

A Career in Physics: My Personal Journey

K. Kirby

American Physical Society
formerly at Harvard-Smithsonian
Center for Astrophysics

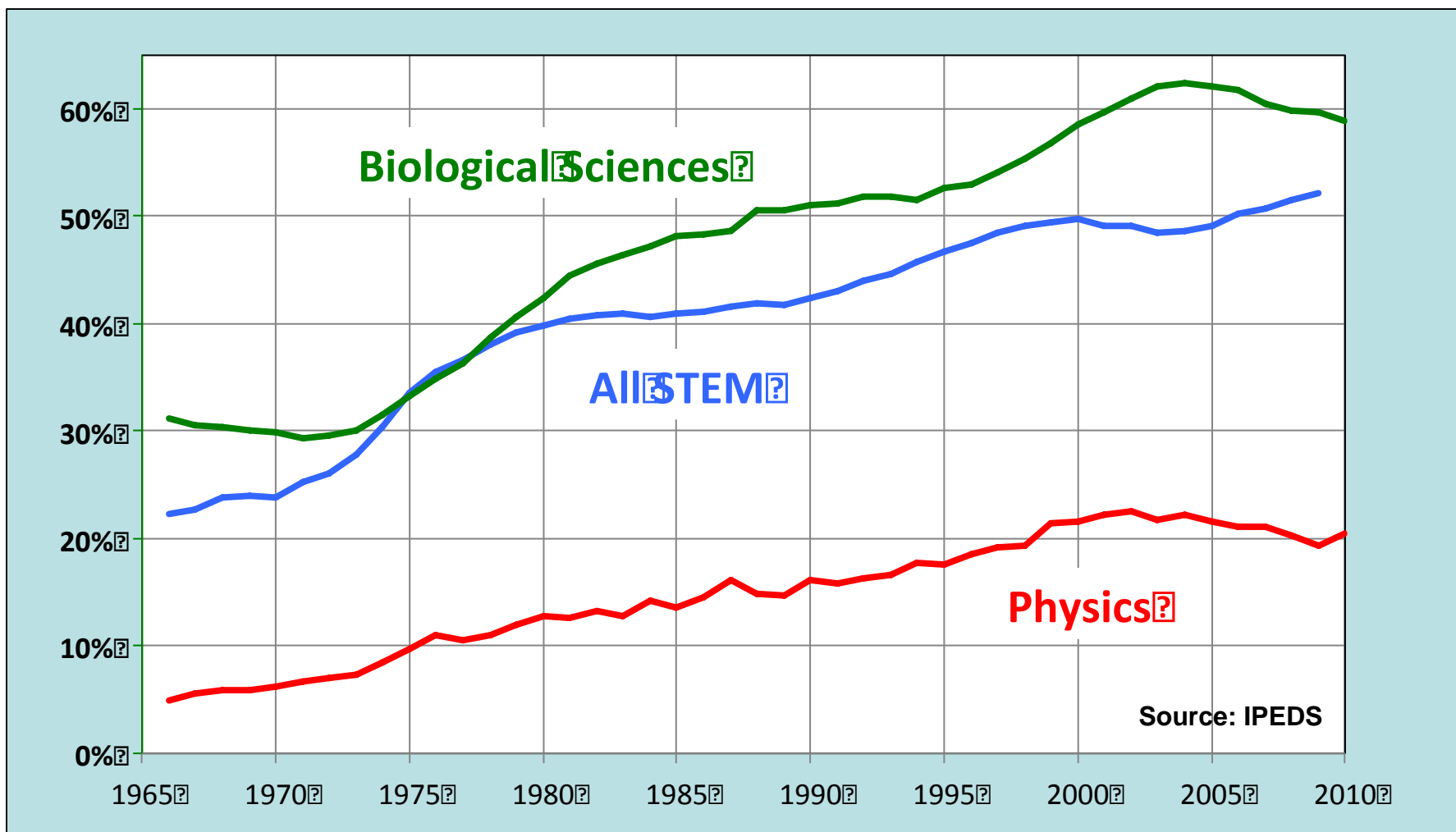
Conf. on Undergraduate Women in Physics January 18, 2014
Mid-Atlantic CUWiP
University of Maryland/NIST



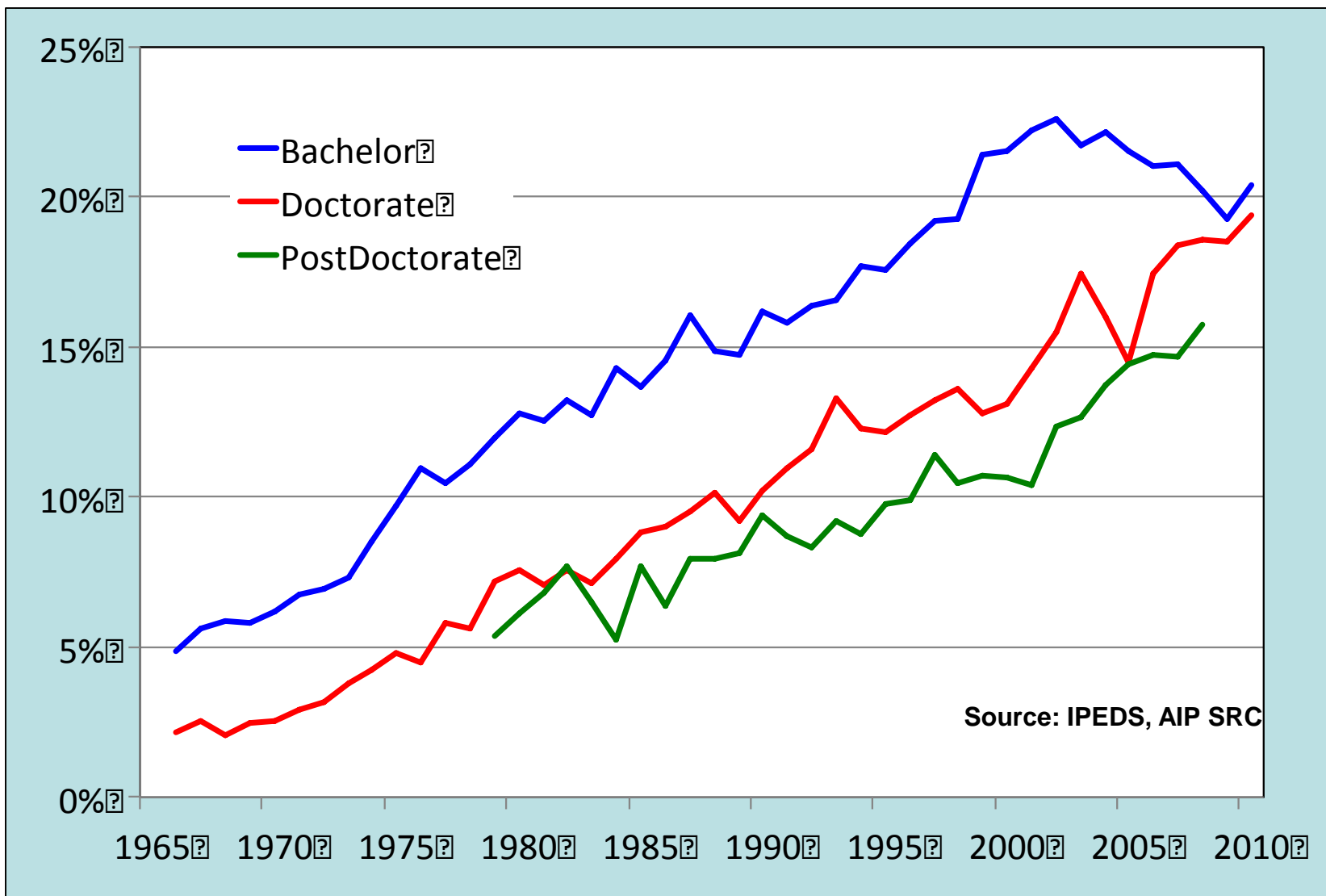
Outline

- ❖ Some Statistics on Women in Physics
- ❖ What the American Physical Society has for women & students
- ❖ Personal journey (early interest in science, education, family life)
- ❖ My research at Harvard-Smithsonian Center for Astrophysics
- ❖ Opportunity to lead APS
- ❖ Engagement with APS – what's in it for you

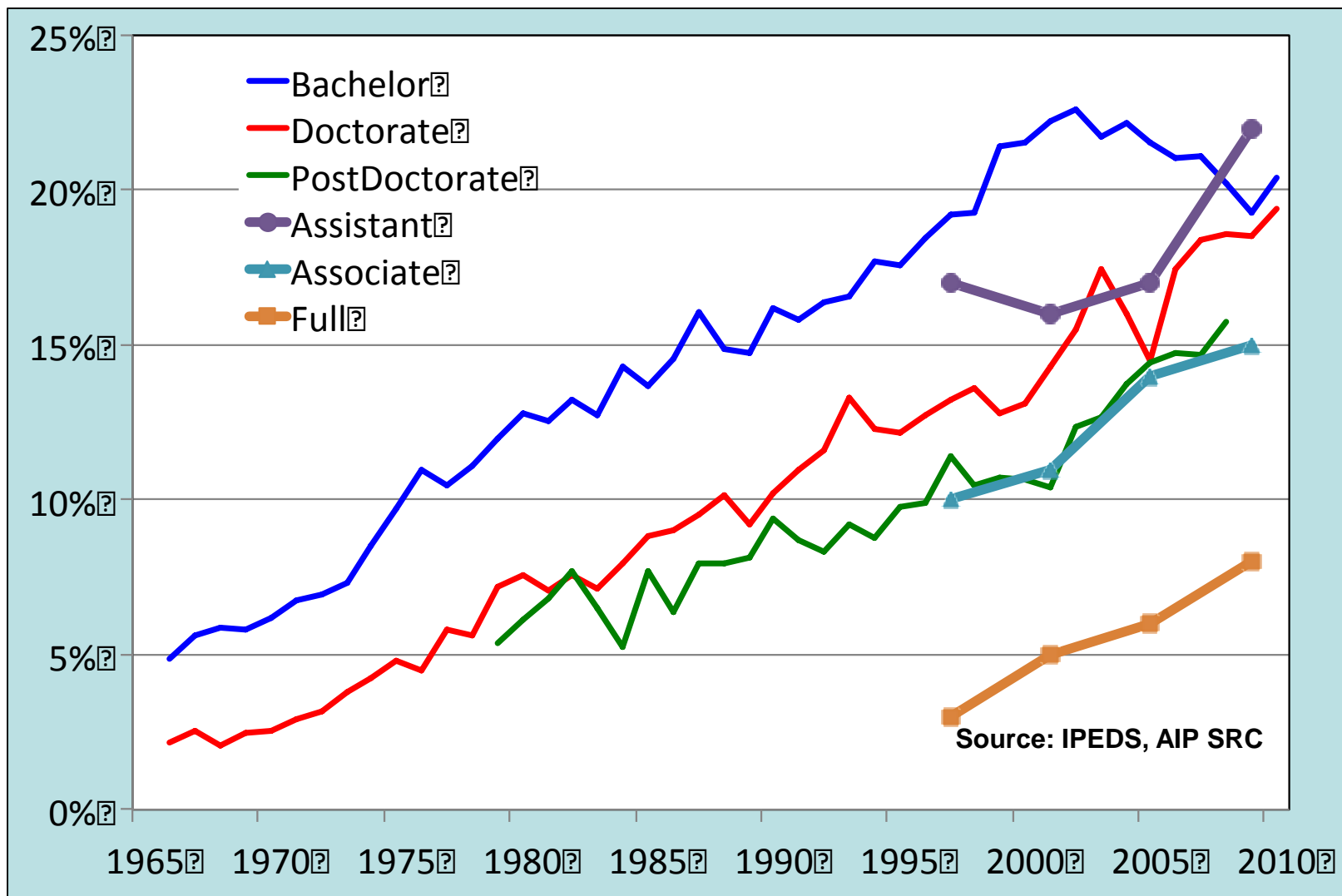
Female Fraction of Bachelor Degrees



Percentage of Women in Physics



Percentage of Women in Physics



The American Physical Society

APS Headquarters in College Park, Maryland, shares a building with other physics societies :

- American Association of Physics Teachers
- American Association of Physicists in Medicine
- American Institute of Physics

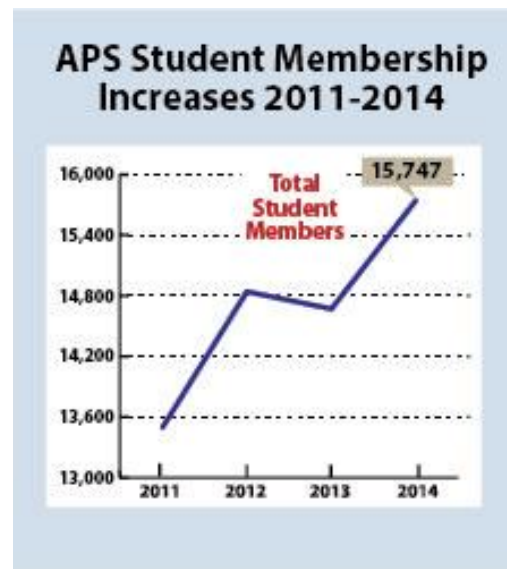
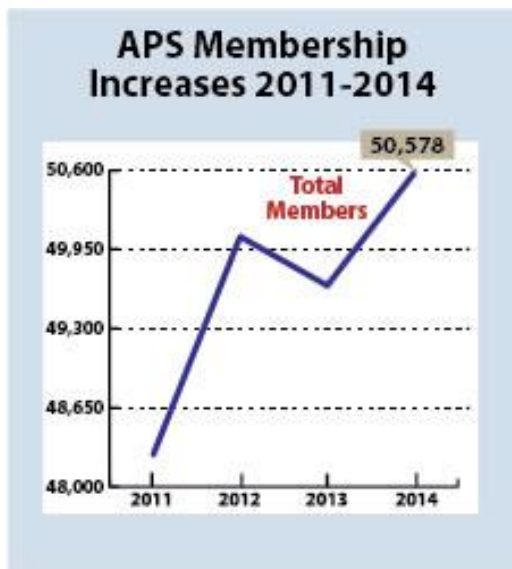


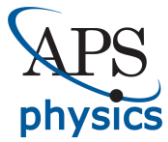
The American Physical Society

APS Membership Statistics:

>50,000 members (mostly academics)

- 30% Students (22% Grads, 8% Undergrads)
- 22% International
- 9% Industrial
- 17% National Laboratories





The American Physical Society

What is the percent of women physicists in the APS?

4%

12%

23%

38%

The American Physical Society

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4%

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38%

Interesting fact:

2/3 of the women in the APS are < 40 years old

APS Programs for Women

- Professional Skills Development workshops
- Childcare grants for meetings
- Gender equity site visits
- CSWP gazette
- Female-friendly website
- Blewett fellowship
- Travel grants
- Woman physicist of the month

www.WomenInPhysics.org



Strengthening the Physics Enterprise in
Universities and National Laboratories



Future of Physics Days Events

Every year, APS and SPS team up at the annual meetings to plan a number of special events just for undergrads. Student registration is FREE!

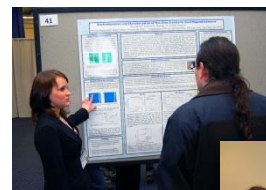


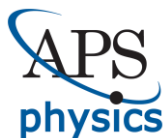
- **Graduate School Fair**—meet face-to-face with representatives from graduate research programs
- **Special Student Presentation Sessions**—an opportunity for students to present their research.
- **Mentor/Student Welcome Reception**—students and mentors team up on a special quiz about physics careers
- **Student Awards reception**—student presenters are recognized, and given an opportunity to network with graduate school recruiters and employers.

Travel Awards are available to presenting students

- **Support is available for March and April Meetings.**
- **All presenting students are eligible.**

Visit: www.aps.org **KEYWORD: Future Physics** for more details





Learning More

APS Webinars

APS webinars are designed to connect students with information on physics careers, educational programs, and professional development for students, working physicists, and educators.

Monthly broadcasts are free and open to the public.

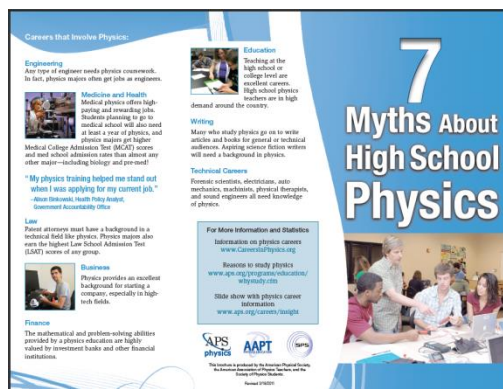
Topics have included

- **Becoming a Physics Teacher (with science educator Eugenia Etkina)**
- **Choosing a Graduate School (with physics professor Peter Collings)**
- **Careers in Patent Law (with physicist and patent attorney Hey Yeung Cheung)**
- **Interviewing without the Angst (with Northeastern University co-op faculty Karyn Rosen).**

Visit: www.aps.org/careers/guidance/webinar



The APS Career Website is the gateway to physics career resources. Here you can find links to the APS Job Center, information on upcoming workshops and meetings, career advice, and other career and job related resources (such as APS webinars, the APS Job Blog, and more!).



7 Myths About High School Physics

Careers that Involve Physics:

- Engineering:** An eye of engineer needs physics coursework. In fact, physics majors often get jobs as engineers.
- Medicine and Health:** Medical physics offers high-paying and rewarding jobs. Teachers planning to go to medical school will also need at least a year of physics, and physics majors get higher Medical College Admission Test (MCAT) scores and need school admission rates that almost always are other major—including biology and pre-med!
- Teaching:** Many who study physics go on to write articles and books for general or technical audiences. Applying career advice systems will need a background in physics.
- Technical Careers:** Forensic scientists, technicians, auto mechanics, mechanics, physical therapists, and sound engineers all need knowledge of physics.
- Law:** Patent attorneys must have a background in a technical field like physics. Physics majors also earn the highest Law School Admission Test (LSAT) scores of any group.
- Business:** Physics provides an excellent background for starting a company, especially in high-tech fields.
- Finance:** The mathematical and problem-solving abilities provided by a physics education are highly valued by investment banks and other financial institutions.

Education: Teaching at the high school or college level are excellent careers. High school physics teachers are in high demand around the country.

Writing: Many who study physics go on to write articles and books for general or technical audiences. Applying career advice systems will need a background in physics.

For More Information and Statistics: Information on physics careers www.careersinphysics.org

Reason to study physics: www.aps.org/programs/education/physicsjobs

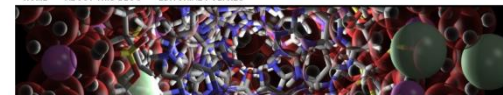
Slide show with physics career information: www.aps.org/careers/teasers

APS physics AAPT logo

physics careers & jobs

hosted by the APS Committee on Careers and Professional Development

HOME ABOUT THIS BLOG EDITORIAL POLICIES



Job Interviews

Q: What is a typical interview like for an academic job? For an industrial job? How can I succeed?

by Mark Wilson


A: The typical academic interview includes a research talk or a sample class lecture (or both), depending on the type of institution, plus meetings with faculty, groups of faculty and administrators. In addition there are sometimes social events – which, make no mistake, are also opportunities for evaluating candidates. The interviewers will ask directly or indirectly questions that are also implied in their job advertisement (so read the advertisement before the interview, and prepare). The interviewers will also listen for indications that you have an interest and appreciation of their accomplishments. They will get a sense of how you would be as a colleague over many years.

Industrial interviews have one primary function: to determine how well

ARCHIVES

- January 2010
- December 2009
- November 2009
- October 2009
- September 2009
- August 2009
- April 2009
- February 2009
- November 2008

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Career Guidance

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Physicists Profiles

What You Can Do With Physics

Physicists don't all work in labs or teach physics, although many do, and love their jobs.

A physics degree will qualify you for a variety of careers from inventing to analyzing to improving. Find out the diversity of physics by exploring the jobs of these physicists.

Albin Gonzalez



Albin is a medical physicist from Panama currently working at Mercy Cancer Center in Elyria, Ohio, where he is helping patients beat cancer.

[Find Out More!](#)


Alejandro Rodriguez



Alejandro enjoys salsa dancing, watching movies, and studying micro machines.

[Find Out More!](#)

Alicia Soderberg



Alicia once wanted to be an environmental scientist, but she fell in love with looking at the stars in the night's sky.

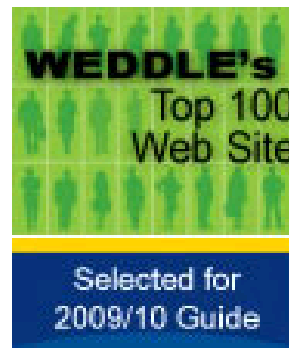
[Find Out More!](#)

Pages For: Physicists/Scientist Go

Our free 60-day summer internship promotion means that lots of employers are advertising internships on our site right now.

Job Seekers can:

- Search for jobs on the Job Center (totally free).
- Store your resume, cover letters, and other materials in your profile on the site.
- Apply for positions directly through the Job Center.



careers.aps.org

SPS Internships

SPS Internships are 9 ½ week long summer programs which provide opportunities for students in areas like:

- Science Outreach—at APS or SPS
- Science Policy—Mather Internships/Capitol Hill
- Science Research—NIST

www.spsnational.org/programs/internships

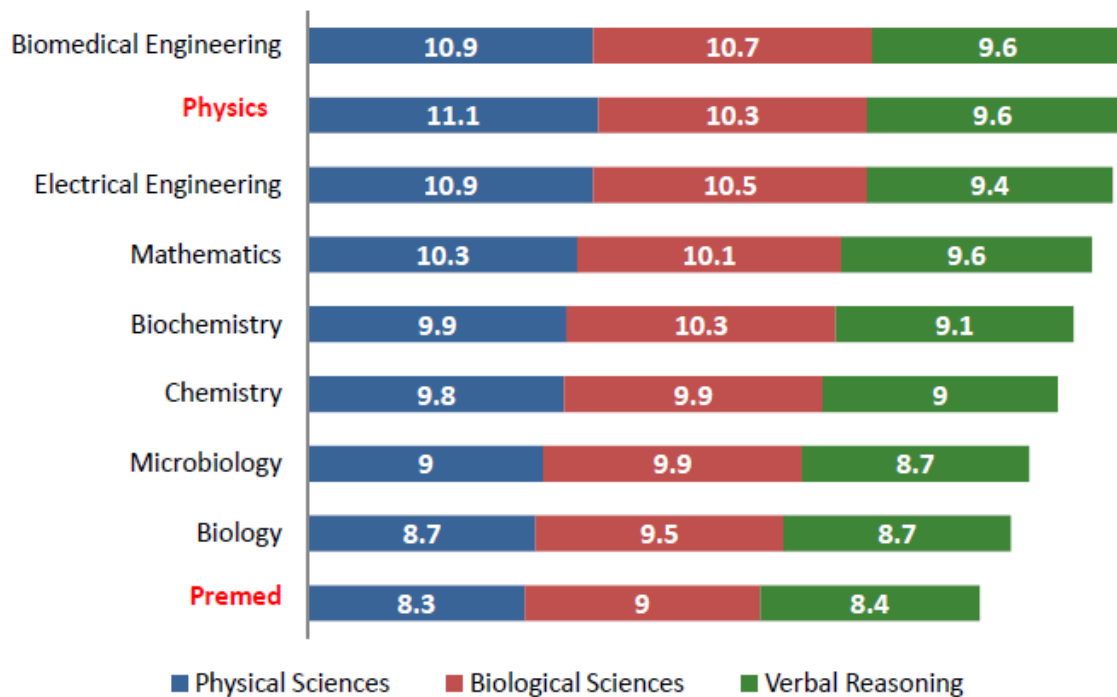


How about Med School?

Physics majors out-performed many other majors (including pre-med) on all three sections on the MCAT.

Average MCAT Scores by Selected Majors, 2009

Scores above 9.5 in each section are considered competitive by most medical schools



These factors make Physics majors stand out compared to other med school applicants.

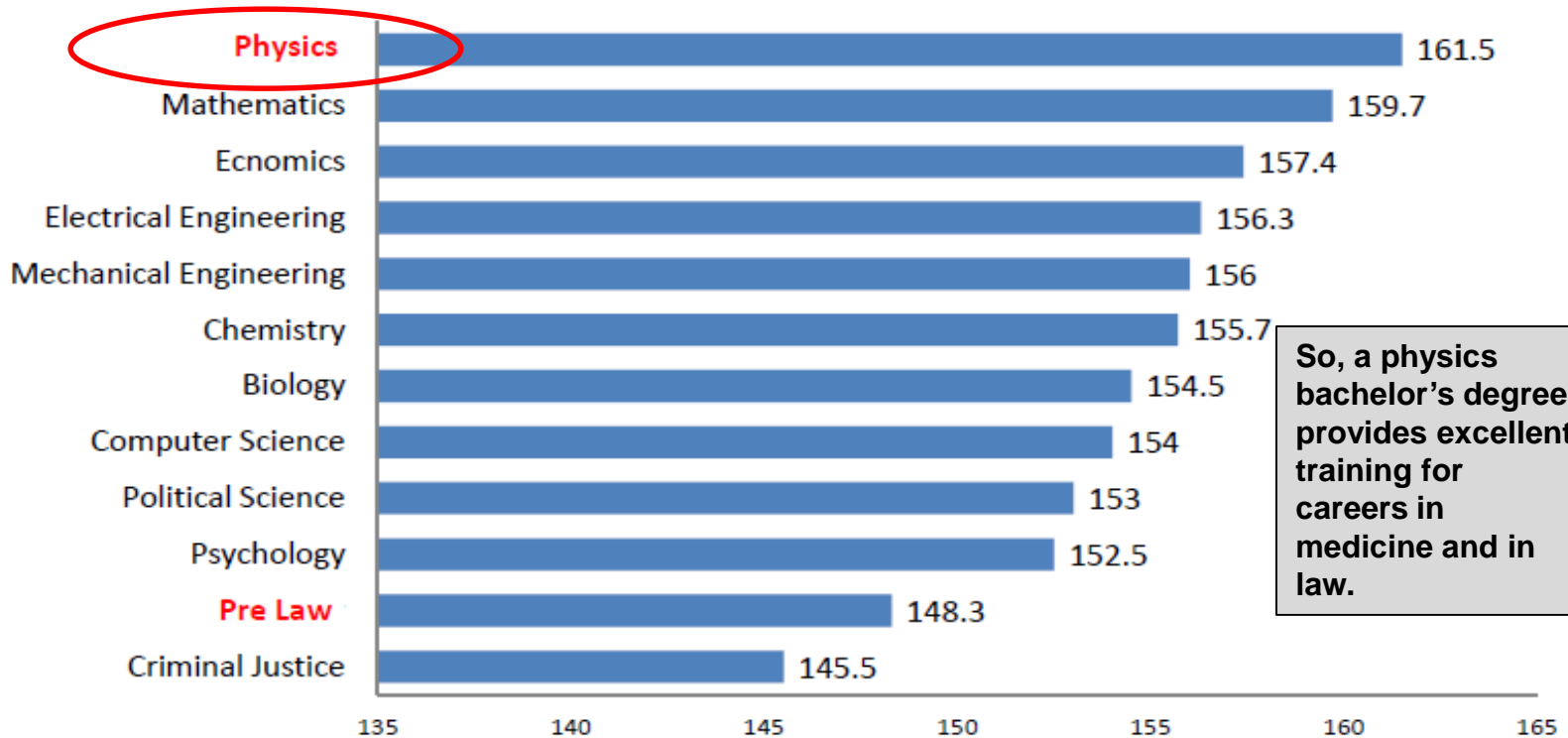
Physics majors also account for less than 1% of individuals taking the exam...

Source: AIP Statistical Research Center compiled data from the Data Warehouse of the American Association of Medical Colleges

Or Law School?

Physics majors also received the highest average LSAT scores compared to several other majors (including Pre Law).

Average LSAT Scores by Selected Major, 2009



So, a physics bachelor's degree provides excellent training for careers in medicine and in law.

Source: AIP Statistical Research Center compiled data from the Law School Admission Council, Newton PA.

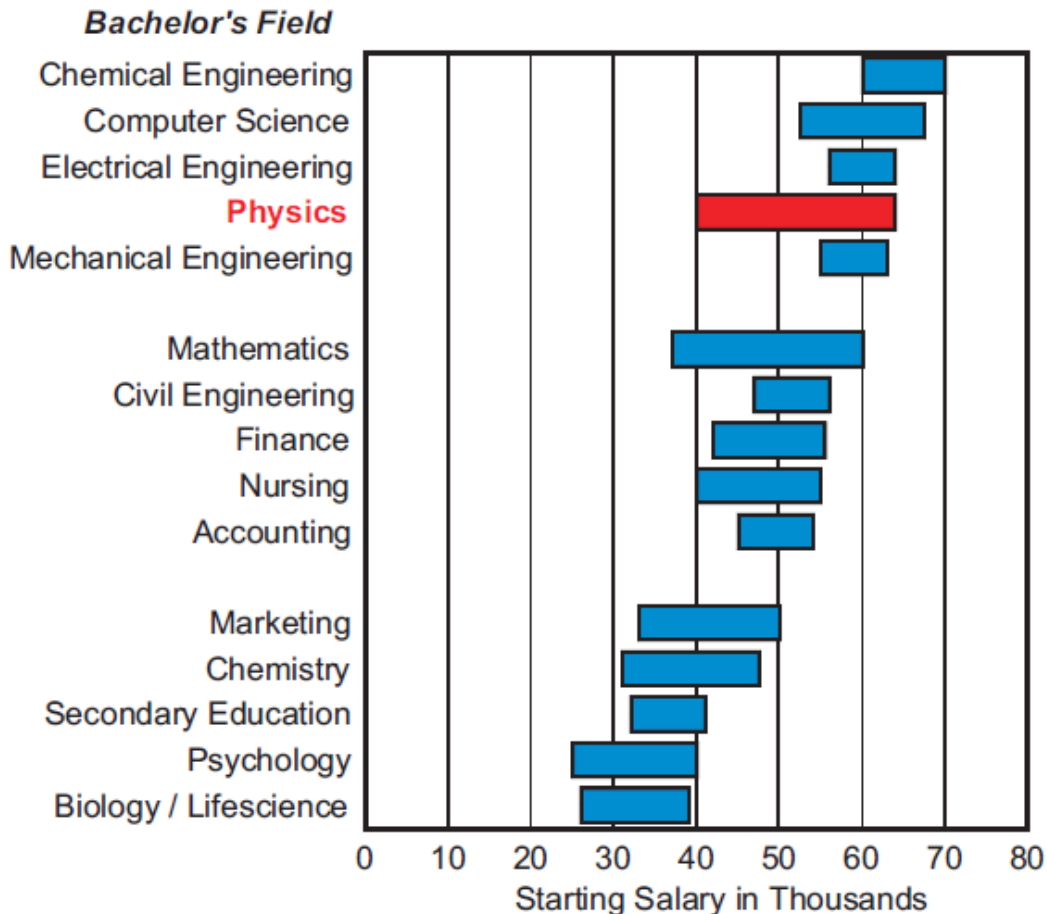
In fact...

A physics bachelor's degree now ranks higher in starting salary than many other technical fields (including mechanical engineering).

The typical starting salary for a physics bachelor degree has increased by nearly \$10,000 since 2003.

What's a Bachelor's Degree Worth?

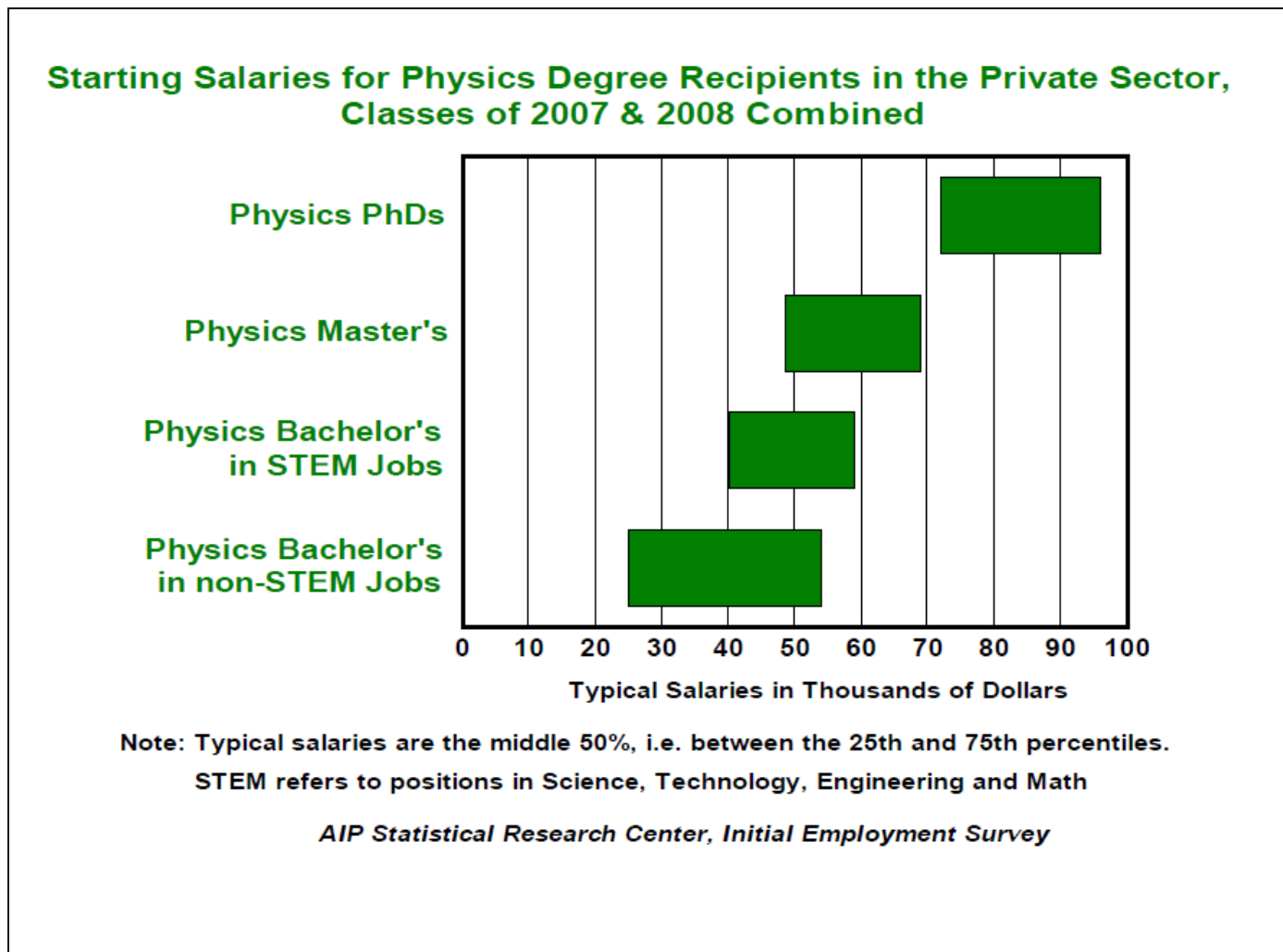
Typical Salary Offers by Campus Recruiters, AY 2008-09



Typical salaries are the middle 50%, i.e. between the 25th and 75th percentiles.

Reprinted from the Fall 2009 Salary Survey, with permission of the National Association of Colleges and Employers, copyright holder.

Not surprisingly, physics master's degree holders also earn more than physics bachelor's:



Bottom line: A physics master's degree will open the door to more advanced positions in a variety of technical fields, with higher salaries.

Wait!! I want a life!

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You CAN have a life and a productive,
satisfying career in physics

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My particular career path, as an example

Childhood

Early interest in
Science –
MEDICINE



Childhood/High School

- Early interest in Science – MEDICINE
- Excellent high school education; lots of encouragement (my mother; Latin teacher)
- High school love of chemistry -- appreciation of the role of math in science; intrigued by mathematical models describing scientific problems

College

- Harvard/Radcliffe College – greatly disappointing my mother
- Intended to major in biochemistry – BUT I hated organic chemistry; loved math & physics → majored in Chemistry & Physics
- Joined a research group in my junior year
- Convinced me to apply to grad school

Graduate School

- Got married just before starting graduate school at University of Chicago
- Husband was just starting medical school
- Funded by NASA Traineeship
- Joined a research group: theoretical molecular structure calculations (heavily computational)

Challenging Times

1st child,
Andrew, born
during my 2nd
year of grad
school!

Finding daycare
was difficult!

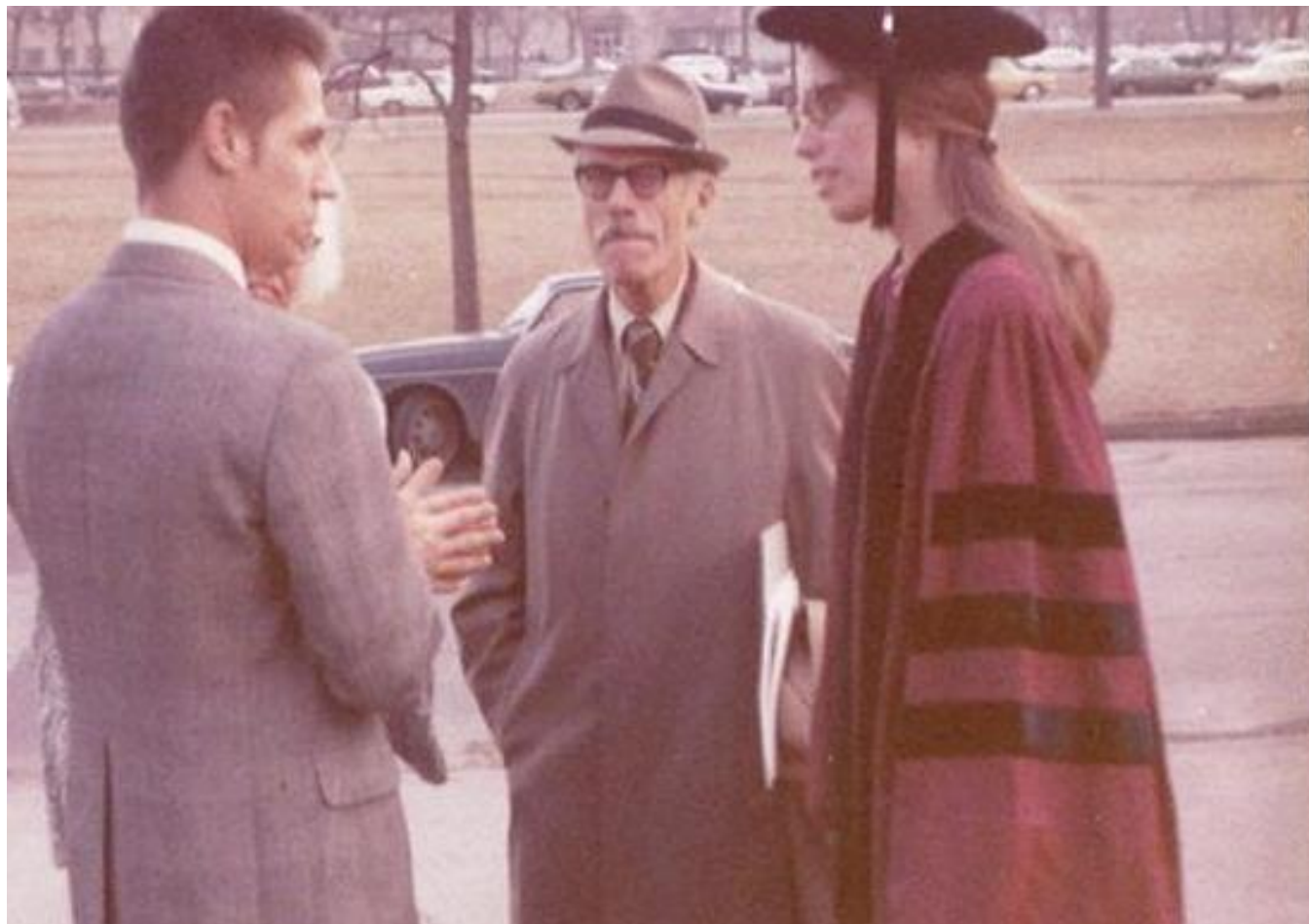


Challenging Times (cont'd)

Received my
PhD degree!

Marriage fell
apart....

Became a
single mom,
looking for a
postdoc
position....



Luck Changed....

- Post-doc position at Harvard College Observatory: theor. atomic and molecular physics w. applications to atmospheric phys. and astrophysics
- After several years, met a great guy...
- My position became a tenured one at Harvard-Smithsonian Center for Astrophysics

My research career in Atomic and Molecular Astrophysics

- Studying the very small (interactions of atoms, molecules and ions with light) in order to understand the very large objects in the universe – stars, planets, interstellar clouds, supernovae, black holes, etc.

Atomic and Molecular Astrophysics

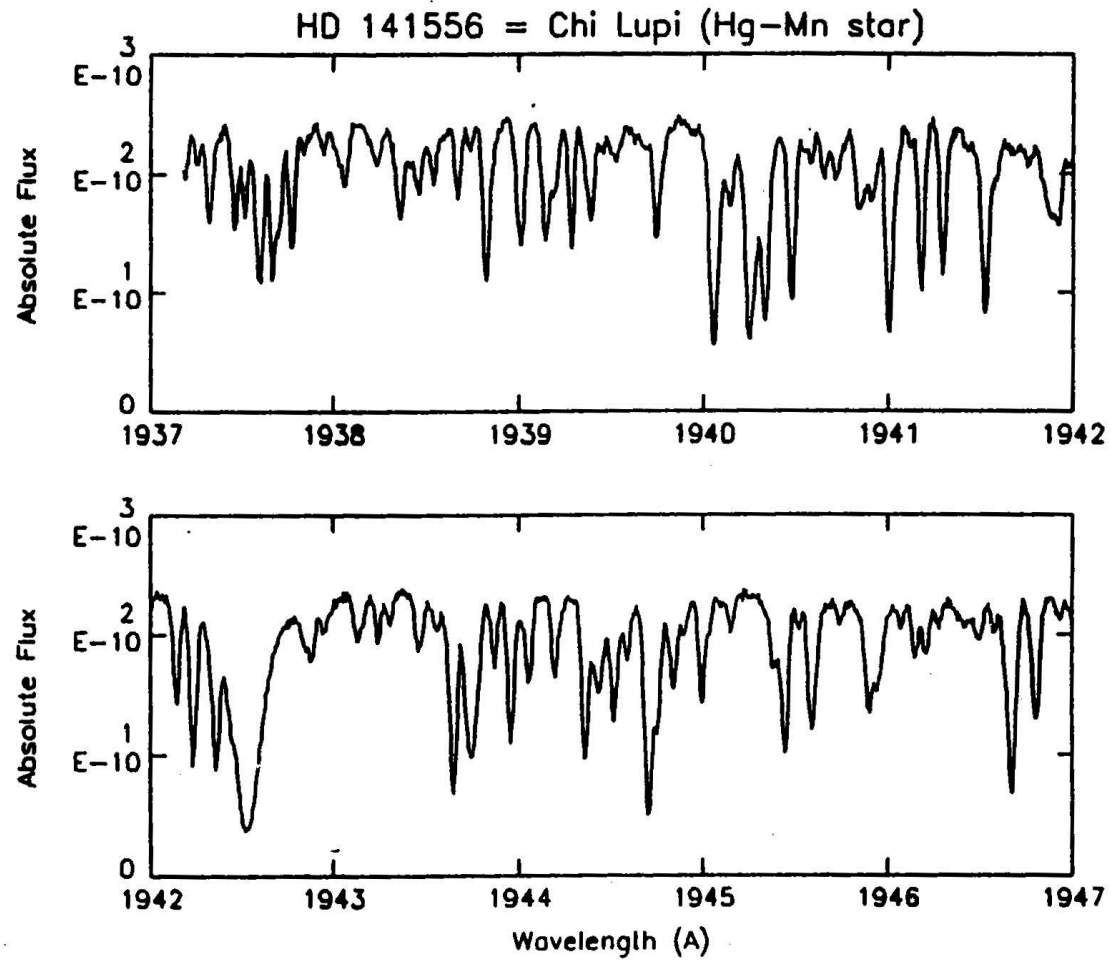
- The Universe reveals its secrets through photons

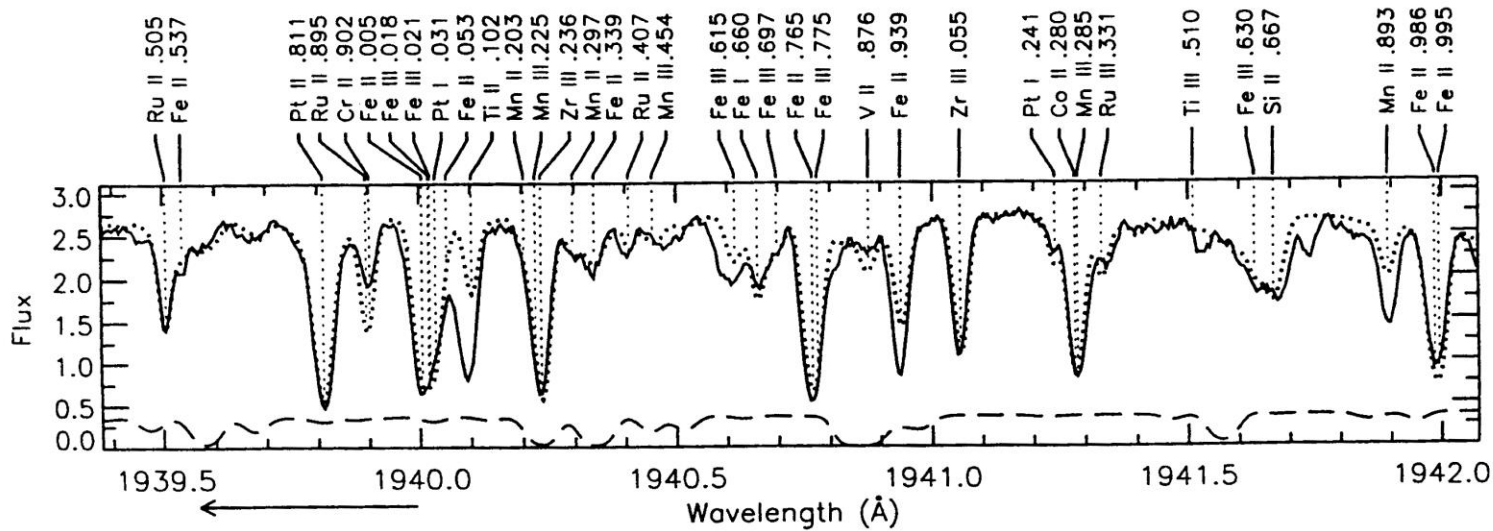
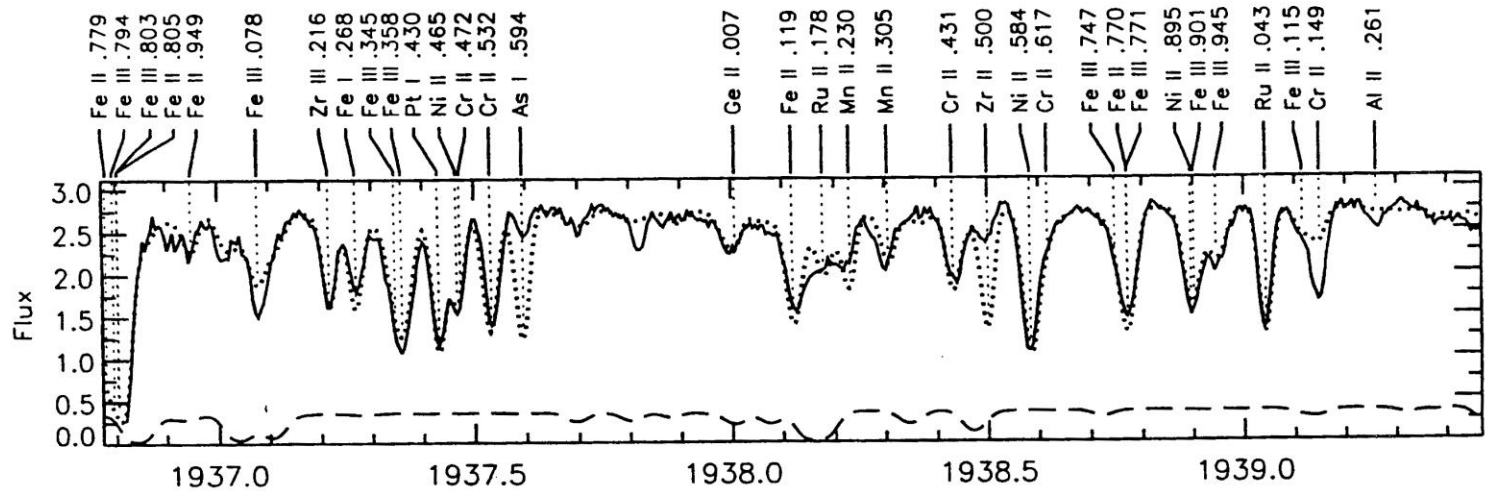




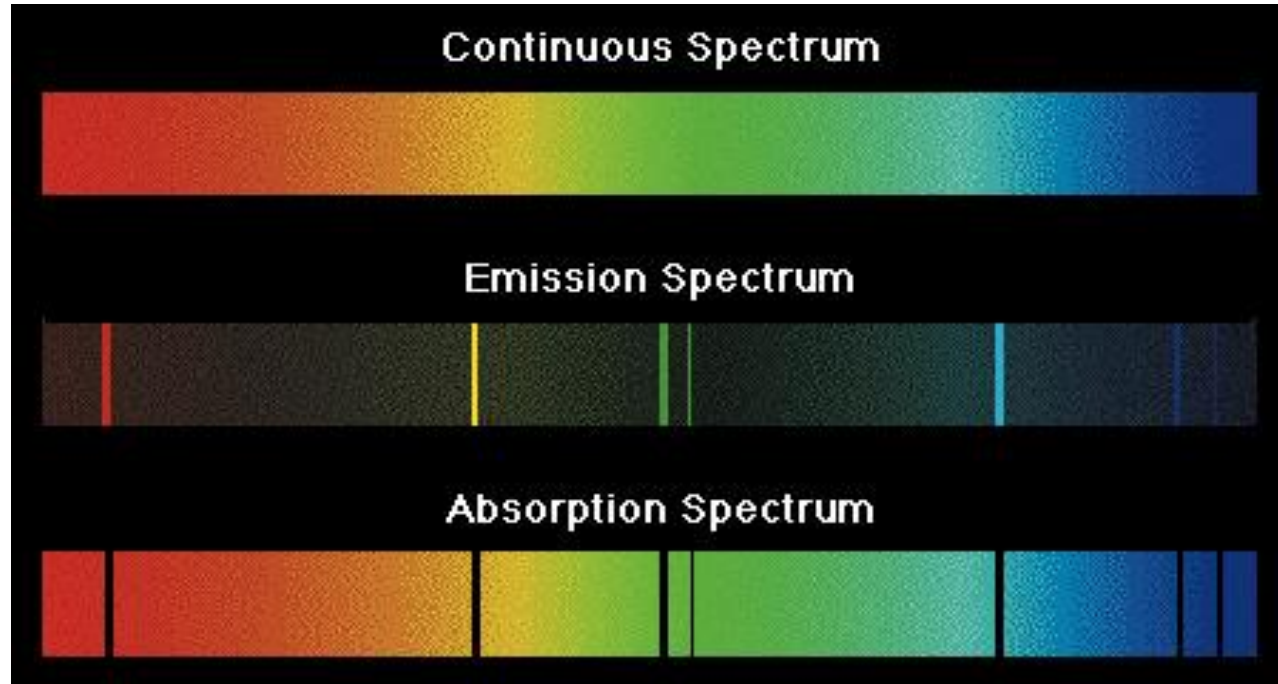
Atomic and Molecular Astrophysics

- The Universe reveals its secrets through photons
- The photons are most useful when they have been analyzed with a spectrometer
- A large part of A & M Astrophysics is directly motivated by the need to understand what the photons are telling us
- The range of wavelengths -- many decades in the electromagnetic spectrum, from radio wavelengths (searches for interstellar molecules) through the x-ray region where the most energetic objects in the universe are seen (hot gas around black hole)





Brief Tutorial on Spectroscopy



- Atoms and molecules emit or absorb radiation only at particular wavelengths (frequencies)
- A spectrum is like a set of “fingerprints”, useful in identifying the presence of atoms, ions, and molecules

Spectra tell us so much...

- Presence of a line
- Position of a line
- Strength of absorp.line
- Emission line ratios for two transitions of the same ion
- Line widths
- Atom, ion or molecule
- Velocity of source (Doppler shift)
- Density along LOS
- Electron temperature, electron density in the source
- Collision-broadening, gas pressure, temperature

Astronomical Needs for Atomic and Molecular Physics

- Spectroscopic information on atoms, ions, and molecules (wavelengths, line intensities)
- Astron. Spectra can be used to deduce physical conditions of objects (temperatures, electron density, ambient radiation field, velocities, opacities, ionization balance, etc.) if one has a knowledge of a variety of atomic collision processes
- Building theoretical models (e.g. chemistry of the Early Universe) requires knowledge of both spectroscopy and collision processes

Some of my research topics

- Formation/destruction of interstellar molecules
- Molecule formation in the Early Universe
- Molecules in cool stellar atmospheres, brown dwarfs, and extrasolar giant planets
- Developed accurate diagnostics for X-ray astrophysical plasmas: excitation of highly-charged ions by collisions with electrons

Exciting Time for Atomic and Molecular Astrophysics

New space missions, new ground-based facilities, with higher spectroscopic resolution and greater sensitivities --> New Discoveries.

A knowledge of atomic and molecular physics is essential in understanding the observations and extracting the science.

More Research, More Family

My 2nd child, Elizabeth,
was born...

Research career thrived

My 3rd child, Carolyn,
born 2 ½ yrs later

My 4th child, Jonathan,
born 5 yrs later...





And they grew up...

Recent Family Photo

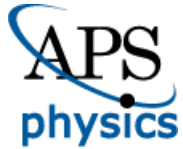


Key to Work/Family Balance

- A supportive partner
- A willingness to forego “me”-time
- Availability of excellent day-care (for my latter 3 children we had a wonderful nanny)
- Living close to work (in my case, 5 blocks away)
- Having perspective

Administrative Responsibilities in addition to my research

- Appointed Assoc. Dir. of H-S Center for Astrophysics, heading up the Atomic and Molecular Physics Division (13 years)
- Became Director of the Institute for Theor. Atomic, Molecular and Optical Physics – NSF funded (8 yrs)
- Prepared me for the unexpected opportunity to become the Executive Officer of the Am. Phys. Soc.



Executive Officer of APS (starting in July 2009)

- Very energizing to do something new and completely different!
- The opportunity to have a position with a broad perspective across all of physics was irresistible.
- Great familiarity with APS – elected as Chair of the Division of AMO Physics; served on committees, Exec. Bd. and Council of APS

APS Journals:

~ 20,000 physics articles/yr



One month of APS Journal publications

- Phys. Rev. Lett.
- Rev. Mod. Phys.
- Phys.Rev. E
- Phys.Rev. D
- Phys.Rev. C
- Phys.Rev. B
- Phys.Rev. A
- Phys.Rev. Applied (launched Jan. 2014)
- + 3 online only publications

APS General Meetings:

March, 2014 - Denver

5 days

~10,000 attendees

45% students

27% international

Focus areas: Condensed Matter, Materials, Polymers, Chemical Physics, Biological Physics, Computational Physics, Industrial & Applied Physics



The American Physical Society

APS General Meetings:

April, 2014 – Savannah, GA

4 days

~1,400 attendees

37% students

8% international

Focus areas: Nuclear Physics, Particles & Fields, Astrophysics, Gravitation, plus Forum sessions



The American Physical Society

Programmatic Activities Include:



Education – improving the quality of physics education from high school through college and graduate school (studies for M.S. and Ph.D. degrees);

Outreach – communicating the excitement and value of physics to the general public;



International Affairs – fostering opportunities for global engagement for members of the physics community; partnering with physics societies internationally



Public Affairs – advocating for government funding of physics research; and contributing physics expertise in addressing problems of national interest.

What APS can do for you!

(APS membership is free for undergrads)

- Opportunity to attend meetings (particularly section meetings) – broaden your horizons, meet new people, discuss your interests
- Actively engage/volunteer
 - More people get to know you
 - You expand your range of contacts (helpful for jobs)
 - Expand your range of research and career options

Some Take-aways

- An example in which atomic and molecular physics plays a critical role in building an astrophysical model – molecules in the E.U.
- Taking on administrative responsibilities as well as doing the science can lead to new opportunities
- Adding in family responsibilities (children) creates challenges, but adds incredible emotional richness to one's life
- APS has many resources to help you on your own individual journeys in physics