Careers in With Physics: Dispelling the Myth

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THE MYTH: There are no jobs in physics.

THE REALITY: There are many good jobs with physics.
Outline

- The economics of a degree in physics: indicators of supply and demand.
- What do physicists do: post-BS education and employment outcomes.
- How to compete in this game: options and strategies.
- How you can learn more.
But first, a definition:

“physicist” = anyone with a degree in physics
As with any market, supply and demand influence the professional options and ultimate outcomes for physicists.

Supply ↓ and Demand ↑ = Value ↑
Supply of Physicists is Down

- The supply of physicists is going down at all degree levels.

**Bachelors Production**

- Physics Bachelor's
- All Bachelor's

**First Year Grad School Enrollments**

- Number of first-year students

Sources: AIP Statistics Division
Demand for Physicists is Up

- Demand for physicists can be measured using two indicators:
  - relative unemployment rate
  - relative salary
- Unemployment is low and below the overall national rate.
- Salaries are competitive, in absolute and relative terms.
Unemployment is Low

- Avg. *overall* unemployment rate fell from ~5.5% in ‘96 to ~5.0% in ‘97.
- For Physics Bachelors, unemployment has dropped from 5% in ‘96 to 3% in ‘97.
- For Physics PhDs, unemployment has dropped from 4% in ‘96 to 2% in ‘97.

Data from BLS and AIP Statistics Div.
Physics PhDs Also Compete Favorably Compared to Other Disciplines

Unemployment Rates (1996-1997 PhDs as of mid-October)

Data from CPST
Salary as an Indicator of Demand

- Physicists rarely work as physicists (in the traditional sense).
- They typically work as managers, engineers, computer scientists, members of technical staff, and other “industrial” titles.
- But is a physics bachelors degree competitive?
- Can physics compete with engineering and computer science?
The Earning Power of Physics Training: Mid-Career

- Median annual earnings by college undergraduate major.
- Bachelors is terminal degree.
- Men aged 35-44 (mid-career).
- Data from Monthly Labor Review, 12/95 (p.3).
## The Earning Power of Physics Training: Mid-Career

<table>
<thead>
<tr>
<th>Rank</th>
<th>Field</th>
<th>Earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Engineering</td>
<td>$53,268</td>
</tr>
<tr>
<td>2.</td>
<td>Math</td>
<td>$51,584</td>
</tr>
<tr>
<td>3.</td>
<td>Computer Science</td>
<td>$50,509</td>
</tr>
<tr>
<td>4.</td>
<td>Pharmacy</td>
<td>$50,480</td>
</tr>
<tr>
<td>5.</td>
<td>Physics</td>
<td>$50,128</td>
</tr>
<tr>
<td>6.</td>
<td>Accounting</td>
<td>$49,500</td>
</tr>
<tr>
<td>7.</td>
<td>Economics</td>
<td>$49,377</td>
</tr>
<tr>
<td>8.</td>
<td>Engineering Tech.</td>
<td>$45,799</td>
</tr>
<tr>
<td>9.</td>
<td>Chemistry</td>
<td>$44,989</td>
</tr>
<tr>
<td>10.</td>
<td>Business</td>
<td>$44,865</td>
</tr>
<tr>
<td>11.</td>
<td>Nursing</td>
<td>$44,677</td>
</tr>
<tr>
<td></td>
<td><strong>ALL FIELDS</strong></td>
<td><strong>$43,199</strong></td>
</tr>
<tr>
<td>12.</td>
<td>Architecture</td>
<td>$42,603</td>
</tr>
</tbody>
</table>

Data from NSF and BLS
The Earning Power of Physics Training: Late-Career -- Growth Potential

- Median annual earnings by college undergraduate major.
- Bachelors is terminal degree.
- Men aged 45-64 (late-career).
- Data from Monthly Labor Review, 12/95 (p.3).
The Earning Power of Physics Training: Late-Career (w/ %growth from mid-career)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Field</th>
<th>Salary</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Physics</td>
<td>$61,965</td>
<td>24%</td>
</tr>
<tr>
<td>2.</td>
<td>Engineering</td>
<td>$59,213</td>
<td>11%</td>
</tr>
<tr>
<td>3.</td>
<td>Mathematics</td>
<td>$56,388</td>
<td>9%</td>
</tr>
<tr>
<td>4.</td>
<td>Accounting</td>
<td>$54,737</td>
<td>11%</td>
</tr>
<tr>
<td>5.</td>
<td>Economics</td>
<td>$52,263</td>
<td>6%</td>
</tr>
<tr>
<td>6.</td>
<td>Chemistry</td>
<td>$52,146</td>
<td>16%</td>
</tr>
<tr>
<td>7.</td>
<td>Comp. Sci.</td>
<td>$51,943</td>
<td>3%</td>
</tr>
<tr>
<td>8.</td>
<td>Enginrg. Tech.</td>
<td>$51,278</td>
<td>12%</td>
</tr>
<tr>
<td>9.</td>
<td>Pharmacy</td>
<td>$51,026</td>
<td>1%</td>
</tr>
<tr>
<td>10.</td>
<td>Business</td>
<td>$50,895</td>
<td>13%</td>
</tr>
<tr>
<td>11.</td>
<td>Communications</td>
<td>$49,984</td>
<td>28%</td>
</tr>
<tr>
<td>12.</td>
<td>Poli. Sci. &amp; Gov’t.</td>
<td>$49,922</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>ALL FIELDS</td>
<td>$49,390</td>
<td>14%</td>
</tr>
<tr>
<td>13.</td>
<td>Geology</td>
<td>$49,007</td>
<td>16%</td>
</tr>
</tbody>
</table>

Data from NSF and BLS
Median Earnings as a Function of Occupation and Field of Study

- Field of study is bachelors level, with bachelors being highest degree earned.
- Salaries are for men aged 25 - 64.
- Data from Monthly Labor Review, 12/95 (p.3).
Median Bachelors Earnings as a Function of Occupation and Field of Study

<table>
<thead>
<tr>
<th>FIELD</th>
<th>ALL MAJORS</th>
<th>PHYSICS</th>
<th>ENGINEERING</th>
<th>COMP. SCI.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL OCCUPATIONS</td>
<td>$42.5K</td>
<td>$50.4K</td>
<td>$51.6K</td>
<td>$44.9K</td>
</tr>
<tr>
<td>PHYSICAL SCIENTISTS</td>
<td>$40.7K</td>
<td>$42.8K</td>
<td>$43.1K</td>
<td>NA</td>
</tr>
<tr>
<td>ENGINEERS, INCL. COMPUTER</td>
<td>$50.4K</td>
<td>$57.5K</td>
<td>$51.5K</td>
<td>$49.1K</td>
</tr>
<tr>
<td>COMPUTER OCCUPS. EXCL. ENGINEERS</td>
<td>$44.9K</td>
<td>$49.4K</td>
<td>$48.4K</td>
<td>$43.8K</td>
</tr>
</tbody>
</table>

Data from NSF and BLS
We have established that physicists have high economic value.

What physics grads do after their BS shows how that value is realized.

The secret is career diversity and flexibility.
So Where Do Physicists Go?
50,000 Physics Bachelors in U.S.A.

- 15,000 Graduate Study in Physics
- 10,000 Graduate Study in Other Fields
- 23,000 Enter Workplace
- 2,000 Unknown

Non USA Students 10,000

Graduate Study in Physics
There are about 200K physics degree holders in the workforce (BS, MS, PhD, obtained in US).

About 16% (32K) of physics bachelors educated in the US get a PhD in physics.

Of these 32K US-trained PhDs, only about 40% are teaching or doing long-range physics research (ie., traditional physics).

There has been an influx of about 4K PhD physicists from abroad.

Thus, of the 200K US-trained physicists in the workforce, only about 7% are doing “physics” in the traditional sense.
If only 7% of our bachelors end up working as “physicists” (in the traditional sense), then what are the rest doing?
Where Do Physicists Work?
Where Do PhD Physicists Work?

- Academia -- 45%
- Industry -- 33%
- Government -- 22%
Where Do MS Physicists Work?

- Academia (incl. HS) -- 27%
- Industry -- 40%
- Government (incl. military) -- 28%
Where Do BS Physicists Work?

- Academia (incl. HS) -- 17%
- Industry -- 63%
- Government (incl. military) -- 17%

- We’re starting to paint a picture here.
Job Titles From the ΣΠΣ Survey: Engineers

- **Test engineer**, automotive seat design.
- **Analytical systems engineer**, fluid control system.
- **Airframe design engineer**, industrial & commercial architecture.
- **Semiconductor process engineer**, thin films.
- **Manufacturing engineer**, plant & safety maintenance.
- **Senior design engineer**, communications satellites.
- **Senior engineer**, optical processors.
- **Systems engineer**, GUIs, vision code.
Why is it, that whenever physicists make money they’re called engineers?
They’re not engineers. They’re industrial physicists!
Job Titles From the ΣΠΣ Survey: Computer Scientists

- **Senior scientist**, software for underwater acoustical data analysis.
- **Computer programming contractor**, mapping and database software for a telephone company.
- **Systems analyst**, communications routing systems.
- **Software developer**, object-oriented software.
- **Computer consultant**, automated business & engineering processes.
- **Software engineer**, CAD preprocessor algorithms.
- **Owner**, computer graphics & multimedia production firm.
Job Titles From the ΣΠΣ Survey: Managers

- **Quality supervisor**, plastics testing.
- **Plant engineering manager**, capital purchases.
- **Divisional VP of operations**, Wall Street firm.
- **Manager of geometric analysis**, aerospace systems.
- **President**, optical manufacturing firm.
- **Marketing director**, electronics company.
- **Technical manager**, VLSI design transfer to IC manufacture.
- **Engineering technical manager**, digital signal processing.
Physicists also become doctors and lawyers:

- Math and science majors tend to out-perform their counterparts from other majors on the MCAT and LSAT.
- Medical and law schools are very attracted to “non-traditional” applicants and they particularly like physicists.
Why Do Employers Like Physicists?

- Problem-solving ability.
- Math skills.
- Computation skills.
- Experience with instrumentation / measurement.
- Quick study.
Why Do Employers Like Physicists?

- Oh yeah, knowledge of physics -- that can be valuable too.
• Physicists have high economic value.
• This value is derived from quality training and career diversity.
• How can you compete in this game?
How can physics majors realize their full career potential?

- Expand your personal list of career options.
- Learn how to market yourself strategically (no generic CVs!).
- Use summers effectively (internships, coops, jobs outside of physics). EXPERIENCE IS KEY!
- Focus on your skills, what you have accomplished, and couple these to the employer’s needs (your physics may be irrelevant!).
- Consider a masters degree to diversify and build skills.
Masters or PhD?

- The decline in PhD enrollments means there are many opportunities if you want to go to grad school.
- However, the academic job market cannot absorb all who want to be a professor.
- But, the economic data indicates that across sectors, PhDs are in demand.
- What about a Masters? Is it a viable option?
Masters or PhD?

- Industry expresses increasing interest in masters.
- But not just any masters; industry values those with a “professional masters” degree in physics.
- Or, they like people with a BS in physics and masters in a separate field: CS, EE, MBA, Materials.
- The key is that the degree provide knowledge, skills, and experience that a particular sector values.
Professional Masters Degree

- Ideal Characteristics:
  - Courses are more applied and geared toward industrial problems.
  - Internship and/or project required.
  - Thesis not required (it’s not a research degree.)
  - Courses outside of physics.
  - Flexible scheduling.
  - Fixed time-frame, < 2 years.
  - Students may be self- or employer-supported -- i.e., no TAs or RAs (this is a major indicator of the market).
Professional Masters Degree

Examples:

- USC “Physics with Business Applications”
  http://physics.usc.edu/Graduate/degreePrograms.html

- University of Oregon “Applied Masters Program”
  http://physics.uoregon.edu/physics/apm.html

- SUNY Stonybrook “Scientific Instrumentation”
  http://insti.physics.sunysb.edu/Physics/msi_intro.htm

- Texas Tech University “Semiconductor Internship”
  http://www.phys.ttu.edu/~ritlg/msihtml/prof_masters.html

- San Jose State “Computational Physics Concentration”
  http://newton.sjsu.edu/Masters.htm

- George Washington University “Computational Science”
  http://www.va.gwu.edu/computation/index.html

- Rochester “Optics Co-op Program”
Useful references.

- http://www.aip.org/industry.html
- *Preparing Physicists for Work* (AIP)
- *Careers for Physicists* (AIP & Sloan)
- http://www.nextwave.org/ (AAAS)
Careers for Physicists

- Funded by the Sloan Foundation.
- Survey of members of Sigma Pi Sigma
- Online Careers Bulletin Board
- Video
  - NOW AVAILABLE
- CD-ROM
  - NOW AVAILABLE
- World Wide Web Information Site
  - http://www.aip.org/careercornerstone/
Concluding Comments

- Economically, physics is a viable option, leading to a wide array of high-paying and rewarding professions.
- Physics is great training for an ill-defined technical workplace.
- Physics is an excellent education for those who love physics and who have not narrowed their career goals.
- Do SPS, use summers wisely, do research, give talks, diversify.
- Maybe a masters is the best choice?
- Sculpt your education and experience into a package employers cannot ignore.
Play the game smartly and confidently, and you will do fine!
THANK YOU!

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