physics isn’t just for physicists
  – Learn lots of useful skills (problem solving, presentation skills, computer skills, writing skills)

• When looking for a graduate school, keep an open mind, talk to lots of people, and find a school/research that fits you well

Questions? Send me an email: kendallm@phys.columbia.edu
Extra slides
List of schools (very! subjective)

• Check: US News & Reports ranking, and older site http://www.phds.org/rankings

• Competitive schools
  – Stanford, Berkley, Caltech, MIT, Harvard, UCSB, Princeton, Cornell, U Chicago, U Illinois-Urbana Champaign
  – Good schools: Columbia! Yale, UT Austin, U Michigan, U Wisconsin, U Penn, UC Santa Cruz, Colorado, Rutgers, U Washington
Tips on the GREs

• Tips for the general GRE:
  – It’s not that hard, just spend some time memorizing words and getting familiar with the exam
  – I found the Princeton Review book and CD to be quite helpful

• Tips for the physics GRE:
  – It’s a very different test than most people are used to taking, so take some time preparing
  – Best to studying using old GRE tests
  – Learn to eliminate wrong answers based on units, and to make educated guesses
Tips for letters of recommendations

– Talk to the professor you want to write face to face, and ask them what kind of recommendation they would write— you don’t want a lukewarm recommendation

– Ask for the letters 6-8 weeks ahead of time, and give them stamped, addressed envelopes and any necessary forms

– Send them a reminder email 1 month ahead of time (and have them send a “sent in” email back to you). Check with the school to make sure all letters were received.
Tips on the personal statement

• Here’s your chance to showcase yourself
  – Be concise, and specific about who you are and what you’ve done and your research interests (to be corroborated with your letters of recc)
  – Keep it to ½ a page ideally, and no more than a page
  – Have your mom/English teacher check it over for grammar, spelling errors
  – It’s acceptable to attach publications or work you contributed to significantly
Women in Physics

• There are more out there than you think, and most are happy to talk about their experiences
  – Check out: http://www.mentornet.net/
  – Or just start talking to someone!
• The number of women in physics is increasing
• Advantages: different skill sets, and people remember you better
• Personally, I have not encountered any sort of problem as a woman
What can you do with a degree in physics?

- Academic research at a university or national lab
- Industrial research
- Scientific Journalism
- Finance, statistics
- Teaching (decent salaries too!)
- Scientific policy
- Medical physics
- Forensic physics (law enforcement and investigation)
- Scientific outreach and public education