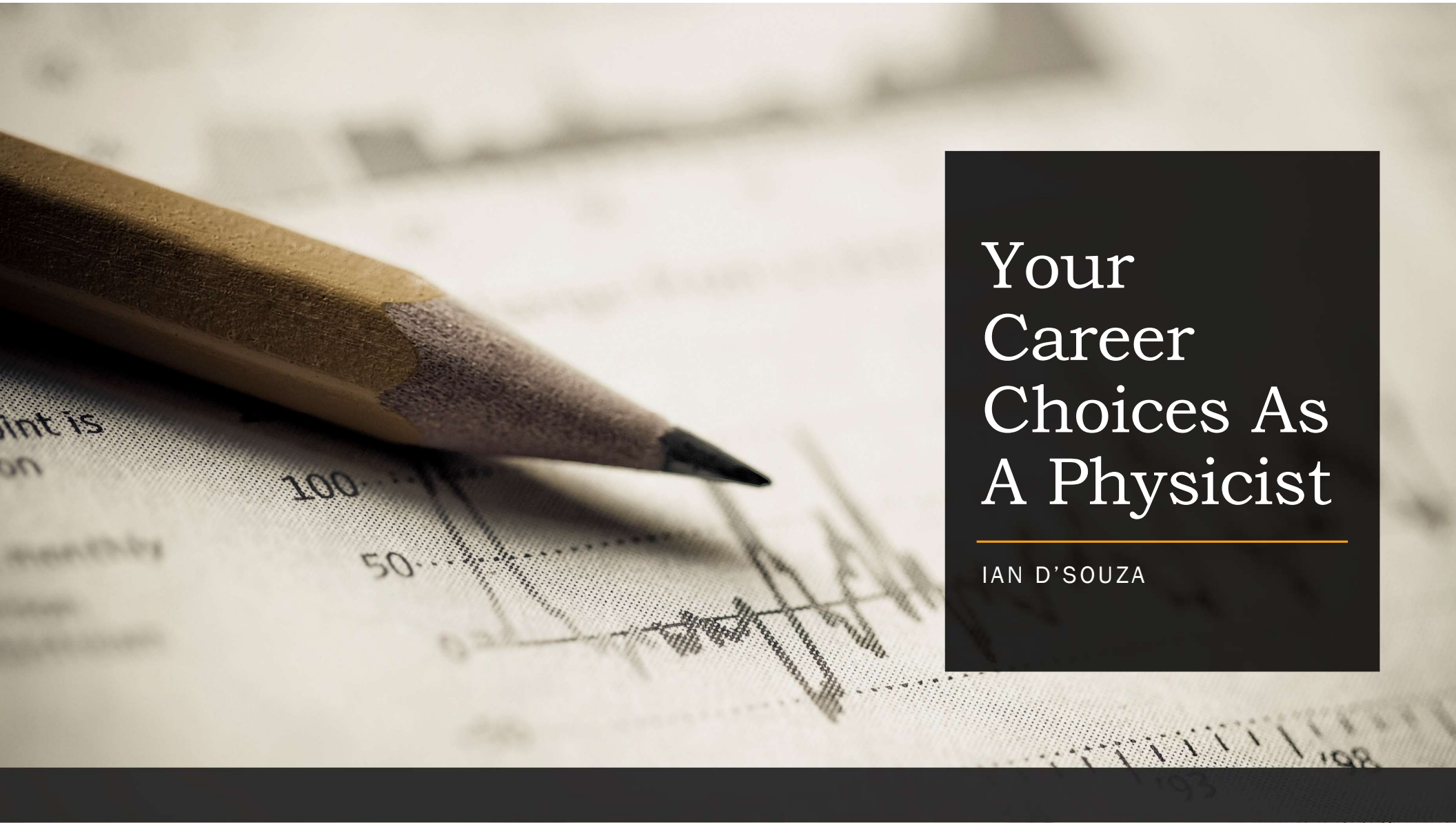


Your Career Choices As A Physicist

IAN D'SOUZA

Careers for physicists

Who am I?

What is this talk about?

...YOUR EMPLOYMENT OPPORTUNITIES; USING YOUR SKILLS.

What are the statistics?

...YOU WILL LIKELY HAVE A GOOD JOB, BUT..

How does Canada look?

... SIMILAR? MAYBE. JUST IN CANADIAN DOLLARS

Skills

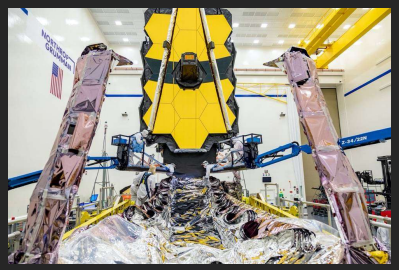
...PHYSICS SKILLS VS OTHER SKILLS

Who am I?

“One can debate whether physics is a field of scholarship or a profession. For us, it is both. We believe that the latter aspect is essential for the continued health of the physics community. Public support for physics research is usually based on the promise of future applications and contributions to economic growth or on an appeal to national pride, not necessarily on scholarship.

… regarding physics as a profession in addition to a scholarly pursuit recognizes the usefulness of physicists and the impact of the science on society.”

Craig Davis, *Physics Dept., Ford Research Laboratory*
James Tsang, *Member of Research Staff, IBM T. J. Watson Research Center*



JWST: FGS & NIRSS - NASA

WildFireSat - CSA

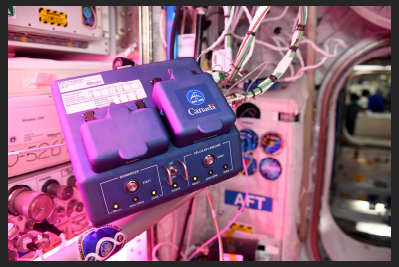
Who am I?

BSc physics (McGill)

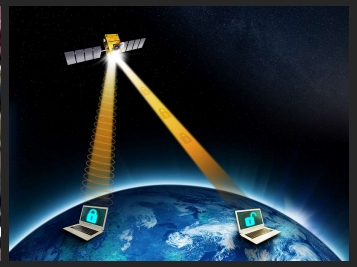
PhD theoretical particle physics (Concordia)

Worked in Design Engineering for more than 30 yr

Director of Private Sector Physics (Canadian Association of Physicists)



BioAnalyzer on ISS - CSA



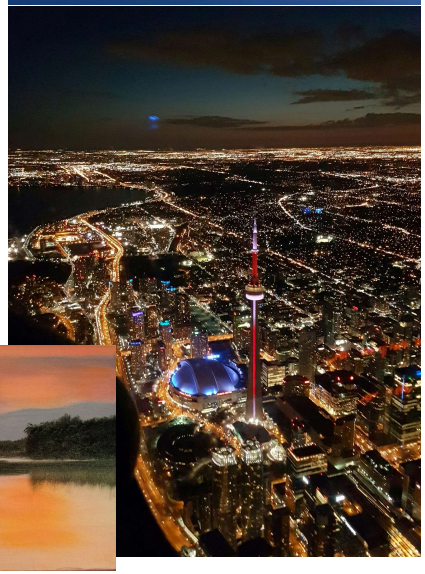
QEYSSat - CSA

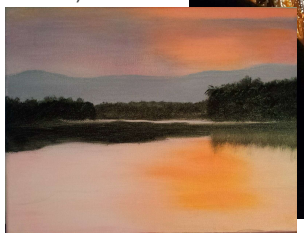
<u>Current positions</u>: *Principal Scientist, R&D, Honeywell Aerospace*. Our group does space science instruments (atmospheric imagers, ionospheric and magnetic field instruments, optical telescope instrumentation, long distance Bell test of quantum entanglement, wildfire radiometric instrument, bio-medical instruments for the ISS), and microsatellite missions and constellation design.

Director of Private Sector Physics, CAP

<u>Past positions/job titles</u>: RF and Microwave Comms Design 'engineer'; Manager of Engineering; Staff Scientist; SAW Device Designer; (Space) Mission Scientist; Business Development; Project Scientist; Program Manager; Technical Lead AIS ship tracking with spin-off *exactEarth*; Adjunct Professor (Guelph)

<u>Distractions and Hobbies</u>: Electronics, Guitar, Painting, Flying (Private Pilot Licence).





What is this talk about?

…YOUR EMPLOYMENT OPPORTUNITIES; USING YOUR SKILLS.

Who's a physicist?

- Anyone who has a physics degree at undergraduate or further: BSc, BA, MSc, PhD, DPhil etc.
  - This is consistent with other degree programs (e.g., Engineering, Chemistry).
  - Defines a view that benefits the entire discipline of physics.
  - Shared culture that includes a scientific approach to problem analysis, and first-principles problem solving based on fundamental/foundational concepts.
- Why does it matter?
  - Physics is one of the most diluted disciplines – only a minority of physicists exist in academia, and ***public support*** of physics as being relevant and important, is waning.
  - This is because they think that physics today is not relevant to their lives – all they hear about is string theory, Higgs bosons and cosmology. They have no idea what physicists have contributed.

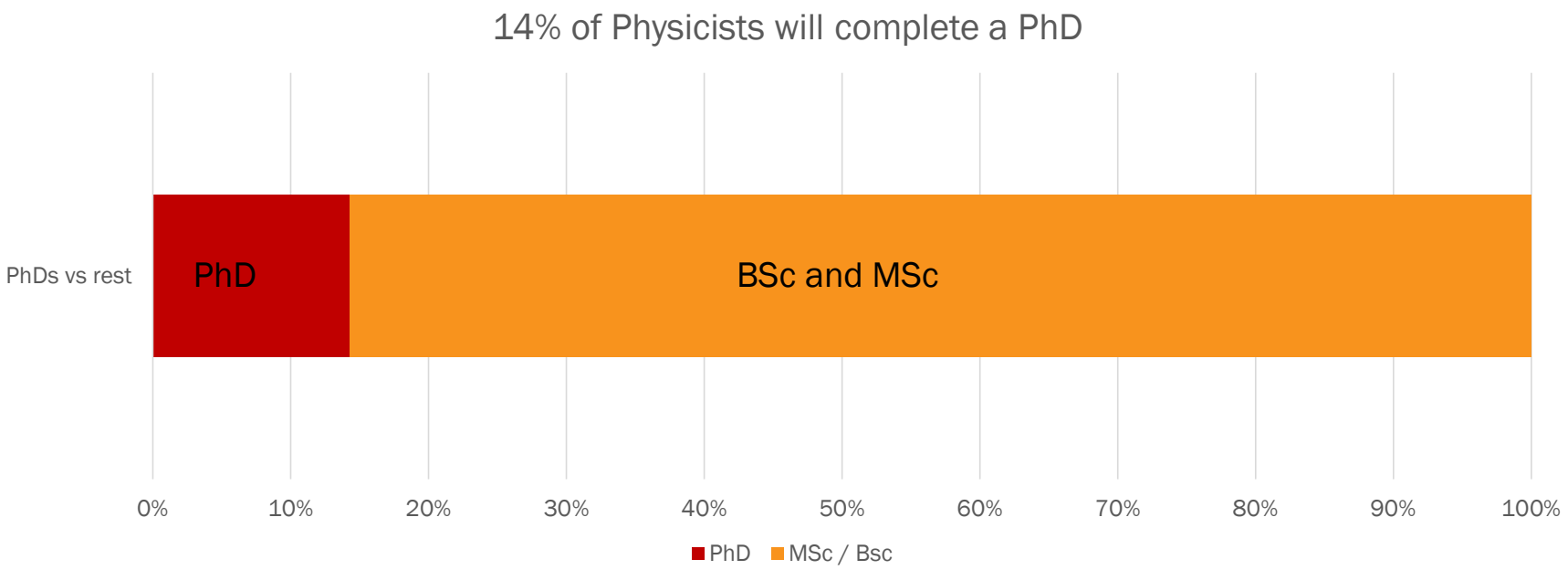
Where's a physicist?

- Today, physicists (and their contributions) are hidden.
  - TODAY: Physics jobs that relate to the subject matter that you studied in grad school, only exists in university environments.
- Once upon a time, the advances of physics made a direct impact on the world and the public reaped the benefits:
  - Mechanics, Optics, Thermodynamics, Statistical mechanics, Radio-waves, radar
  - The Transistor (and hence the IC and all of modern computing), Modern Communications
  - Nuclear Energy
  - The Laser (and all related items, fiber, optoelectronics etc)
- Today physicists are far ahead of current engineering technology. Today's technology is the physics from more than 50 years ago
- Today, graduating physicists are employed in **many disciplines** other than academic physics and they are hidden.
  - Physicists work under various job titles: *Engineer, Computer Scientist, 'Scientist', Financial Analyst, Group Leader (multi-disciplinary team) etc.*
  - If someday you are in a position to hire, you may want to consider hiring a 'physicist'

What are the statistics?

…YOU WILL LIKELY HAVE A GOOD JOB, BUT..

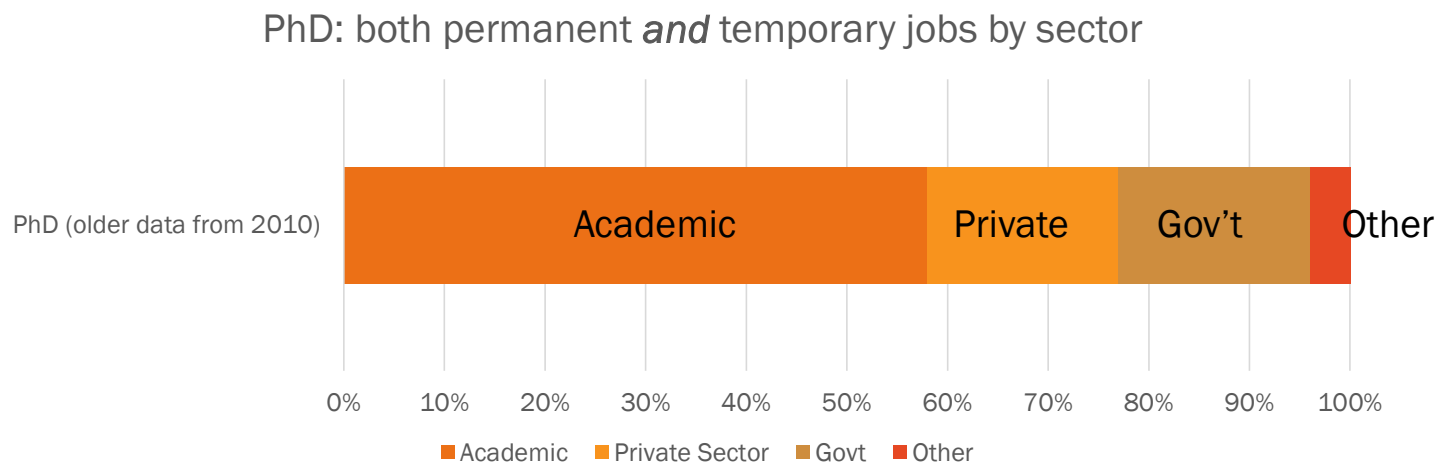
Here is what happens to physics PhDs (statistically)* 1



**USA Data from the AIP*

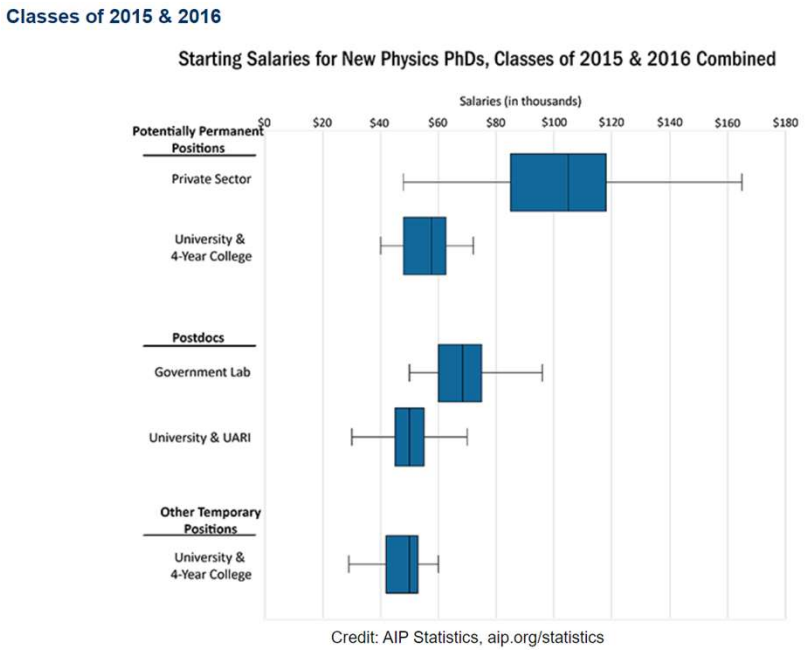
Here is what happens to physics PhDs (statistically) 2

- Of the 14% PhDs, they split as follows



Of these, the permanent jobs were: Academic (23%), Private Sector (57%), Gov't (16%), Other (4%)

Typical PhD starting salary (AIP)

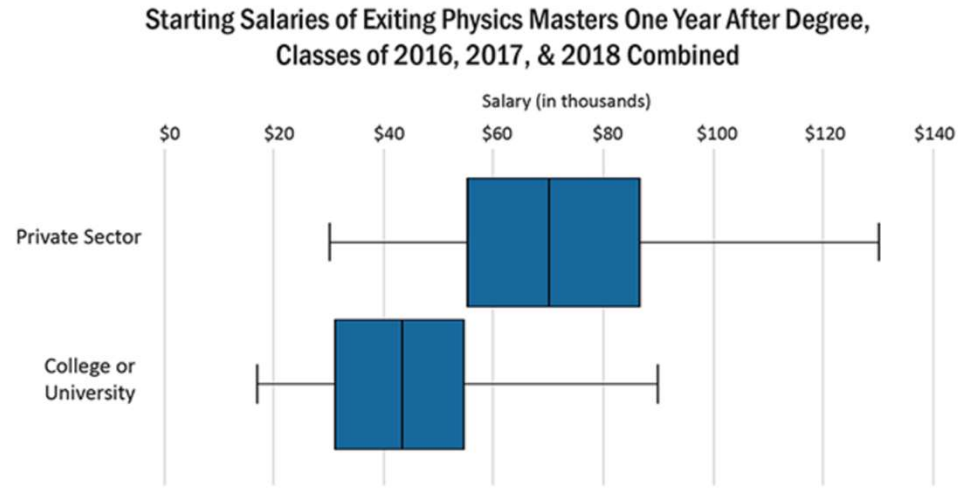


Credit: AIP Statistics, aip.org/statistics

Non-weighted avg of these medians is about $65k
See later for Canadian stat.

Typical MSc starting salary (AIP)

Classes of 2016, 2017, & 2018

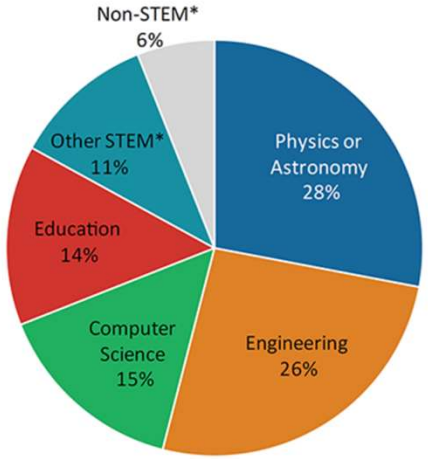


Credit: AIP Statistics, aip.org/statistics

(Exiting)MSc physics grads

Classes of 2016-2018

Fields of Employment of Exiting Physics Masters One Year After Degree, Classes of 2016, 2017, & 2018 Combined

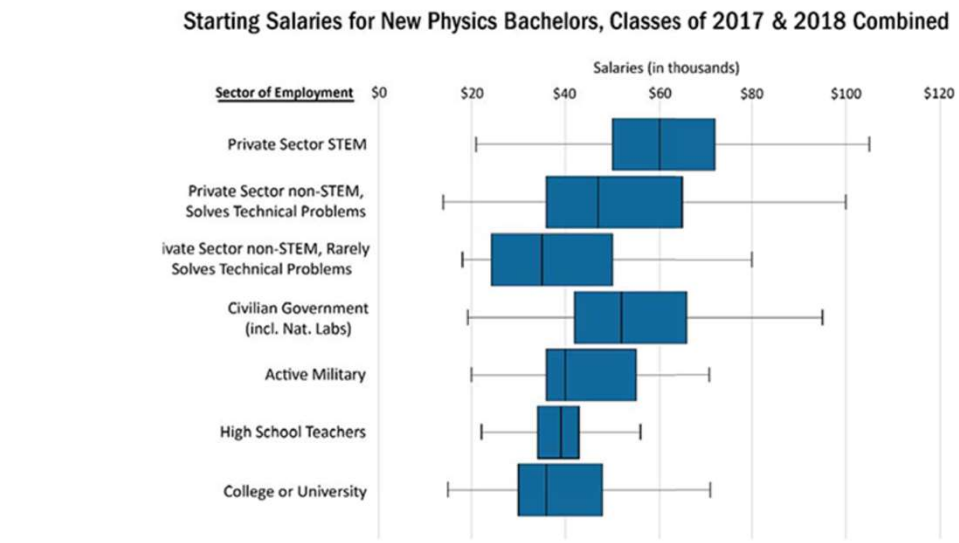


Credit: AIP Statistics, aip.org/statistics

Exiting masters are individuals who, upon receiving their master's degree, leave their current physics departments.
Figure includes US-employed physics masters, including those who were employed part-time and masters continuing in positions they held while pursuing their degrees.
Figure is based on responses of 331 individuals

Typical BSc starting salary (AIP)

Classes of 2017 and 2018



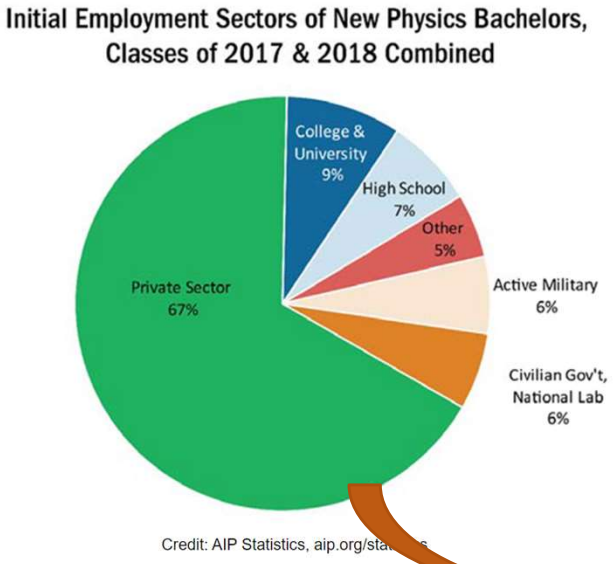
Credit: AIP Statistical Research Center, *Focus on Physics Bachelor's Initial Employment*

Full time, newly accepted positions only. The average of the medians is $44k

BSc & private sector breakdown

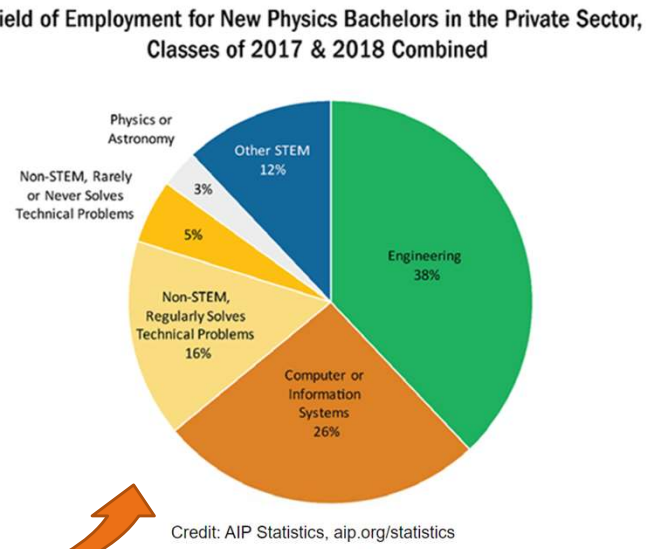
Initial Employment Sectors for Physics Bachelors

Classes of 2017 and 2018



Field of Employment for Physics Bachelors in the Private Sector

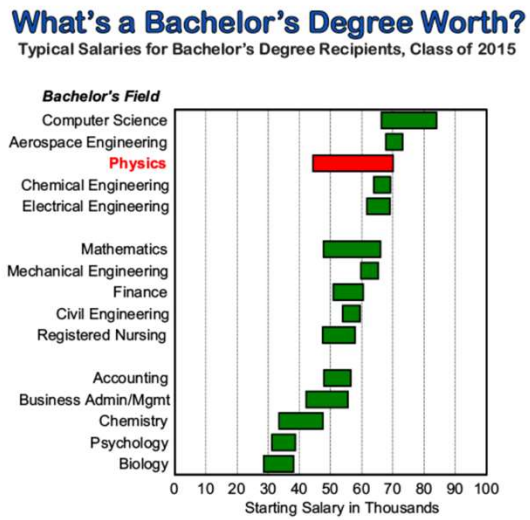
Classes of 2017 and 2018



Private sector breakdown

Where do physics BSc fit?

Academic Year 2015-2016



Credit: AIP Statistics, aip.org/statistics

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

Workforce Summary

- Faculty positions are not the most common career path for physicists! There are too few faculty positions compared to the number of ‘physicists’ (BSc, MSc, PhD) we graduate.
- Industry/private sector is the largest employer of physics PhD, MSc, and BSc
- You may not be working under the title of ‘physicist’ in industry (but please identify as one!)
- As a PhD you may or may not be working in a related field of physics in the private sector: (27%) physics research in different subfield, (31%) physics research in same subfield, (42%) different field than physics.
- Less than 50% of PhD are employed in Engineering, Business/Finance, Education or Medical Services

How does Canada look?

… SIMILAR? MAYBE. JUST IN CANADIAN DOLLARS

Canadian Data (there is very little)

Stats Can (for the period prior to COVID-19)

Physics PhD: 5-yr median earnings, adjusted for age, institution and graduation year:

$75,000 (compare with US $65k starting salary non-weighted avg over medians)

No breakdown by sector available.

Physics BSc: 5-yr median earnings, adjusted for age, institution and graduation year:

$68,000 (compare with US new hires with non-weighted avg of medians $44k)

No breakdown by sector available.

https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2020018-eng.htm
https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2020020-eng.htm
Which Doctoral / Bachelor's Degree Programs Were Associated with the Highest Pay Prior to the COVID-19 Pandemic?

Skills

…PHYSICS SKILLS VS OTHER SKILLS

What skills you have (employers know this)

- Physics: how the world works, bottom up and top down.
- Mathematics
- Problem solving by breaking it down
- Probably computer programming / simulation skills
- Big picture grasp of how things work
- Multi disciplinary understanding (but not necessarily working with multi disciplinary teams)

Other skills you need (things employers say you don't have) 1

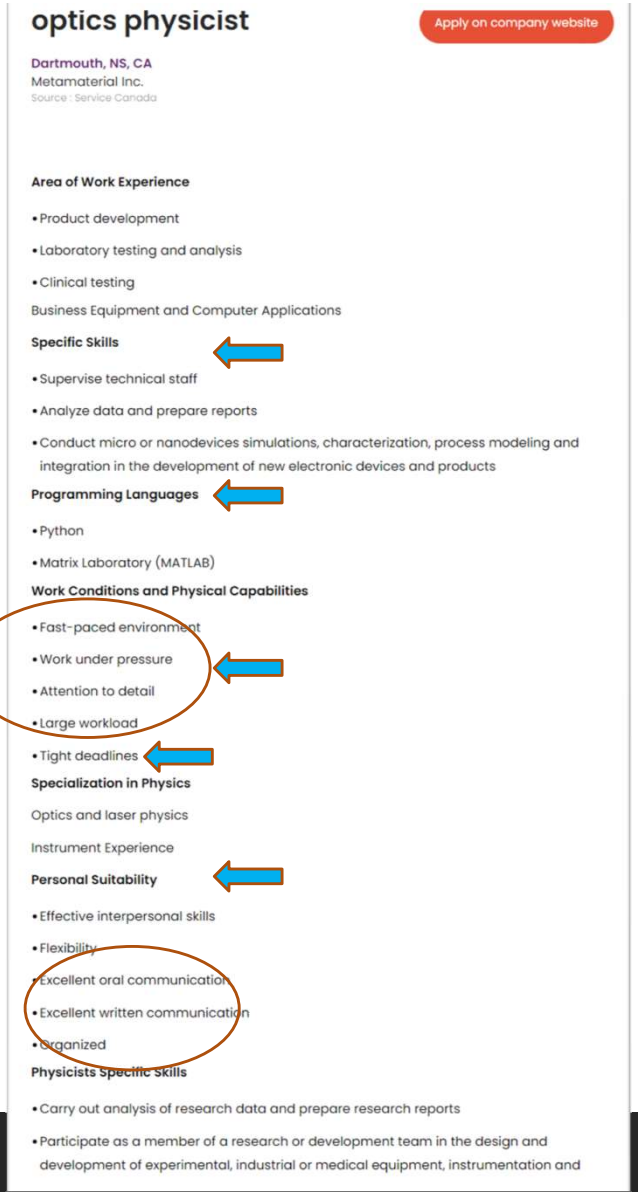
- Every subject area has its own jargon. You MUST learn the jargon of your job. You will be spoken to in jargon that you will likely find unfamiliar. There is a whole chunk of just business-related jargon.
- Analysis vs Synthesis – Physicists are good at analysis. Engineers are good at synthesis (design to a specification).
- Time-sensitivity: be on time. Deliver your results on time or early.
- Communication skills: How to tailor your message to the intended audience (customers, bosses, co-workers, vendors).
- Know how to approach people and network. Growing your network is the best way to get a sense of the company, and how you can fit in and help out better.
- People skills – the ability to FUNCTION in a multi-disciplinary team. Recognize the value of other team members

Other skills you need (things employers say you don't have) 2

- Time Management. Often you will be required to only put in a maximum number of hours to do a task. You must manage your time to make that happen.
- You will have multiple tasks, or jobs or projects that all need to be worked into your own schedule. They will often be run by different managers, who will have expectations and you will have time conflicts.
- There will be regular job evaluations, and your boss may get feedback from your co-workers or other managers (maybe including that one incompetent person).
- Be fair and give proper credit to whoever and wherever it is due.
- Leadership: You may have to oversee or supervise an activity or team. Learn the needed team leading skills.
- Learn some basic accounting/finance/marketing/proj management business skills. Intellectual property protection.

$46/hr = $95k

Examples of jobs found in job search site. Does not say degree requirement



optics physicist

Apply on company website

Dartmouth, NS, CA
Metamaterial Inc.
Source : Service Canada

Area of Work Experience

- Product development
- Laboratory testing and analysis
- Clinical testing

Business Equipment and Computer Applications

Specific Skills

- Supervise technical staff
- Analyze data and prepare reports
- Conduct micro or nanodevices simulations, characterization, process modeling and integration in the development of new electronic devices and products

Programming Languages

- Python
- Matrix Laboratory (MATLAB)

Work Conditions and Physical Capabilities

- Fast-paced environment
- Work under pressure
- Attention to detail
- Large workload
- Tight deadlines

Specialization in Physics

Optics and laser physics

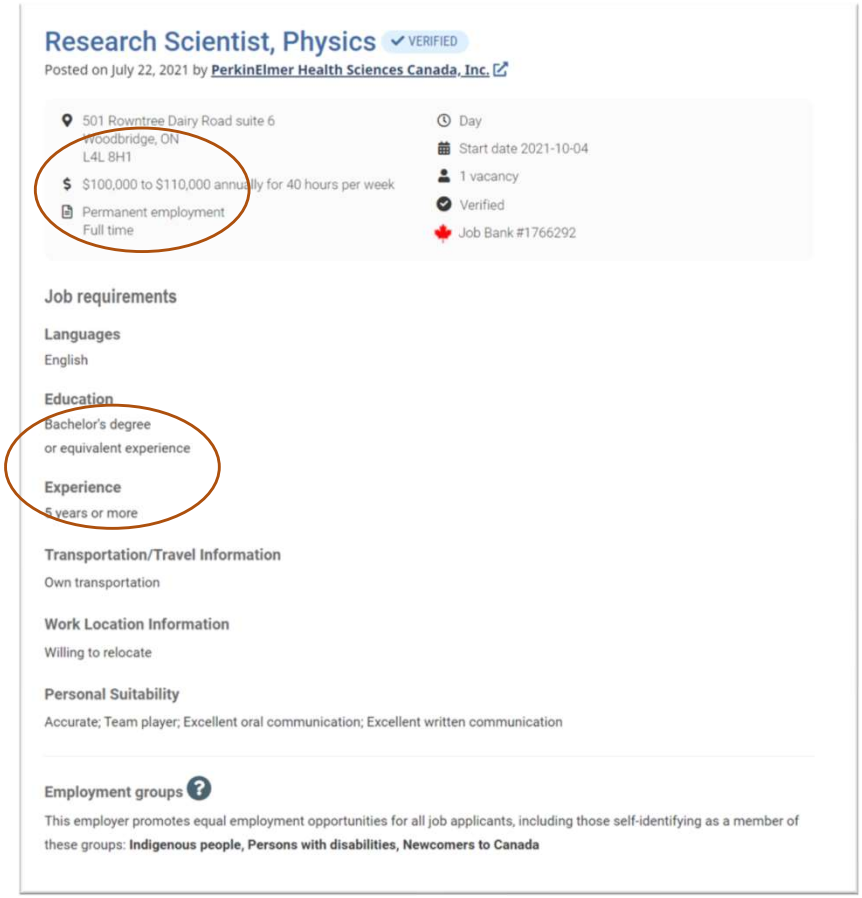
Instrument Experience

Personal Suitability

- Effective interpersonal skills
- Flexibility
- Excellent oral communication
- Excellent written communication
- Organized

Physicists Specific Skills

- Carry out analysis of research data and prepare research reports
- Participate as a member of a research or development team in the design and development of experimental, industrial or medical equipment, instrumentation and



Research Scientist, Physics

VERIFIED

Posted on July 22, 2021 by PerkinElmer Health Sciences Canada, Inc.

501 Rowntree Dairy Road suite 6
Woodbridge, ON
L4L 8H1

$100,000 to $110,000 annually for 40 hours per week

Permanent employment
Full time

Day
Start date 2021-10-04
1 vacancy
Verified
Job Bank #1766292

Job requirements

Languages
English

Education
Bachelor's degree
or equivalent experience

Experience
5 years or more

Transportation/Travel Information
Own transportation

Work Location Information
Willing to relocate

Personal Suitability
Accurate; Team player; Excellent oral communication; Excellent written communication

Employment groups

This employer promotes equal employment opportunities for all job applicants, including those self-identifying as a member of these groups: **Indigenous people, Persons with disabilities, Newcomers to Canada**

Thank You for Your Attention

- APS News, Nov 2001, Spotlight on the Profession of Physics, "*Physicists in the Engines of Tomorrow*", C. Davis, J. Tsang. Read it here: https://aps.org/publications/apsnews/200111/spotlight.cfm
- AIP Statistics pages: aip.org/statistics
- Stats Can: https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2020020-eng.htm and also https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2020018-eng.htm
- APS Success in Industry Careers Series: "*Why You Should Consider an Industry Career*", Crystal Bailey: https://youtu.be/YIEYPlm9y94
- Careers in Physics. Putting your science to work. https://www.aps.org/careers/guidance/webinars/science-to-work.cfm
- Crystal Bailey's talks and pages: Google "Breaking the Myth of the "Non-Traditional" Physicists, also see her talk by same title in the June CAP Congress, Session TS-5 (if you are a CAP member and attended the congress).
- The CAP Congress June 2021, Private Sector Physics Symposium TS-5, panel discussion and talks. (if you are a CAP member and attended the congress)