

Secret Lives of the Hidden Physicists:

From Spandex
to Blackberries
to Bioinformatics
to Flight Control
to Wind Energy
to Radiology
to Spintronics...

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Presented at various SPS Zone meetings

SPS Zone meetings

outline

- Some definitions
- Some data
- Some examples
- An aside
- A problem

Almost like a textbook chapter...

Physicist = anyone with a physics degree: BS, BA, MS, PhD, etc.

- Why?

- Consistent with some other disciplines
- Larger group
- Common set of experiences, texts
- Critical group for academics and for research future
- Inclusive worldview is better for survival of discipline

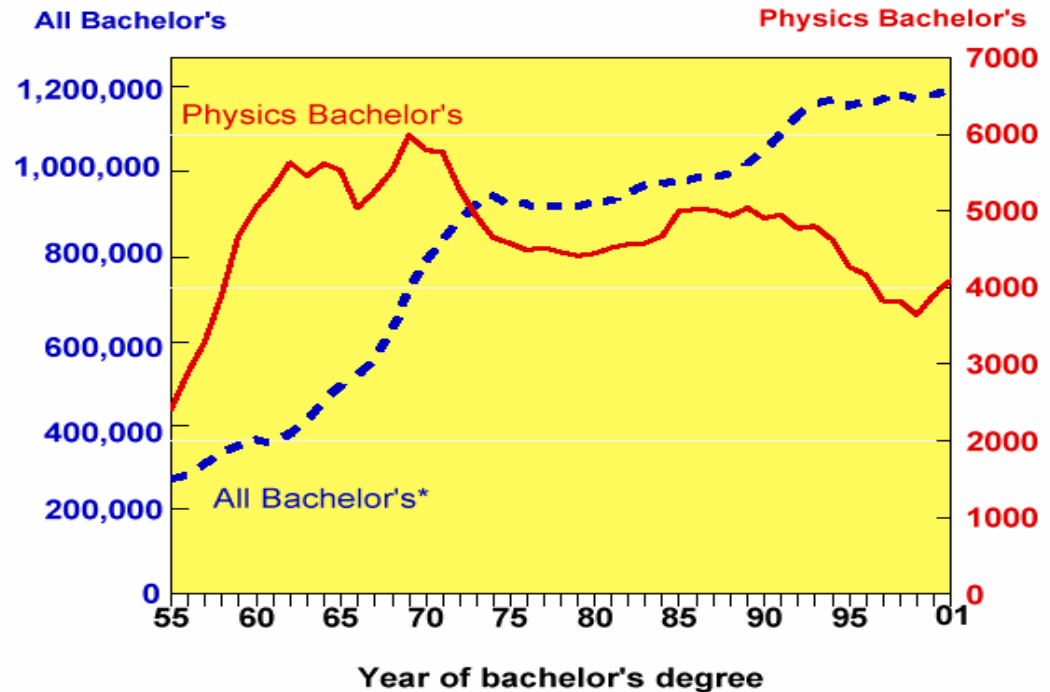
Q1) How many new physicists are produced per year per zone, on average?

a) 50 b) 200 c) 500 d) 2000 e) 5000

Physics BS (or BA) production in US

b) Average is just over 200 per zone per year

Physics bachelor's and total bachelor's produced in the US, 1955 to 2001.



AIP Statistical Research Center, Roster of Physics Departments, and
* NCES Digest of Education Statistics

Hidden physicists

- = physicists whose careers have taken them away from the “traditional” physics community
- Traditional = physics professor? or any PhD physics researcher?

(Ed Neuenschwander, editor of physics honor society $\Sigma\Pi\Sigma$'s *Radiations*, has published over 100 of these biographies)

Q2) What percentage of physicists are hidden?

a) 30 b) 45 c) 60 d) 75 e) 90

After the Bachelor's

Bachelor's only---
About 1/3 enter
the workforce
earning no
additional degree

About 1/3 get a
master's
degree after a BS
in physics

About 1/4 get PhD,
about 60% of these in
physics

Others include Eng., Math,
Chem., Geo.

Most of remainder get MD, JD

e) So about 90% are hidden

Adapted from Roman Czujko---AIP Statistics,
"The Physics Bachelor's as a passport into the
workplace"

Q3) Who hires the most Bachelor's?

- A) high schools
- B) military/government
- C) industry
- D) colleges
- E) other

Employer Distribution for BS

Industry-60%

High school
Military/government
College/Other

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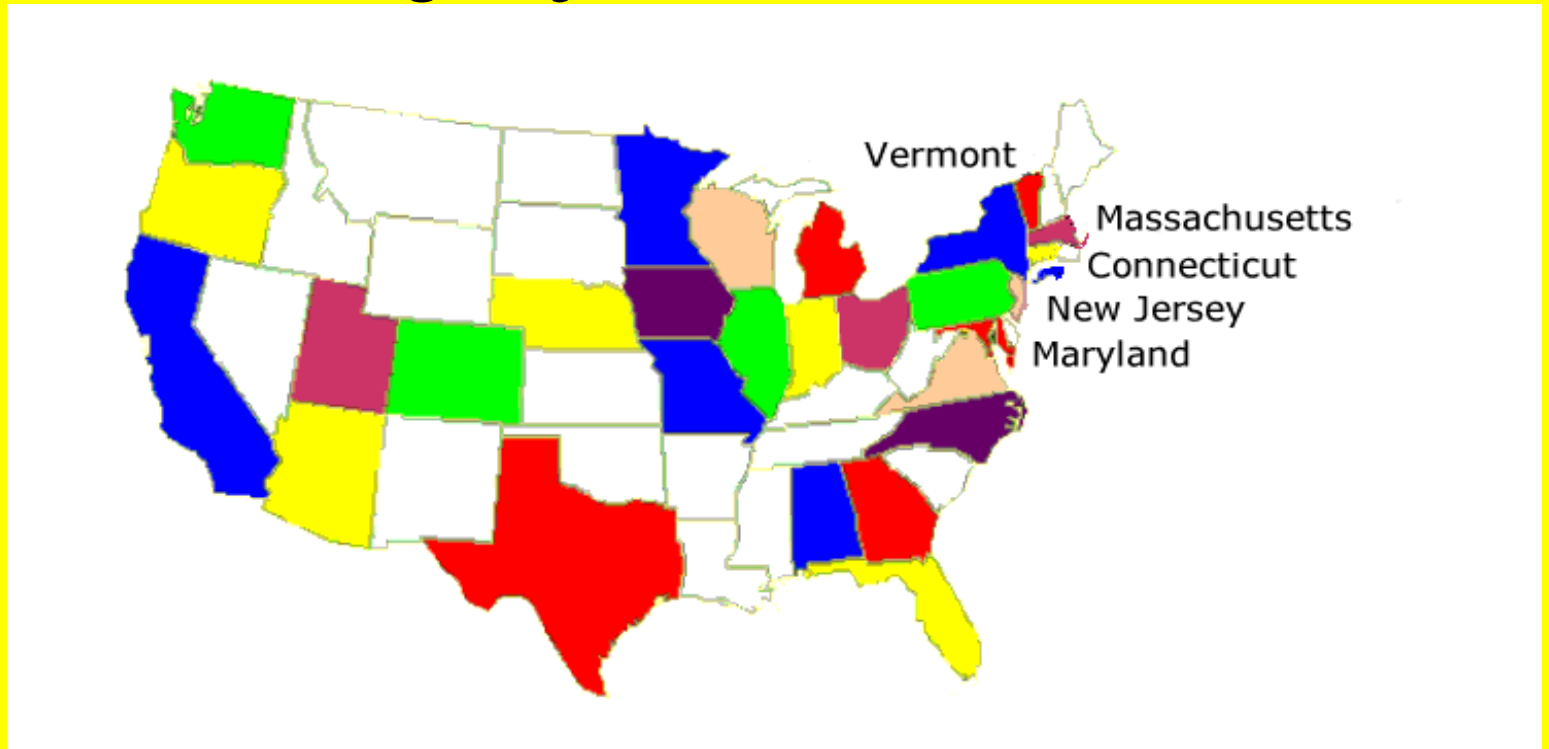
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Roman Czujko---AIP Statistics, "The Physics
Bachelor's as a passport into the workplace"

Who's hiring physics bachelors'?

Go to

<http://www.aip.org/statistics/trends/states/state.htm>
to see who's hiring in your zone

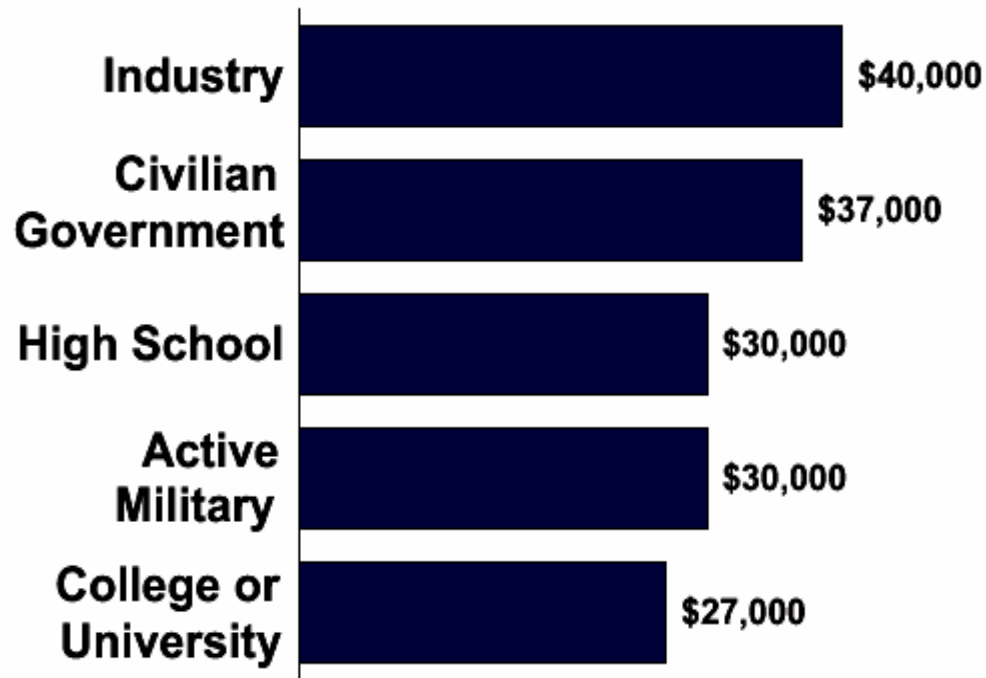


BS Examples

- ❖ Greg Wohlford, VA---programmer for Blackberry (hand-held email, internet link), now with a def. contractor
- ❖ Gretchen Chapman, MD--- “It was proof that I could be analytical...even though I was female...gave me a knowledge base for my career in the computer industry”...works at W.L. Gore and Associates
- ❖ Carolyn Silver, Texas Instruments--- “I did a co-op, acquired sales training, and attained a business marketing position. Physics has helped me attack problems...”
- ❖ Martin Ener, Dual Inc. Engineer, I work with spacecraft guidance, navigation, and control simulation.
 - ❖ Karen Diane Cash, Peace Corps--- “My job is to train teachers to better utilize available materials for labs.”

Physics Trends

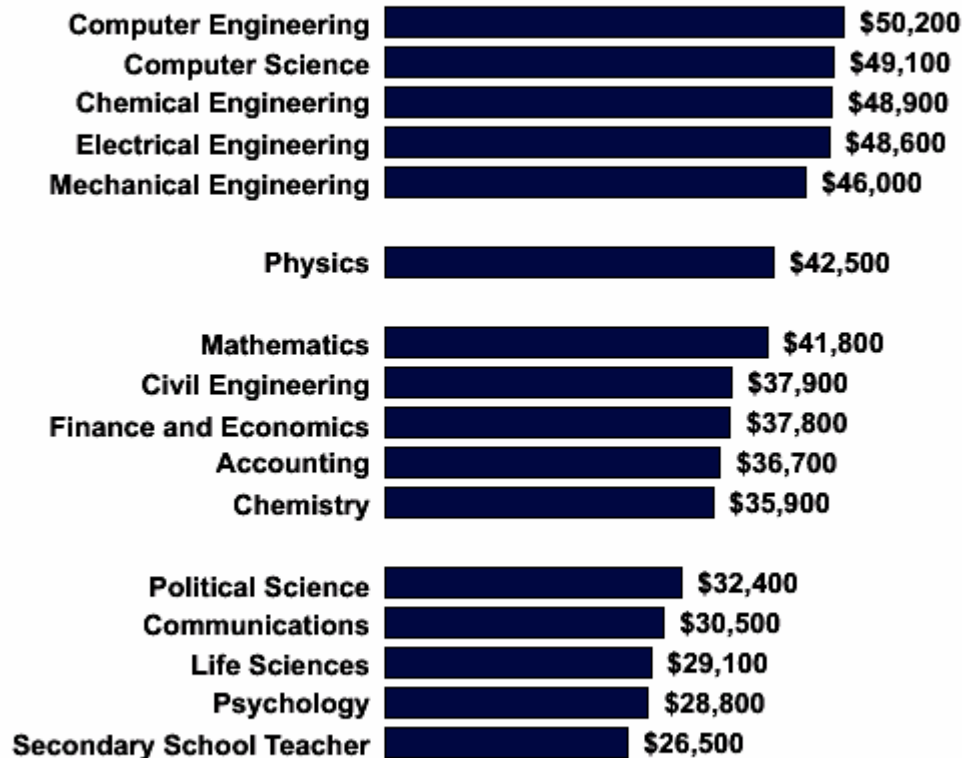
Median Starting Salaries: Physics Bachelors Class of 1998.



Source: 1999 Initial Employment Report

Physics Trends

Average Salaries Offered by Campus Recruiters to New Bachelors in Selected Majors, 2000



Source: National Association of Colleges and Employers

Physics Trends

What Do Physics Bachelors Do?

<u>Type of Job</u>	<u>Percent</u>
Software	28
Engineering	17
Science & Lab Technician	10
Management, Owner & Finance	19
Education	12
Active Military	5
Service and Other Non-Technical	9

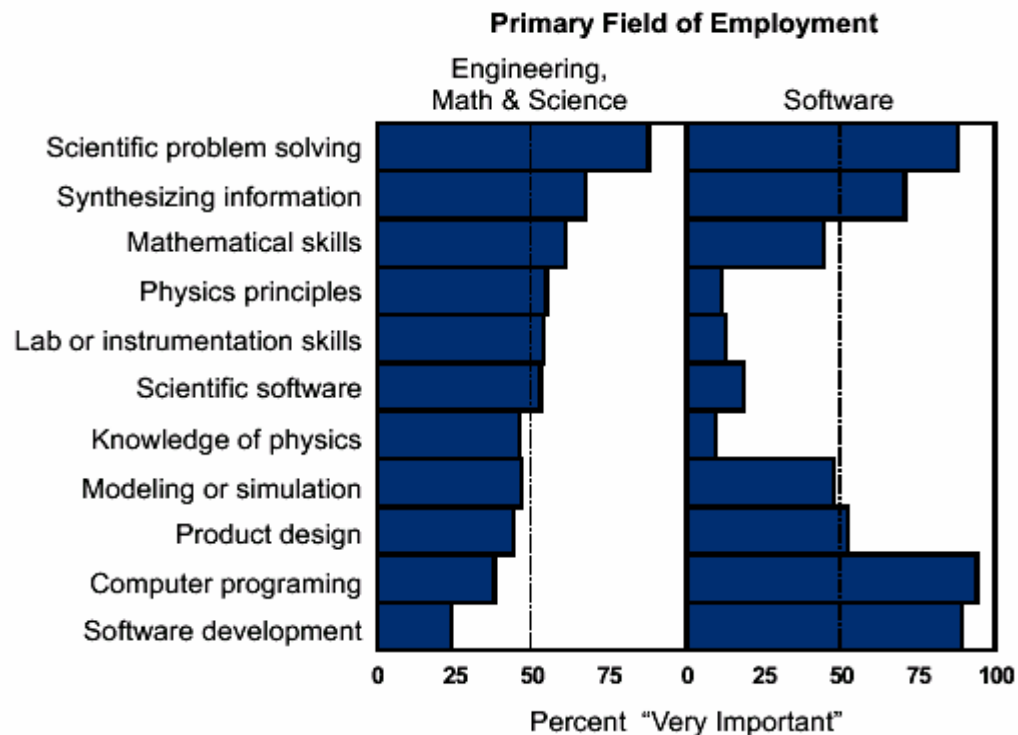
Type of employment of physics bachelors 5 to 7 years after earning their degrees, 1999.

Source: 1998 Bachelors Plus Five Study

Physics Trends

What's Important?

Importance of knowledge and skills for physics bachelors, 5 - 7 years after degree



Percentage of physics bachelors who chose 4 or 5 on a 5-point scale where 5 = essential.

Source: 1998-99 Bachelors Plus Five Study, preliminary results

What about the Master's?

Q4) What percentage of physicists with any master's degree, get that degree in physics?

- A) 20%
- B) 40%
- C) 60%
- D) 80%

After the BS, what master's ($\Sigma\Pi\Sigma$ members) ?

Industry

High school
Military/government
College/Other

About 1/3 get masters

Only 40% in physics

Others in Eng., MBAs, CS,
Math, Ed.

About 1/4 get PhD,
about 60% of these in
physics

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Roman Czujko---AIP Statistics, "The Physics Bachelor's as a passport into the workplace"

A master's profile...

- Joe Cohen---BS, Physics, William and Mary; MS, Technology and Human Affairs Engineering, Washington University in St. Louis
- Currently Vice President, Alternative Energy Practices, at Princeton Energy Resources International (PERI)
- Conducts energy/environmental analysis for government utilities, manufacturers and the military
- Principal author of "Distributed Wind Power Assessment", February, 2001, which addresses the feasibility and cost-benefit analysis of practical wind power in the US

The masters ($\Sigma\Pi\Sigma$)

- > 60% of master's degree holders with physics backgrounds are employed in industry or the private sector.
- Master's degree holders with physics backgrounds enjoy a wide range of career options, with engineer and manager the most common
- > $\frac{3}{4}$ agree that "my undergraduate education in physics provided a solid background for my career", irrespective of employment sector or field of highest degree

Returning to the Doctors

BS---

About 1/3 enter the workforce earning no additional degree

About 1/3 get masters

Only 40% in physics

Others in Eng., MBAs, CS, Math, Ed.

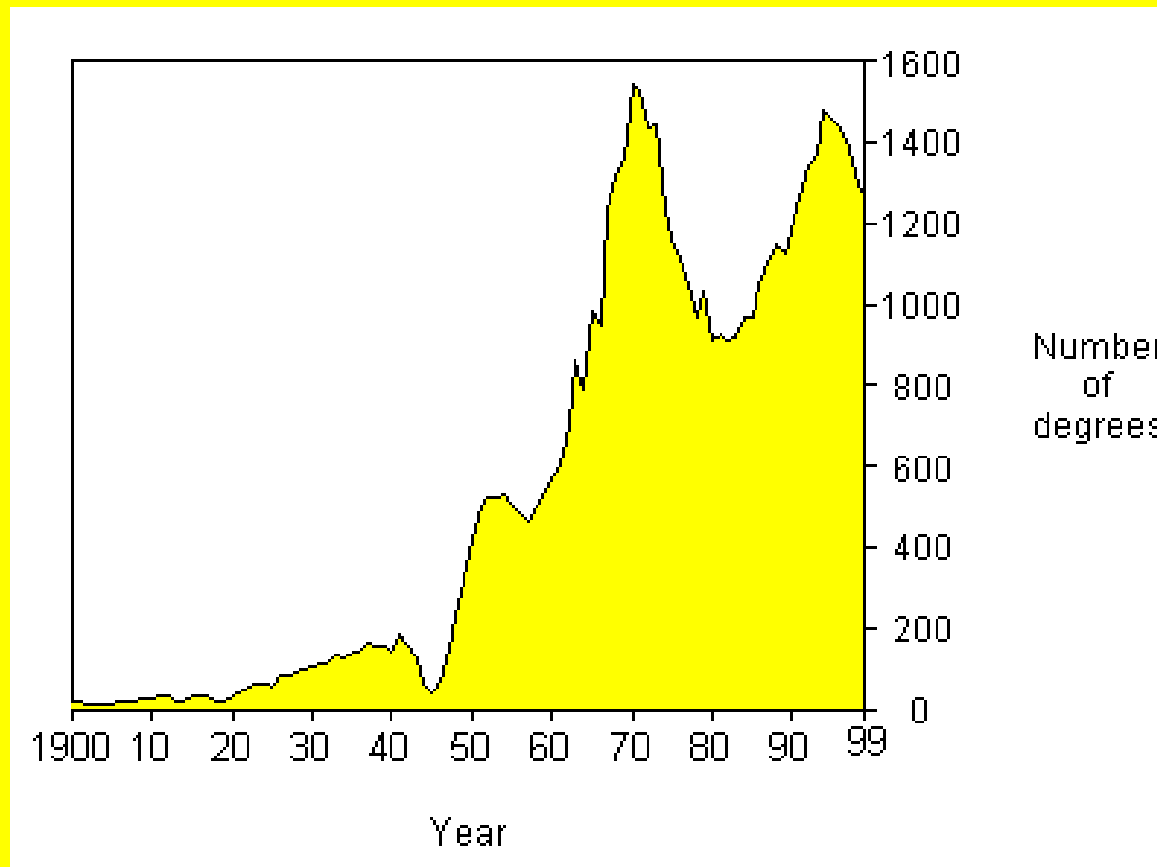
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Roman Czujko---AIP Statistics, "The Physics Bachelor's as a passport into the workplace"

US Physics PhD Production (from AIP statistics)



Non-academic physics

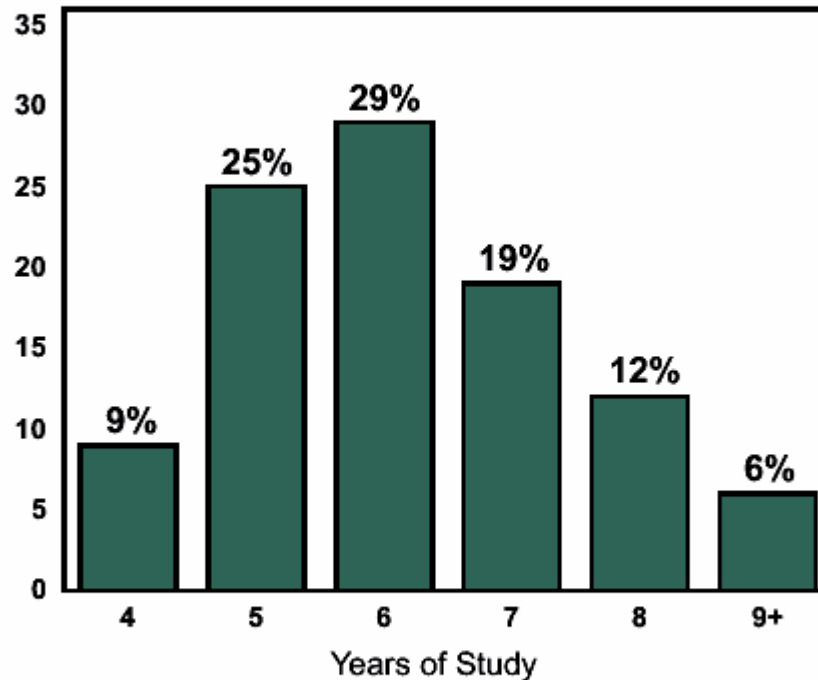
Dr. Examples

- **Lynn Young**---BS, Centenary College, La., PhD at Purdue on Normal modes of DNA---took a series of post-docs, first in molecular dynamics, then at NIH in structure-based drug design.
"I always liked the computer aspects of the work best---now I have a permanent position at NIH working in bioinformatics, programming for micro-array analysis and gene sequencing."

- **Frank Sogandares**---PhD in laser physics, now working for Mitre, programming air flight control simulators.
- **Susan Godzac**, Doctor of Optometry--- "My background in physics (Oswego State, NY) made the optics courses easy...whether calculating cross cylinder powers or understanding refractive surgery."
- **Greg Rose**---PhD in solid state theory, then MD, now a radiologist in Houston area

Physics Trends

How Long Does It Take to Get a Physics PhD?



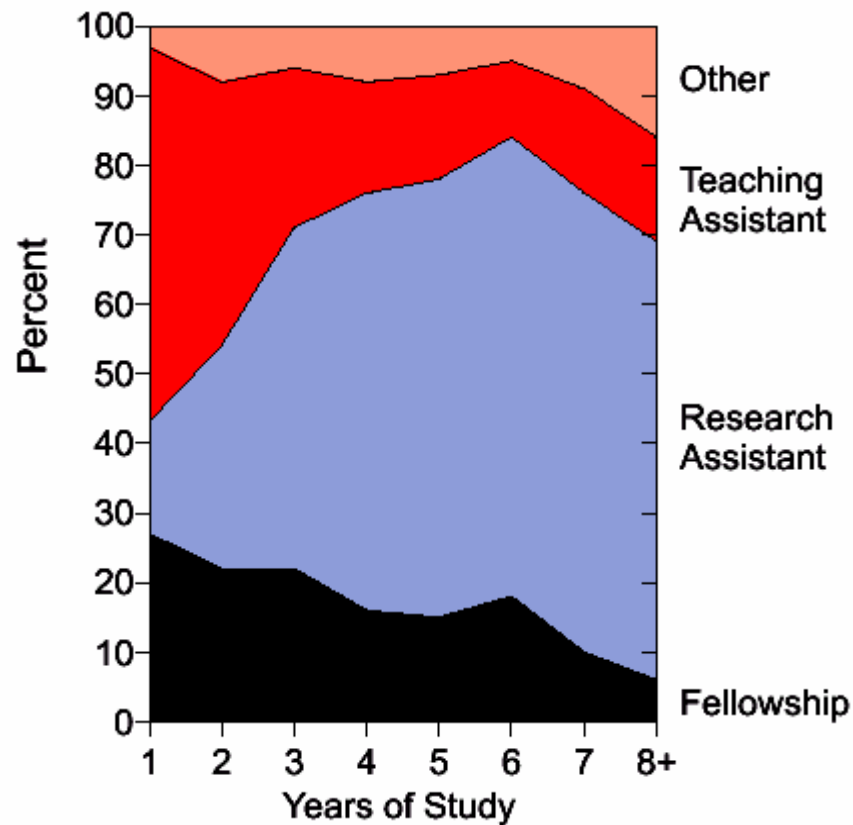
This graph depicts the number of full time equivalent years of graduate study completed by the PhD class of 2000.

Source: Initial Employment Report

Physics Trends

Primary Source of Support for Physics Doctoral Students.

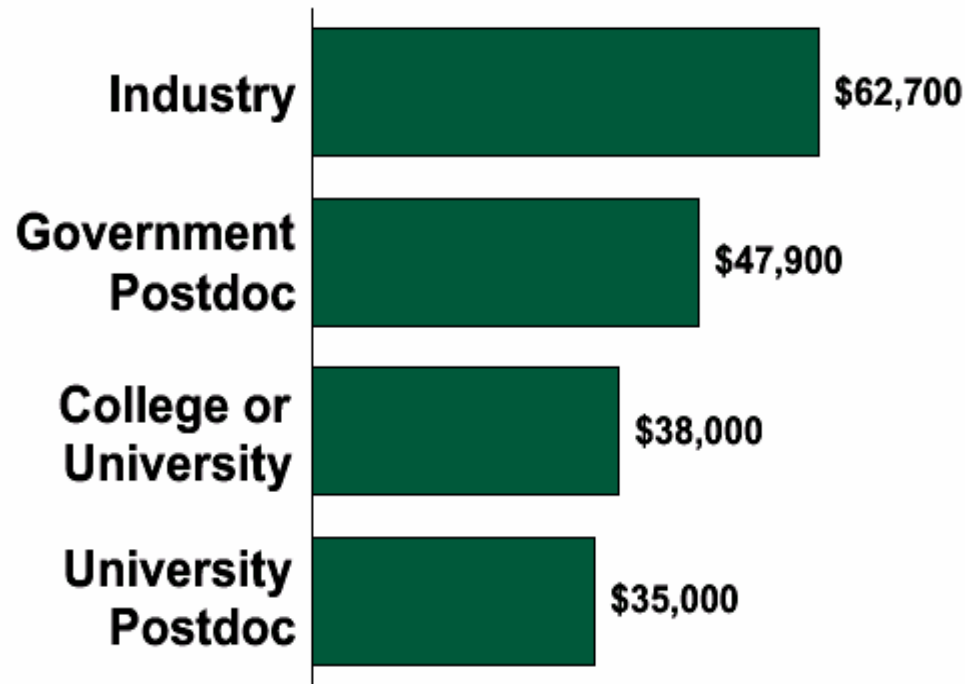
US Citizens Only



Source: Graduate Student Report, July 1999

Physics Trends

Median Starting Salaries: Physics PhDs Class of 1998.



Source: 1999 Initial Employment Report

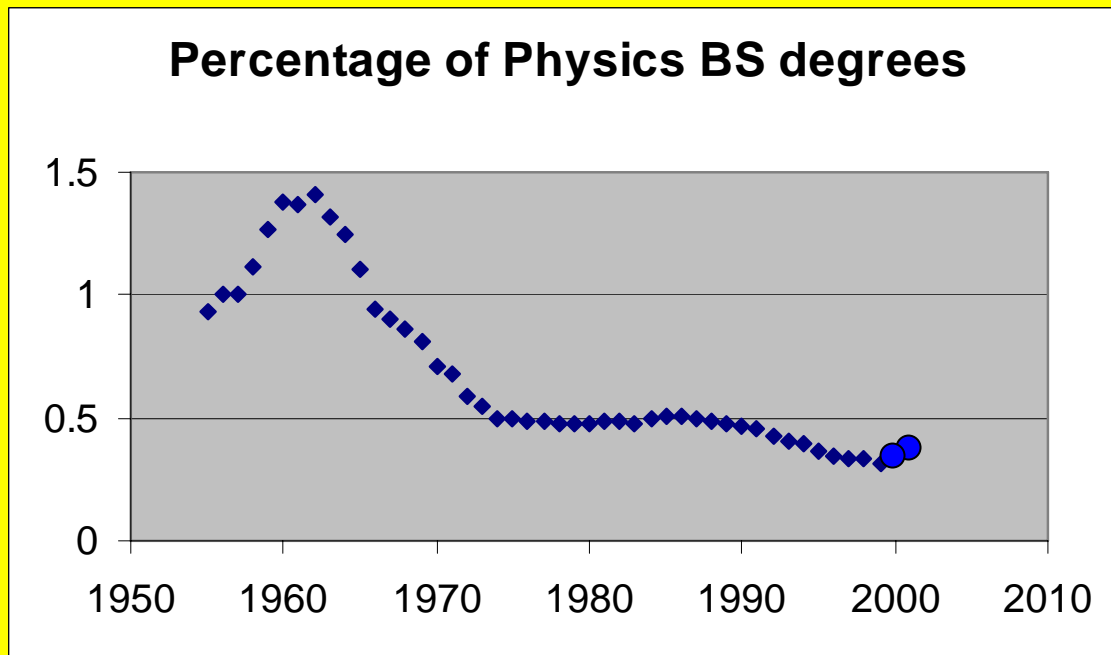
Another Physicist's Profile

(yours truly)

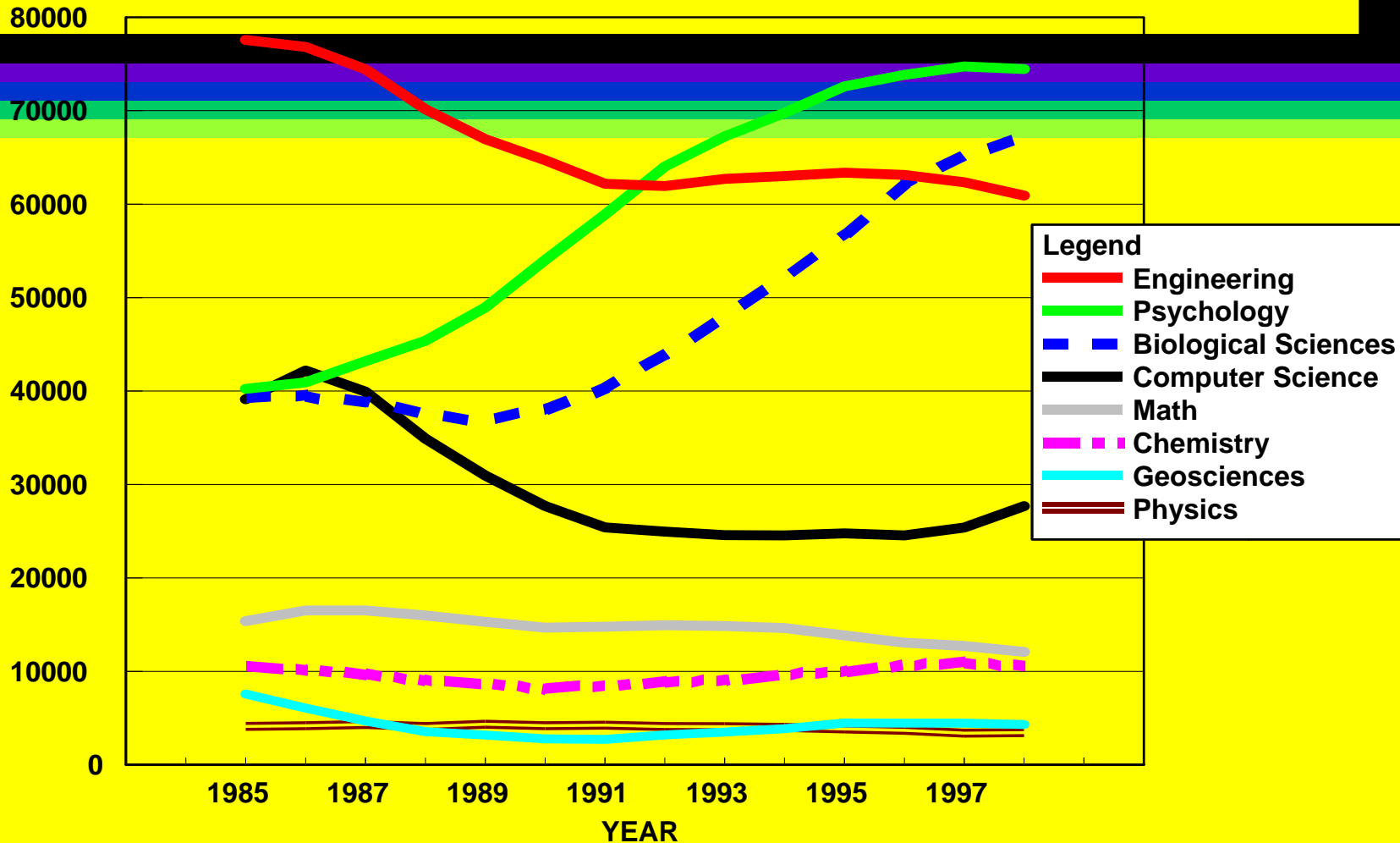
- BS at NE La U, PhD in Nuclear Theory at Tex. A&M
- Sole physics professor at NW State of La in 1987
- '91--Post-doc in Nuclear Engineering, ion beams
- Return to faculty, 10 yrs. working with Spandex, among other things
- Becomes bureaucrat for SPS in 2001

"I knew the first time I saw the derivation of parabolic motion for a rock in a uniform field (when a sophomore in college) that I was hooked on the elegance of physics...that I liked teaching was *lagniappe*, a little extra, as we say in Louisiana."
GDW

A serious problem for society



Total number of bachelor's degrees granted by discipline, 1985 to 1998



Source: AIP Statistical Research Center compiled data from NSF WebCASPAR Database System, March 2002

Any Solutions?

0 Dedicated Faculty

1 Undergraduate Research

2 Departmental Communities

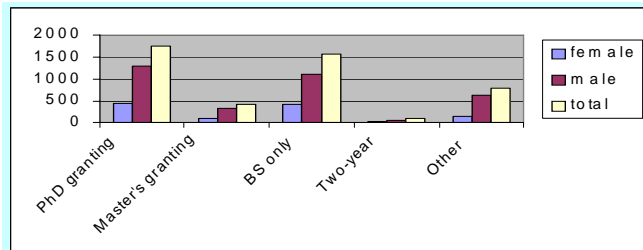
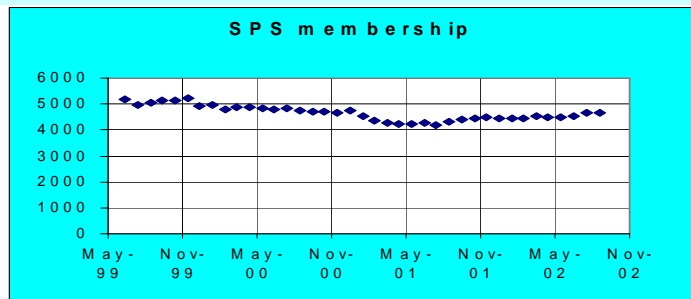
These have been documented by the National Task Force on Undergraduate Physics, also by Robert Ehrlich in a January 1998 article in the American Journal of Physics---the next few slides show my own biases for other approaches to this problem...

SPS and $\Sigma\Pi\Sigma$: Linked, but Distinct

SPS is the Society of Physics Students

The professional society

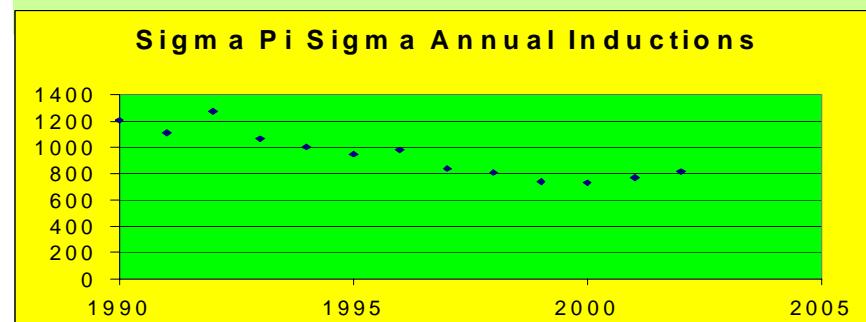
for physics students and their mentors



Go to www.spsnational.org for more information

$\Sigma\Pi\Sigma$ is the

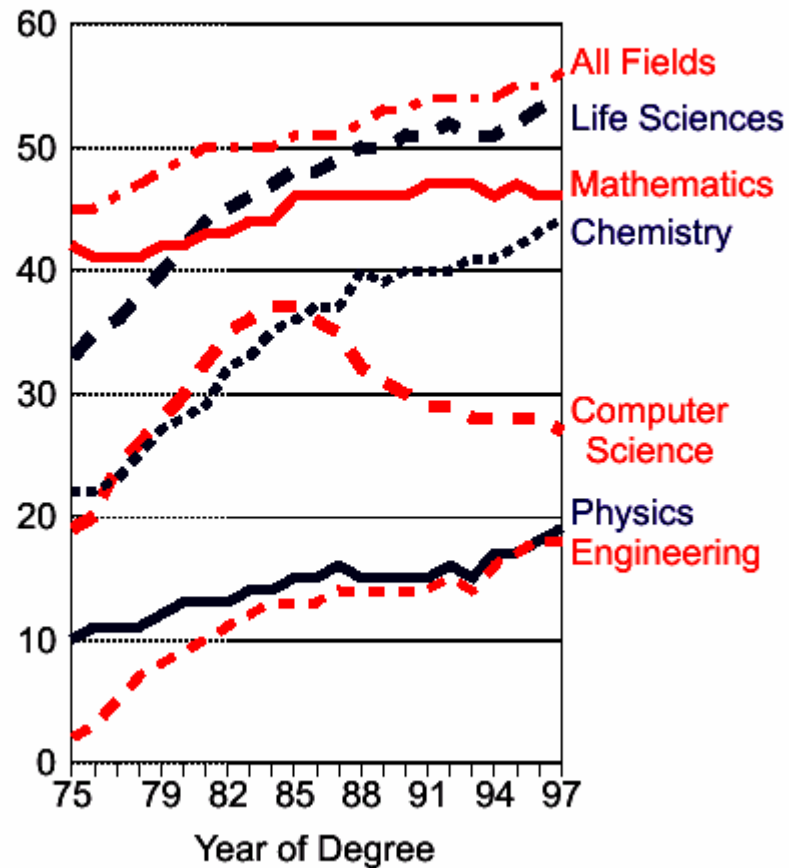
the national physics honor society



Radiations magazine goes to about 35,000 members of Sigma Pi Sigma. Donors provide annual support for SPS programs, awards, and scholarships.

Physics Trends

Percent of Bachelor's Degrees Earned by Women in Selected Fields, 1975 to 1997.



Source: Women in Physics, June 2000

Percentages of Physics Degrees Awarded to Women in Selected Countries, 1997 & 1998 (2 year averages).

	PhD %	1st Level %
France	28	~30
Poland	23	36
Norway	23	20
Australia	22	20
Turkey	21	37
India	20	32
Columbia	--	28
UK	19	19
Denmark	17	19
Taiwan	13	19
US	13	18
Sweden	13	17
Canada	12	22
Mexico	10	18
Germany	9	10
The Netherlands	9	5
South Korea	8	30
Japan	8	13

France-----Bachelor's data are for 1996 through 1998.				
Poland-----1998 data only.				
Norway-----1996-2001 data.				
Australia-----PhD data include some Master's degrees (Higher degree by research).				
India-----Partial data from the Registrar General of India, 1998.				
Germany-----Includes astronomy and astrophysics.				
Columbia-----1998 and 1999 data.				
UK-----Bachelor's data are for 1997 only.				
Mexico-----PhD data for 1998 only. Bachelor's data for 1998 and 1999.				

Source: 2001 International Study of Women in Physics

Statistical Research Center of the American Institute of Physics

France-----Bachelor's data are for 1996 through 1998.

Physics degrees granted to US citizens by ethnic group, 1999

Group (2000 census in parenthesis, some overlap)	BS		MS		PhD		Big producers
	number	%	number	%	number	%	
Afr. Am. (13%)	160	5	24	6	10	1	Louisiana (Xavier, So. U)
Hisp. (13%)	71	2	9	2	10	1	PR & CA, also FL, TX
White (75%)	2948	86	329	85	603	90	
Asian Am. (4%)	158	5	21	5	30	5	Source: Enrollments and Degrees Report, August 2001---AIP's Statistical Research Center
Other (8%)	68	2	7	2	18	3	
total US citizens	3405		390		671		

Thanks to

- AIP Statistics, especially Roman Czujko, Patrick Mulvey, Katie Stowe, and Starr Nicholson
- Tracy Schwab, SPS communications
- Ed Neuenschwander, SPS Editor and the rest of the SPS staff