Expanding your Career from Research Physics to Industry

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TLDR

So you want to transition from a physics PhD or postdoc to industry? Great! There's many ways to do it, and the journey is a little different for everyone. What we can tell you is what worked for us, and some of the many, many options you have.

Who Wrote This?

This document is an amalgam of the experience of several physics Ph.D. graduates who graduated around 2007-2010. They spent the most recent years in industry. Some did postdocs, some not.

Does Your Degree Matter?

Yes! But, unlike academia, the topic and result aren't that important. A Successful Ph.D. in basically anything is a signal that you can work on large problems without having the whole plan at the start, adjust to unexpected challenges, communicate, pick a solution from a host of options, and push through to completion. These skills are rare and valuable, and they're why PhDs are valued by employers. More than learning specific esoteric physics, you learned *how to learn*. If you also gained skills in computing, mathematics, or engineering during your thesis, and they're job-relevant, great! But make sure when you are asked about your research, you focus on the things that matter to the hirer: independence, grace in uncertainty, tenacity, and capacity for self-growth. Feel free to share your enthusiasm for the topic, but *how* you did your research might get you the job more than what the topic or end result was.

In a typical company, a Ph.D. at hire time is equivalent to ~4 years of experience, salary wise. In the long run, at the best companies, demonstrated skills matter much more than degrees for long-term promotion and compensation.

Finding a Job To Apply For

 Unlike faculty positions, there are literally *thousands* of industry jobs hiring right now that you probably qualify for, but employers don't always know how to advertise to physicists effectively. You may not know from reading a posting if the job is a good fit, and the employers don't know

how to find you. Searching for "physics" on LinkedIn is pretty useless. Lots of jobs like trading quants, which are historically perfect for physicists, will say "Ph.D. in Math or related field." This will not appear in a "physics" search.

Some resources:
- **Former colleagues**. We know physics PhDs in software, electrical engineering, analytics, medical device manufacturing, local politics, chemical manufacturing, aerospace, … they are all, by and large, very happy.
- **Searches**: Search for the *role* you have performed or desire, ***not the title***. Search for software engineering, operations management, machining, prototyping, instruction, design, engineering, analysis, project management, etc. These are all *roles* that many physicists perform during their dissertation or postdoc.
- **Job search websites** like LinkedIn etc. Keep your resume in sync with your profile, and recruiters may contact you directly ***occasionally***. This is not a good strategy if you are actively looking. BEWARE: most reach-out recruiters of fresh PhDs and undergrads are headhunter scams. If they have the same email address and employer as the hirer, great! If they are asking your interest in an X Corp job, but have a "johndoeassociates.com" or "analyticsbuzzwordstaffing.com" email address, ignore them. Their goal typically is to hire you out as a contractor, and skim your salary. Don't even reply to them. Apply directly to the company. They offer you nothing.
- **Groomers**: see the website of insightdatascience.com for an example program. These organizations, there are many, take fresh PhDs, groom them a little, and then pass them to tech companies who paid in advance. The tech companies get a refined source of talent, the candidates get an introduction to a field and a bunch of chances to learn about the companies they apply for. Win win win. We know two folks that went through insight, and were happy with the result. There are several of these. Just ask yourself though, how do these organizations make their money? If they are contracted and paid directly by the hirers, great! If they are looking to garnish wages from successful hires, you should be highly suspicious.

Choosing The Jobs to Apply For

First, ask yourself what you want out of a job:
- Specific location?
- Lots of travel, or none?
- Steady work or always changing?
- Lots of free time or lots of money?
- Time flexibility or steady paycheck?
- Financial stability or the chance to get rich?
- Work by yourself or on a team?
- Work with customers directly or only with employees?
- Lots of guidance or lots of freedom?
- Do you like wearing business clothes or casual?

- Ethics constraints: are there industries you refuse to work in, like weapons, gambling, or finance?

These aren't either/or questions, but you should be able to locally rank them.

Types of Company

- **Startup**: the wild west. Each one is different, but the defining feature is that they are *not-yet-profitable,* but may become so. Many are small, but some, like Uber, are huge. Their goal is to continuously convince investors to invest, to grow, and become profitable. Most startups define success as selling out to a larger company or taking their stock public. Somekeep their identity after becoming profitable.
    - Pros: might mean lots of freedom, a new frontier, and maybe you get rich. You will probably learn a lot.
    - Cons: might go bankrupt at any moment, you might need to do things yourself that would be someone else's job at a different company. Many are cash strapped, and so might offer tricky stock options instead of health insurance. Many are very demanding for hours of work. Most are run as a dictatorship by a "founder," who might be a good person, genius, fraud, or sociopath. Probably some mix of the four.
- **Privately held company**: a profitable startup, which sells no stock, or only private stock. Too many varieties to describe. Some are old, some new, some well oiled machines, some crusty, some are chaos. Some are run by a board of directors, some by a single person.
    - Pros: not subject to the whims of the sock market. Might mean better long term planning.
    - Cons: subject to the whims of the owners. Maybe very poor long term planning.
- **Publicly Traded Company**: typically "large" either in terms of money, staff, or both. The fact that it is publicly traded often implies oversight. That means regulators make sure they're mostly honest about finances, and investors might impose some standards of operation and behavior, which can be a really good thing. What differentiates these is their investor types and their customers. If your investors are long-hold dividend seekers, then that's typically low chaos, low adventure. If they want capital gains then the company might be more capricious and chaotic, constantly trying new things and giving up before the experiments finish.
    - Pros: often have specialized departments to help you do things, like in-house lawyers. Steady paycheck.
    - Cons: depending on your investors, you might get a new set of goals every quarter. Potentially lots of burocracy and territorialism.
- **Federal or federal contractor:**
    - Often slow, steady work, but often with lots of burocracy.
- **Consultancy:** When a company needs experts it doesn't have, it might hire consultants for a specific project. This might mean they need to redesign their office telecommunications system, or write a website, or analyze some data that won't be a

recurring thing. The firm sends consultants for weeks or months or years to the customer site to do whatever.
  - ○ Pros: lots of variety. Often lots of travel, which might be a con.
  - ○ Cons: short periods of high stress, as there may be strong project deadlines.
- **Independent Contractor**: like above, but you work for yourself. We know a few software developers who do this. If you can keep 6 months+ salary in the bank for dry spells, and like independence, maybe a good idea for you after you learn an industry and make contacts. Likely not a good idea for your first job, though.

Types Of Industries

- **Commoditized and professionalized**:
  - ○ Fields that are 20 years old or more have the advantage of experience. We know how to change the oil in a car because it's been done many times. We know how to train someone to do it, and we know how to evaluate a candidate for the job of an oil change technician. We know how long the work takes, and how much to charge. When you see a job posting for an oil change technician, you know what it means. A Java Developer, Veterinarian, Police Officer, and Insurance Analyst are cases where many people do similar work, and that work is often well defined.
    - ■ Pros: in large organizations, steady work and pay.
    - ■ Often highly portable to new geographic areas.
    - ■ Cons: not flashy title. This is a pro for me, personally. Potentially lots of competition.
- **Boutique and emerging**
  - ○ People bandy about words like "ML Engineer" and "Data Scientist." as if they communicated something. They do mean something within a team, but within a company, two jobs with the same "Data Scientist" title might be very different. So ignore the title. Focus on what problems the team is trying to solve. Who are the customers? Who are the investors? What resources does the company have and what are they willing to try? What will the person filling the role be responsible for?
    - ■ Pros: flashy title
    - ■ Cons: the company might not know how to use you, and might dissolve the team after a few quarters. The job posting might also be a bait-and-switch, where the title is Data Scientist, but the work is a DBA or Data Analyst.

Interviewing

Resume

What's the difference between a CV and a resume? There's many answers to this question but I think most important is:
- CVs often focus on who you *are* relative to the <u>context</u> of your established subfield.
- Good resumes tell the story of what skills you *have demonstrated* and who you have helped.

 For example: your professor's name. Very common on a CV. It's useful information for a university hiring committee, because academia is a small, closed system full of cronyism and quid pro quo. Outside your tiny subfield though, no one knows who your adviser is, much less cares. Never put it on your resume unless the hiring company knows them professionally.

Both resumes and CVs are commonly presented in a chronological manner. They often aim to tell the story about how a child was born, and their life was an unbroken arc leading to them getting the job they are applying for today. Your life may not be continuous. Maybe you were a committed academic until recently. If so, a chronological resume is not for you.

A functional resume is a format which is organized not by time, but by *demonstrated* skills. Researcher is a title, not a skill.   Instructor is a title, not a skill. Software Development is a skill. Leadership is a skill.

So here's how you do it:
- Look at a job posting, and write down the stated required skills, one on each line. These are your functional resume section headings.
- For each section heading, add a brief description of a time you *demonstrated* that skill. Say what the deliverable was and who, beyond you, benefitted.
- Once you've filled out each skill section, add a brief chronology at the end, just because it's expected. No one really cares.
- Add, at the top of the resume, a brief summary. **Not of titles**, but of **roles** you've had. "Software developer with quantitative background and team leadership experience". Or perhaps "Systems modeler with project management experience." Or "Solutions architect with rapid prototyping experience." See how these are fitting to many HEP-Exp, Condensed Matter Theory, and Plasma Exp PhDs?

Broadcasting your resume.

- If you set up your LinkedIn profile, some companies let you one-click apply. I've never gotten a callback from these. Give it a shot, it's free.
- Adapting your resume for a specific job posting will take a long time at first, maybe 8hours. Practice will make it fast, maybe 30 minutes or less.

- Keep a vanilla template resume.
- Keep a folder for each company you apply for.
- In each folder, make a spare copy. Be CAREFUL if you ever copy from one company's version to another.
- Name your resume familyname_givenname_company_resume_YYYYMMDD.pdf never "resume.pdf" like the other 500 candidates.
- Never send a *.doc, or *.odx. Only pdf.
- Print out extra copies if you ever get an in house interview.

Letter of Intent, aka "Cover Letter"

Our contributors disagree, so here's the two extreme opinions:
- **Opinion #1:** Some job postings accept a letter of intent, where you're supposed to tell your story. **Don't ever send one** unless demanded by the application form or specifically suggested by the recruiter. They're rare to see in a technical application, waste time to write, and any careless mistake are grounds to drop your application. For a technical position, they're irrelevant at best. For a Physics PhD applicant, there's never an identical resume out there you are competing with. Work instead on an evidence-based resume.
- **Opinion #2**: Do your research, write a cover letter -- you are competing against other PhDs applying for this position. Assuming you all have the same background in the classroom, research projects, and subsequent supplemental data training, your resume is going to look the same, too. Show how you understand the business to which you're applying by tailoring a cover letter.

Miscellaneous Resume Advice

- Use the ****exact**** same wording as the job posting if possible.
- Make your section ordering to the job postings stated requirements. Make it easy for someone to see that you check many or all of the boxes.
- Don't include your address, unless requested, or you are local. It's easier to hire a local person, so recruiters prefer them. No one is going to notify you of an interview by post.
- Avoid subjective or value-judgement words where possible. Avoid "good," "expert," and "large". Unless you can recite PEP8, you are not a python "expert." Instead, say "three years python development experience." Better yet, say what you did with Python. Give evidence, not assertions.
- Avoid jargon and name dropping.
- Avoid lists of buzzwords. Say what you've used by saying how you used it and who it helped.
- Don't include information irrelevant to the job. Don't include your thesis title unless it **directly** applies to the job you're applying for.
- Get someone else to read it, preferably a non-scientist.

- Read it backwards. You'll find all sorts of mistakes. If a hirer has 11 equally good resumes by content, and only wants 10, they will throw out the one with careless mistakes.
- Your first industry job resume should likely be 1 page.   Making it longer can result in the critical information being difficult to find. Recruiter assistants might spend less than 60 seconds with a resume before deciding to pass it on or not. Make their job easy.

Your Story

 The biggest worries that hirers probably have about you is not intelligence or experience. Employers are much more likely to be worried that you are a "flight risk" and that you lack professionalism. Industry folks tend to have a physicist stereotype of an aloof daydreamer who can't speak in straightforward terms, and who is slumming it in industry and will return to academia at their first chance. You should have:
- A well rehearsed description of your research that is less than **30 seconds**, and could be understood by anyone with a high school education. It should explain how your work might benefit the general population, even if that application is vague or far off. Example: if you worked at CERN, "Understanding elementary particles is an enabler for some forms of clean energy production and cancer therapies. I didn't work on those applications directly, but the research I did could potentially benefit those applications in the future."
- A **5-minute** version of the above description. It should explain what you worked on specifically, and why that thing was hard. It should explain who your "consumers" were, who your collaborators were. Papers are products. Grants are products. Measurements are products that are consumed by theorists. Calculations are products consumed by experimentalists. Include group leadership, mentoring, grant writing. These are business-like activities. Who will miss you when you are gone?
- A coherent story about why you went into physics, why you're leaving now, and why you're applying to whatever job. "I mostly want to make more money, have more free time, and live in X because my family is here. I think this job has that, and also sounds like work I could be proud of." Is a perfectly fine story. Outside the cult of academia, this is why most people take the jobs they do.
    - Try to express that you think their work is interesting and important. If you don't think it is, ask the recruiter or interviewer: "What challenges does your team face?" "Why do your customers choose you?" You may be happily surprised at the answers. Lots of boring-sounding fields are actually really interesting in practice.
    - You also need to be very attentive to language that might signal arrogance, like "It's too technical for me to explain." Compare that with:, "Let me know if this sounds relevant and I can go into more detail."
- It can be very helpful to learn and use some vocabulary specific to the business you are applying for. This can typically be obtained by studying the job posting and the company web site.

Practice

You gotta practice interviewing. It's a stylized dance, and it takes as much practice as smarts. There are four levels to this

- **Project experience:** Code school and kaggle.com both have many real world large-scale projects to work on. This will give you the ability to answer mature, open-ended, full-stack questions.
- **Real life**. Fun fact: you don't have to take a job if they offer. You can and *should* apply to jobs you think you don't want. There are thousands. They don't talk to each other, so if you bomb an interview, the next company you apply to won't know. But: make sure you take notes and learn from each interview. Ask the interviewer about their job. You are also interviewing them. They might convince you that you do want that practice job after all. At the end, ask the interviewer a very specific question: "What's one thing I can work on to be more ready for this position?". The "one thing" phrase is critical, and the non-judgemental tone is also key. Otherwise, they'll probably just say "You did great, bye." because they don't want to take 20 minutes explaining all the different ways you bombed. Hopefully they'll tell you the top way. Interviews are free. Apply to one job a day. This might take a long time at first, but it will become faster with practice. Interview, fail, improve, repeat. There's no telling how long it will take to hear back from a job. A week is a good guess, but month is not rare. Fill your pipeline.
- **Simulation**: If you are interested in software, you're in luck. There's books. Get a white board or open a shared IDE, and have a friend pretend to interview you using stack overflow questions, etc. If you're interested in specialized fields or emerging fields, see the bullet above.
- **Theory:** For software, there are tons of toy-problem interview questions in books, glassdoor.com, and codeschool.com. Better than nothing, but not as good as practice en vivo.

The Journey (a prototype)

- You apply. You will not get the job if you don't apply.
- You are one resume in 500. A regular expression, or an admin with a high school education discards all but 50, because most are not remotely qualified. Help them help you. Make this person's job easy. If the job posting lists skills, put those skills in bold on your resume, with evidence. Do they require a PhD? Put that near the top. Do they not mention a PhD? Then put that at the end. Don't use jargon. This person is going to spend at most 20 seconds with your resume. They have 500 resumes, and their boss wants 50.
- up to four weeks later: If you passed the regex, a recruiter, who may or may not know the hiring team looks at maybe 50 resumes. They will maybe pass on 25. Again, giving clear evidence that you have demonstrated the skills for the job makes their job easy. Help them help you.
- You may get a screening call.
  - Common questions:

- This job is located in X. Can you live in X?
                - When is your available starting time for your next position.
                - You may get a question asking if you will require visa support in order to begin employment.
                - Ability to travel (if relevant)
        - Grey questions
                - "What salary do you currently make", or "what salary do you expect?" This is typically because the recruiter doesn't want to invest weeks in you if the salary is too low for you to accept. You can say what you want, or deflect: "I think it's early to discuss salary. I'm more interested in the technologies you use."
        - Probably Illegal questions in the US:
                - Protected status: sex, sexual orientation, health, marital status, religion, if you have kids or not, your age (unless you are applying to be a long-haul pilot, which has age caps).
                - Whether you own your house or are renting.
                - Citizenship (unless it's a military contractor, or requires global travel, etc.)
                - If they ask you one of these, you can, instead of answering, ask, "how is this a requirement of the role?" or, if you are feeling saucy: "isn't that a protected status?"

- Up to four weeks later, the hiring team might then call 10 people to do phone interviews. Don't just answer their questions. Try to understand why their questions align to what they are looking for. If they're looking for a team member, then answering their questions correctly without collaborative interaction is a form of failing. Most good companie's interviews aim to simulate collaborative work, **not re-enact your thesis defense**. They know you are smart. They want to see if you can contribute to the team. In the old days this was called "team fit," but most companies eventually saw this word as being a cover for unconscious bias on the part of the interviewers. Companies now try to explicitly focus on positive reception of feedback, communication, empathy for users or coworkers, and exceeding the requirements of the problem at hand.
- Up to four weeks later, the hiring team might call three folks in for an in-house interview. These are all different. Ask the hiring manager: what is the appropriate attire? Is a suit expected, or would that be weird? What do you normally look for in candidates? They'll typically tell you. Again, it's typically **not a thesis defense**. They're looking for a future teammate. Someone who can contribute, but who is also professional and pleasant to work with. In-house interviews are really expensive, timewise. It takes a lot of people away from their normal work. They're not out to haze you, and if you feel uncomfortable with them, leave. There's lots more jobs out there. Likely though, you'll be asked probing questions, and given constructive criticism or help. Try to take these constructively. Use this time to learn about them and their business. Have some stock questions ready like:
        - What's something you've worked on here that you're proud of?
        - Why did you choose this job over others you may have applied for?

- ○ How many times last week did you work at night? (The last week part is critical. You'll never get an honest answer if you ask in general.)
  - ○ What makes your customers happy?
  - ○ What does it take to be successful on this team?
  - ○ What about my resume made you decide to invite me for an in-house?
  - ○ What's one thing you don't like about this job?
  - ○ What does it take to get promoted on your team?
- Up to four weeks later, if you get an informal offer, then they will probably tell you by phone call. Then begins the salary negotiation. You might be able to change the offered mix of stock and cash by asking, often not. Commonly, the only way you can negotiate the total package value is to have another, formal offer in writing. The only way to do this is to be interviewing multiple places at the same time. Many places put deadlines on their formal offers of two to four weeks. If your role is commoditised, glassdoor.com can give you a rough, but realistic idea of your salary at your level. If your job is boutique, experienced colleagues are your best guide. If your compensation includes non-salary components like stock, try to read about "vesting" restrictions. Definitely learn about HSA "seeding" and 410k matching benefits. For some companies, these can result in effectively increasing your total compensation by 5% or more, albeit not immediately withdrawable, if you take advantage of them.

Additional Reading:

- https://medium.com/bull-market/a-cynic-s-guide-to-fintech-3cd0995e0da3
- Slide deck by Glenn Stryker.
- Resume advice talk by Homer Wolfmeister.
- O'Reilly Book: Site Reliability Engineering.
- O'reilly Book: Software Engineering at Google.

TODO:

- Analytics Jobs Dedicated Document
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