



Getting a Ph.D. AND Shaping your Career

Graduate Student: Get out as fast as possible with the most papers possible, while having as much fun possible. Get dream job.

Advisor: Publish the most and the best papers possible. If you are very good, hang around as a postdoc for a while. Get dream job.

Educator: Design program to make sure that student gets his/her dream job.

What are the dream jobs?

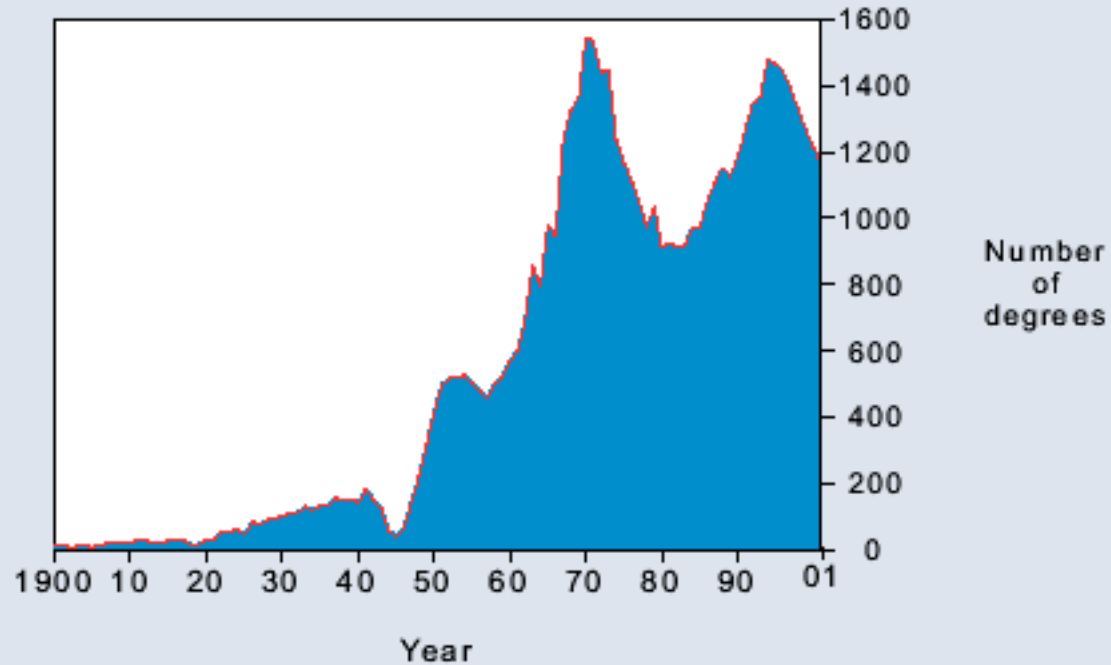
What do PhD's in physics do?

Where do they go?

How can we design our graduate program to prepare students to be more competitive?

While at the same time maintaining quality, research productivity etc.

**Number of physics PhDs conferred in the United States,
1900 to 2001.**

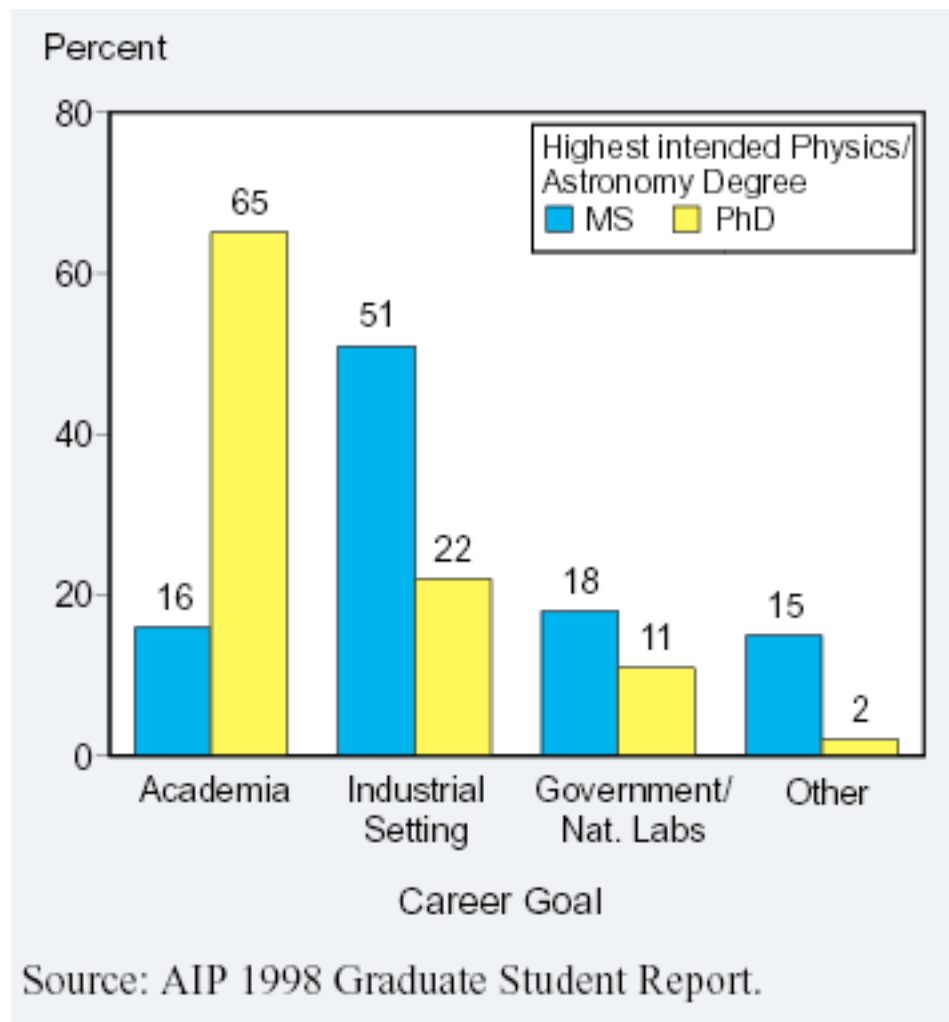


Sources: ACE (1900-1919), NAS (1920-1961), AIP (1962-2001)
AIP Statistical Research Center, Enrollments and Degrees Report.

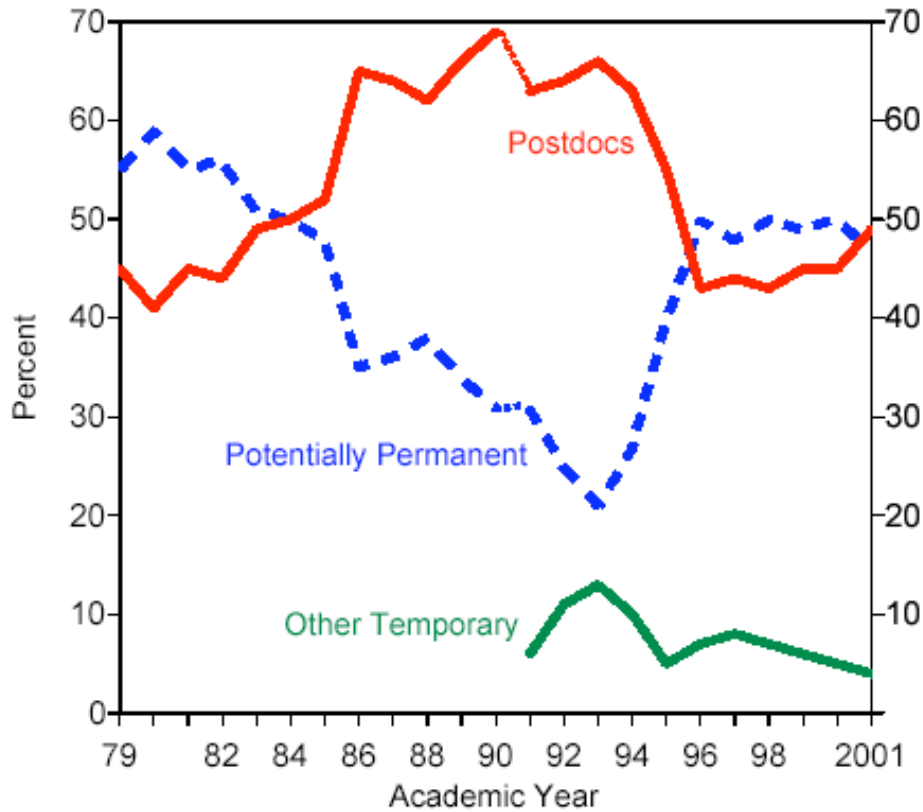
Total grad student population at CU Boulder: 205
Graduations per year \approx 30?

Career goals by intended highest degree

1st year US physics & astronomy grads students, 1997-98.

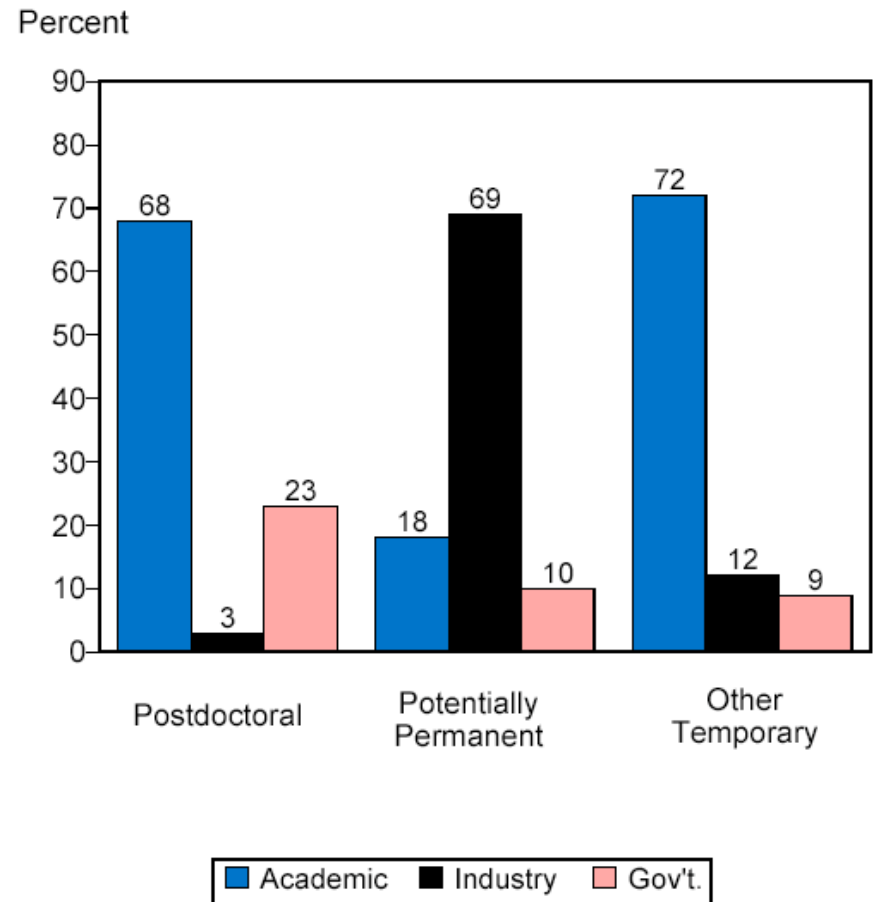


Trend Data on the Type of US Employment Secured by Physics PhDs in the Winter Following Their Degree, 1979-2001



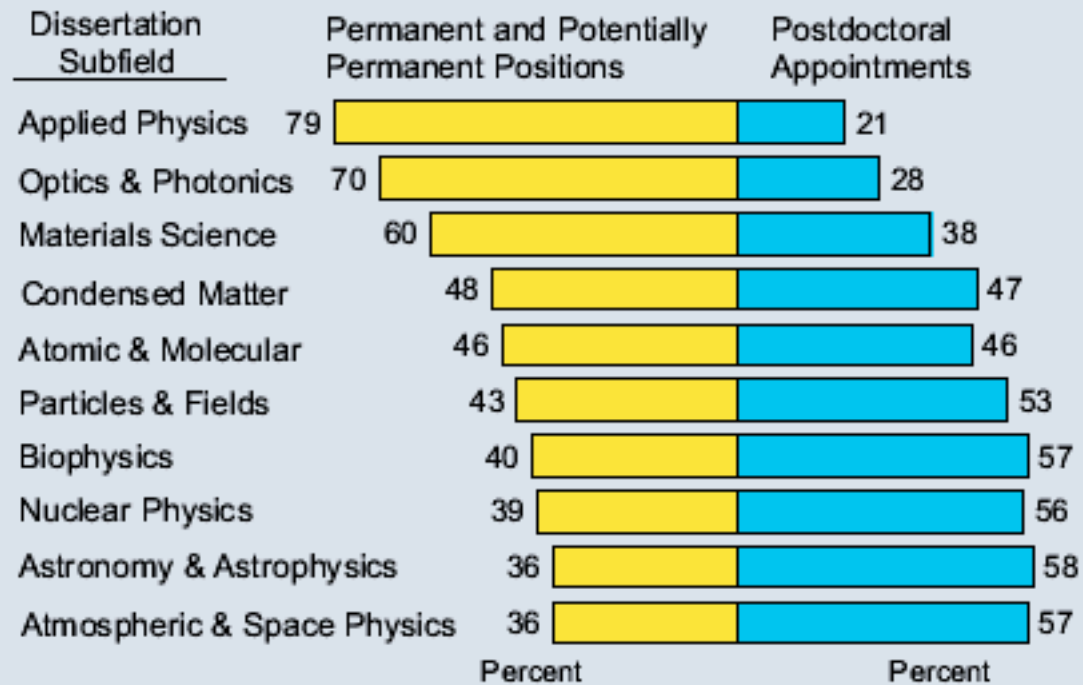
AIP Statistical Research Center, Initial Employment Survey

Employment Sector for Physics PhDs, Classes of 2000 & 2001.



AIP Statistical Research Center, Initial Employment Survey

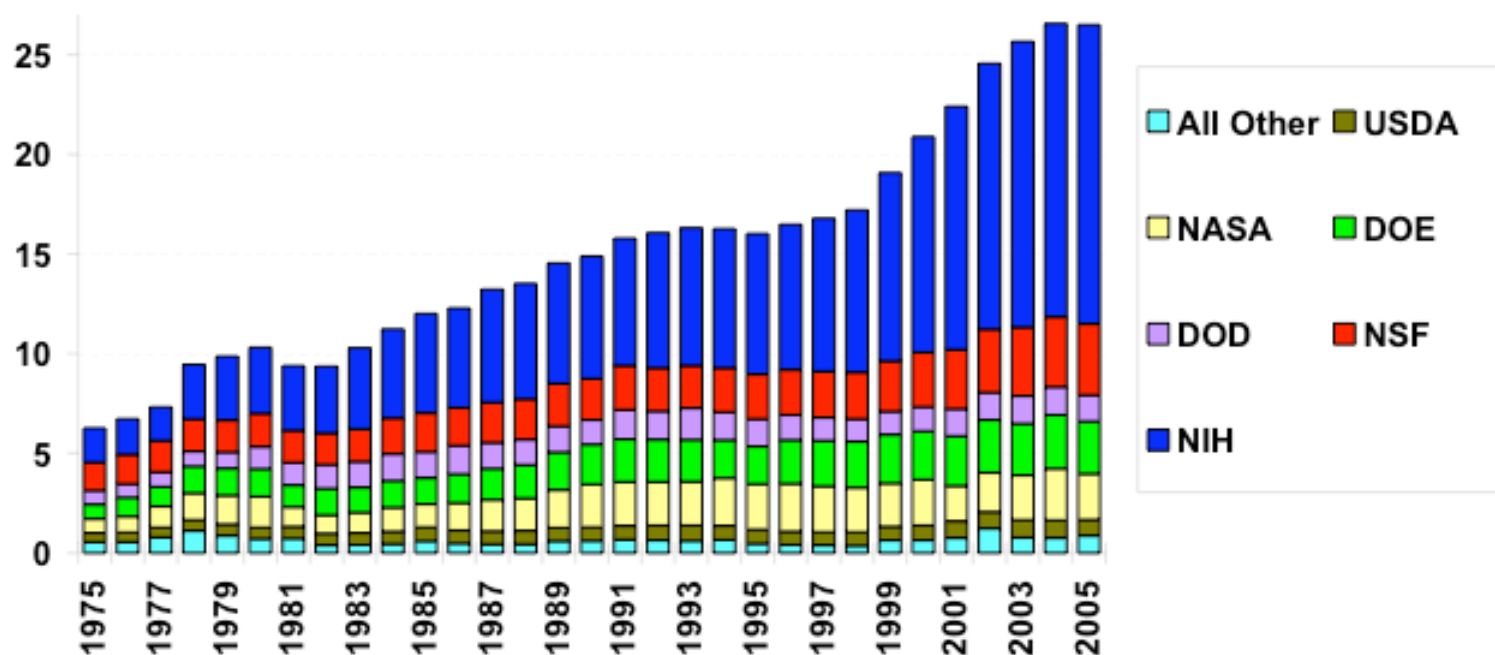
Figure 3. Initial employment of physics PhDs by subfield of dissertation, classes of 2000 & 2001.



Rows do not add to 100% since they do not include PhDs who accepted other temporary positions.

Trends in Basic Research by Agency, FY 1975-2005

in billions of constant FY 2004 dollars



Source: AAAS analyses of R&D in *AAAS Reports VIII-XXIX*. FY 2005 figures are President's request; FY 2004 figures are AAAS estimates of final FY 2004 appropriations.
 MARCH '04 REVISED © 2004 AAAS



Table 1. Departments by highest physics degree offered, academic year 2000-2001.

	Number of Depts.	Percent of Depts.
Bachelor's-granting	514	67
Master's-granting	72	9
PhD-granting	182	24
Total	768	100%

AIP Statistical Research Center, Enrollments and Degrees Report.

Table 4. Estimated Number of Physics Faculty Hired, 2002

	Type of Department				Total
	PhD	Master's	Bachelor's		
All Faculty	274	40% 71	10% 342	50%	687
Tenured and Tenure-Track	197	56% 32	9% 124	35%	353
Percent of Depts. Hiring any Faculty	72	59	45		53
Percent of Depts. Hiring Tenured and Tenure-Track	60	34	20		31

AIP Statistical Research Center: 2002 AWF Survey

Table 13. Previous Positions of New Physics Faculty, 2002*			
Type of Department			
	PhD (%)		Bachelor's (%)
Postdoc	47	Postdoc	23
Research Scientist	29	Tenured or Tenure-Track Prof.	23
Tenured or Tenure-Track Prof.	20	Visiting Prof.	15

AIP Statistical Research Center: 2002 AWF Survey

*Includes permanent non-tenured faculty at schools without tenure, and tenured and tenure-track faculty at other schools.

Table 14. Backgrounds of New Physics Faculty, 2002*

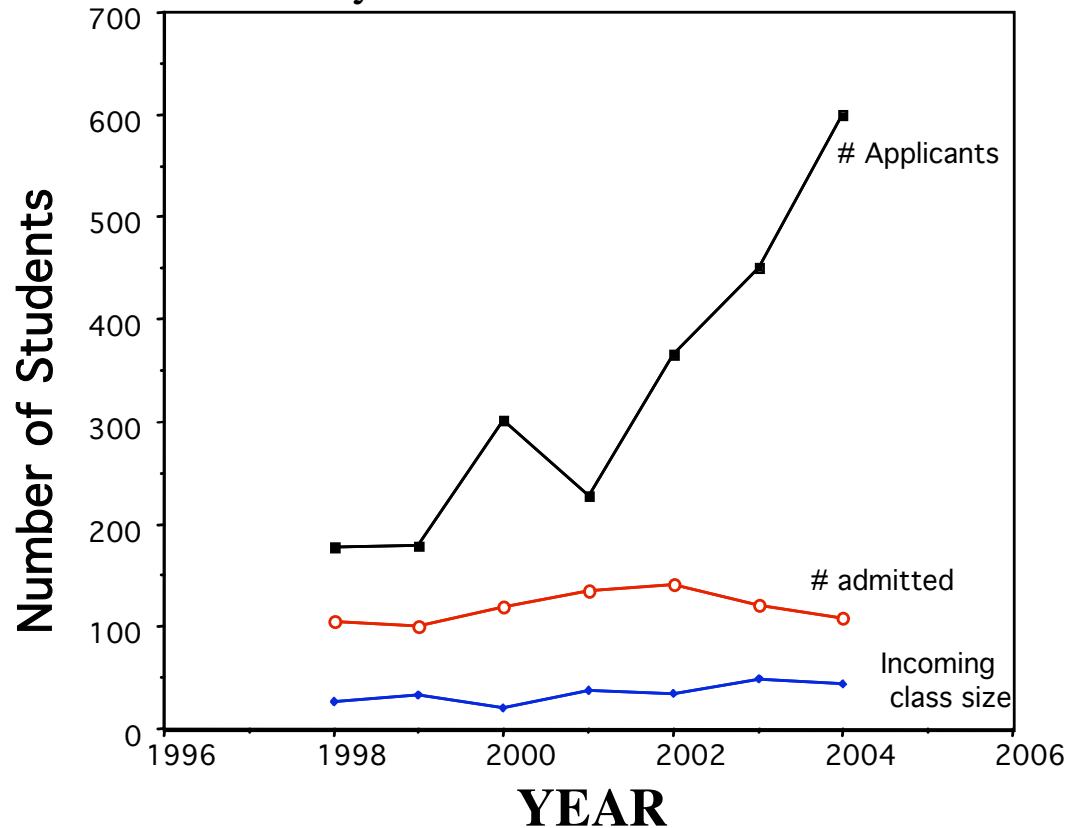
	Type of Department	
	PhD (%)	Bach (%)
Earned PhD in US within last 5 years	34	55
Earned PhD outside US, any year	30	13
Earned PhD in US > 5 years ago		
Previous Employer		
US Academic Institution	29	29
Industry, National Lab, Other	7	3

AIP Statistical Research Center: 2002 AWF Survey

*Includes permanent non-tenured faculty at schools without tenure, and tenured and tenure-track faculty at other schools.

Ph.D. in Physics at CU Boulder

- Number of applicants has tripled since 1999
- Quality and preparation has increased
- So redesigned Ph.D. program to cater to career aspirations and needs of students
- Would saturate eventually



Three Major Changes to our Program since 2000

I. Eliminated written general exams and substituted oral presentations

II. Reduced core courses from 6 to 5 as Comps 1

Classical Mechanics

Quantum Mechanics I & II

Statistical Mechanics

Electricity and Magnetism I & II

NOTE: Need additional 5 courses to complete Ph.D. degree

III. Developed Applied Physics and PER tracks

Physics Education Research

Nano and Materials Science

Biophysics

Optics


Geophysics

Plasma physics

Already have OSEP program

Benefits: CU Boulder will get you further faster.....

- Providing a comprehensive program for rapid transition to Ph.D. research - more training
- Stress area flexibility and enable interdisciplinary work (e.g. students in biophysics and geophysics can take advanced courses earlier in their Ph.D. program)
- Stress presentation and writing skills (assume students learn problem solving skills in courses and research)

Year 1	Year 2	Year 3	Year 4	Year 5
<i>Quantum Theory</i> PHYS 5250-5260 <i>Electromag. Theory</i> PHYS 7310-7320 <i>Other core courses</i> Part I of Comprehensive Examination	Selected advanced courses (total of 5 additional courses beyond core) Part II of Comprehensive Examination	 Part III of Comprehensive Examination		Thesis defense
Teaching or Ph.D. Research	Teaching or Ph.D. Research	Amazing Ph.D. Research	Amazing Ph.D. Research	Amazing Ph.D. Research

Applied Physics Certificate Program

Sample Ph.D. Curriculum in Geophysics

(NOTE: students in Geophysics can also avail of Geophysics Degree Program)

Five Core Courses

Quantum Mechanics I (Phys 5250)

Electromagnetic Theory I (Phys 7310)

Theoretical Mechanics (Phys 5210)

Earth and Planetary Physics 2 & 3 (Phys 6620, 6630)

Five courses to be selected from the following -

Quantum Mechanics II (Phys 5260)

Electromagnetic Theory II (Phys 7320)

Earth and Planetary Physics 1 (Phys 66210)

Statistical mechanics (Phys 7230)

Introductory Plasma Physics (Phys 5150)

Nonlinear dynamics (Phys 5220)

Theory of the solid state (Phys 7440)

Introduction to Fluid Dynamics (APS5400)

Computational Fluid Mechanics (ASEN5327)

Solid Mechanics (MCEN 5023)

Other graduate courses at CU including independent study

See physics web page for more details

Skills needed in any job and that we expect you to pick up along the way

- **Hard work**
- **Meeting deadlines**
- **Organization**
- **Clear writing**
- **Strong resume**
- **Public speaking**
- **Teaching**
- **Teamwork and communication skills**
- **Mentoring others and seeking mentors**
- **Smarts? We assume you are smart!**
- **Leadership**

Ph.D. Granting Professor Position

- **Hard work**
- **Meeting deadlines**
- **Organization**
- **Clear writing**
- **Strong resume**
- **Public speaking**
- **Teaching**
- **Teamwork and communication skills**
- **Mentoring others and seeking mentors**
- **Smarts? We assume you are smart!**
- **Leadership**

Bachelors Granting Professor Position

- **Hard work**
- **Meeting deadlines**
- **Organization**
- **Clear writing**
- **Strong resume**
- **Public speaking**
- **Teaching**
- **Teamwork and communication skills**
- **Mentoring others and seeking mentors**
- **Smarts? We assume you are smart!**
- **Leadership**

Small High Tech Startup

- **Hard work**
- **Meeting deadlines**
- **Organization**
- **Clear writing**
- **Strong resume**
- **Public speaking**
- **Teaching**
- **Teamwork and communication skills**
- **Mentoring others and seeking mentors**
- **Smarts? We assume you are smart!**
- **Leadership**

Develop more professional and rounded graduate environment

- **Stress skills set (like PFPP or OSEP)**
- **Improve the physics graduate handbook and web-based information**
- **Create a web-based tracking system for each student from the time of application**
- **Provide increased opportunities for graduate students and alumni to interact**
- **Annual assessment of all graduate students**
- **Providing increased leadership and feedback opportunities for students for graduate students by increasing the role of our graduate council**
- **Performe in-depth exit interviews**
- **Provide increased mentoring of junior faculty and faculty affiliates on how to be a good Ph.D. advisor**
- **Provide an increased number of informal gatherings between faculty and graduate students**

Free Advice

- **Enhance your skills (communication, organization, management, negotiation, teamwork)**
- **Broaden your education**
- **Participate in Student Organizations**
- **Take a business course (e.g. Harvard)**
- **Talk to senior students and postdocs**
- **Talk to your advisor and collaborators**
- **Work on presentation skills (attend seminars)**
- **Identify and work on your weaknesses**
- **Enjoy your work!**
- **Give us feedback**