

# MS vs. PhD

Russ Joseph, Northwestern University  
Jaime H. Moreno, IBM Research

# Russ Joseph - rjoseph@eecs.northwestern.edu

- From: St. Thomas, USVI
- Education:
  - BS Carnegie Mellon
  - PhD Princeton
- Now: Associate Professor, Northwestern
- Research:
  - Computer Architecture (Power/Reliability Aware Systems)
- Fun:
  - Running (Nine Marathons)
  - Golf



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# Jaime H Moreno – [jhmoreno@us.ibm.com](mailto:jhmoreno@us.ibm.com)

- Originally from Chile
- Current role
  - Distinguished Researcher, IBM TJ Watson Research Center, NY
  - Recent big project: IBM Summit and Sierra supercomputers (#1/#2 in 2018 Top500, #2/#3 today)
  - Current focus: Cloud Infrastructure
- Previously (although long ago ..)
  - Faculty Member, University of Concepcion, Chile
- Computer Science PhD, UCLA
- Electrical Engineer, University of Concepcion, Chile



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# INTRODUCTION

# Who is in the audience?

- What type of program are you in?
  - Master or PhD program
  - Course or Thesis program (for Master program)
- What type of University?
  - Research University
  - College, Teaching University
  - Selective Liberal Arts College
  - Teaching-Oriented College



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# Revisiting Career Choices

At some point in graduate school, you may ask yourself questions such as:

- Am I in the best program for me?
- What do I want from the graduate school experience?
  - Likes? Dislikes?
- What do I want as a future career path?
  
- If not, then how do I get to my preferred track?
  
- Should I correct course?
  
- ....., .....

# Exercise: Turn And Talk To Your Neighbor

- What is your current plan?
  - Complete PhD
  - Complete Master
- What do you expect from the graduate school experience?
  - Educational experience and friends for life
  - Path to professional life and stable salary
  - Discover opportunities for the future
  - Just enjoy the time at school
- What do you want as your future career path?
  - Become a famous Professor or famous technical person
  - Become VP or CEO of a company
  - Create a successful startup company
  - Invent something that will impact the world and society
  - Make amazing discoveries
  - Join and contribute to a company
  - Join and contribute to a startup company
  - Be a freelancer
  - Become a technical analyst/writer
  - Just get a job and enjoy doing it

# CAREER PATHS FOR MS AND PHD

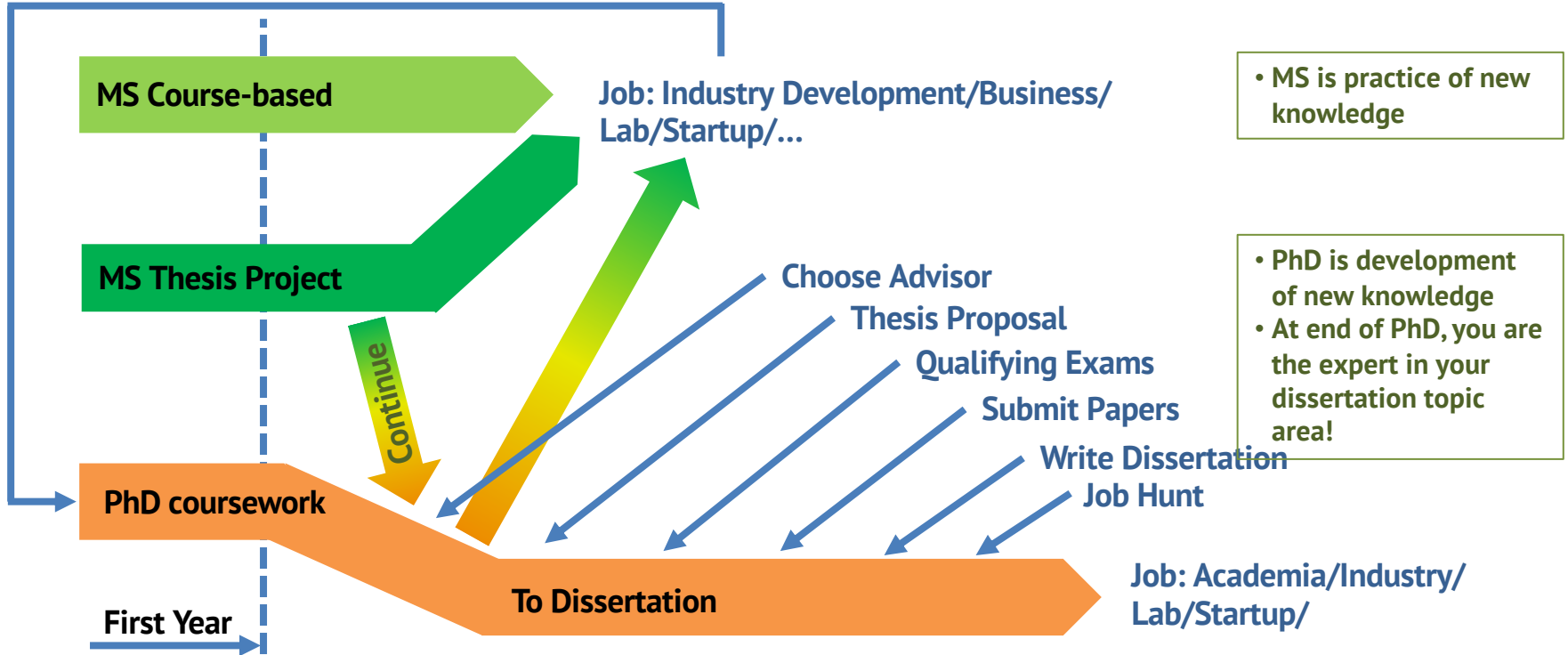


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# Graduate School Paths



All choices are valid

# Program Comparison

	Course-based MS	Research MS	PhD
Educational Goals	<ul style="list-style-type: none"> <li>• Acquire knowledge via coursework and internships</li> </ul>	<ul style="list-style-type: none"> <li>• Acquire knowledge via coursework and internships</li> <li>• Acquire research skills (thesis)</li> <li>• Get taste of research or advanced development</li> </ul>	<ul style="list-style-type: none"> <li>• Acquire knowledge via coursework and internships</li> <li>• Do original research</li> <li>• Achieve expert-level knowledge</li> </ul>
Program	<ul style="list-style-type: none"> <li>• Short duration</li> <li>• Courses deeper than undergraduate</li> <li>• Become capable of technology and/or business development</li> </ul>	<ul style="list-style-type: none"> <li>• Short duration</li> <li>• Courses deeper than undergraduate</li> <li>• Become capable of technology and/or business development</li> <li>• Introduction to research or advanced development</li> </ul>	<ul style="list-style-type: none"> <li>• Long process</li> <li>• Become capable of doing independent research</li> <li>• Expected to publish in conferences and journals</li> </ul>



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# Entry-Level Career Opportunities

## MS Degree

- Types of Jobs
  - Operations and IT type jobs
  - Product or application development
  - Research support (contribute to prototyping and publications)
  - Team member in development project
  - Industry, laboratory, start-up
- Course-based MS
  - May qualify for marketing, project management roles
  - If of interest, beneficial to take some business classes!
- Research MS
  - MS project may qualify you for more interesting development roles
  - More attractive for a research lab position
  - Thesis should help with publications
- Employers
  - Same as PhD employers

## PhD Degree

- Types of Jobs
  - Academic research and teaching in a university as Assistant Professor
  - Research or advanced development in industrial research labs
  - Development leadership roles in industry
  - Technical project management/ leadership
- Employers
  - Universities and Labs
  - Information Technology (IT) companies
  - Companies in other industries
  - Startup companies



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# Professional Ladder – Entry Level

	Entry Level	Contribution and Impact	Expertise
PhD →	Assistant Professor	Teaching undergrad and graduate Join other faculty on research projects Develop own research line	Expert in area of contribution
PhD →	Research Scientist	Team Member / Leader in advanced research project or product	Expert in area of contribution
MS →	Advisory Engineer	Team Member / Leader in a product/project	Advanced knowledge and development skills in one area of contribution
BS →	Engineer	Team Member in a product/project	Working knowledge and development skills in one area of contribution



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# Professional Ladder – Long Term

	Career Level	Contribution	Expertise/Impact
PhD	Associate Professor	Teaching undergrad and graduate Lead own research line Strong publication record	Leader in academic community Expert in area of contribution
	Full Professor	Beyond Associate Professor	Leader in broad community Renowned leader in area of expertise
PhD, MS	Senior Researcher or Engineer	Leader in development projects (research or technology)	Project-wise expert Impacts a project or product
	Distinguished Researcher or Engineer	Leader in developing large successful projects (research or technology)	Technical authority, impacts a large project or new product
	Fellow, Senior Fellow	Leader in developing successful product lines or technologies	Top technical leader in broad industry Technical visionary
	Director of Product or Business Development	Develop new or drive existing business lines	Product or Business expert Impacts business lines
	VP of Product or Business Development	Strategic direction for new or existing business lines	Product or Business expert Impacts broad business lines
	CEO/CTO	Business or technical leader, strategic decision maker	Business and technical strategy, visionary



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# Industry and Academia Impact

	Industry	Academia
Research	<ul style="list-style-type: none"> <li>• Engage in scientific discovery, collaborate with peers, seek funding for research (but typically later in career, possibly internal funding)</li> <li>• May involve university faculty and students</li> <li>• Develop creative thinking about technical solutions to problems</li> </ul>	<ul style="list-style-type: none"> <li>• Engage in scientific discovery, involve graduate and undergraduate students</li> <li>• Secure funding for research</li> </ul>
Tech Transfer	<ul style="list-style-type: none"> <li>• Contribute to company's products, client engagement, open source, intellectual property (patents)</li> <li>• Develop new products</li> <li>• Demonstrate strong problem-solving skill</li> <li>• Publish work and engage with academia</li> </ul>	<ul style="list-style-type: none"> <li>• Active teaching, mentoring, advising</li> <li>• Consultants to industry</li> </ul>
Service	<ul style="list-style-type: none"> <li>• Departmental, Company-wide committees: hiring, engagement, promotion, mentoring, ..</li> <li>• Professional: conference committees, organizations</li> </ul>	<ul style="list-style-type: none"> <li>• Departmental, University-wide</li> <li>• Professional: conference committees, organizations</li> </ul>



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# FINANCIAL ASPECTS

# Financing Your Degree

## MS: Generally self-supported

- Most programs: student finances studies
- Other options:
  - Fellowships (internal/external), student loans
  - Employer sponsorship (full/partial)

## PhD: Generally, funded by university

- Support for students in “good academic standing”
  - Maintain GPA, Find advisor, Pass qualifying exams, Make research progress
- Mixture of fellowship (internal/external), research assistantship (grants), teaching assistantship (departmental)



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# Financial support for PhD program

**Research Assistantship:** Work on research project (hopefully aligned with your thesis), funded by external agency...need to show results!

**Teaching Assistantship:** Work as teaching staff (grade, help students, occasionally lecture), funded by department/university...need to juggle teaching with your own work.

**Fellowship (Internal/External):** Recognition of your academic potential (research/courses)...no other commitments, although used by industry to identify candidates

Most students will use a mixture of these funding sources at various points

# PhD Fellowships

- Even if advisor has plenty of research funding, should apply for fellowships whenever possible:
  - Gives more freedom (choose advisor or topic)
  - Exposes you to people in the funding agency
  - Upgrades your Resume
  - May come with other perks (e.g., internship)
- Where to apply? Look high and low:
  - Government: National Science Foundation (NSF), Department of Energy (DOE), ...
  - Major corporations: Google, Facebook, IBM, Intel, Microsoft, ...
  - Others: Ford Foundation, GEM, Hertz, ...



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# Poll

- What is your financial support?
  - Personal/family funds
  - Student loan
  - Part-time or full-time work
  - Company sponsored
  - Scholarship
  - University funding: Teaching Assistant, Research Assistant
- Will you need funding in the future
  - Yes
  - No
  - Don't know



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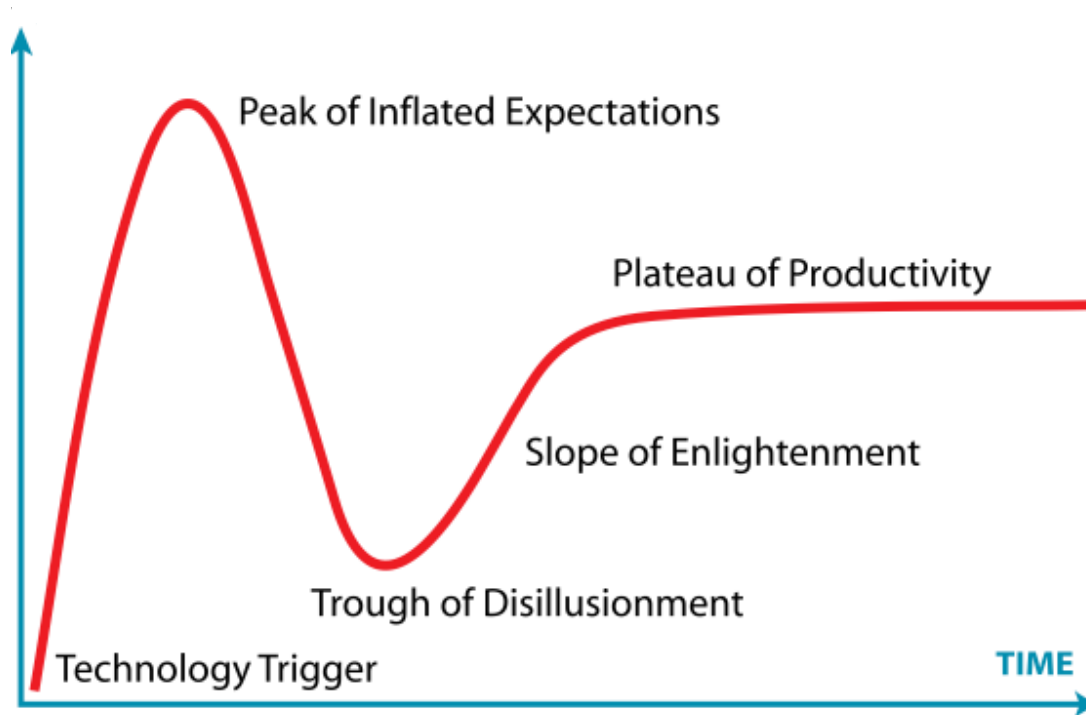
# PERSPECTIVES ON MASTER PROGRAM



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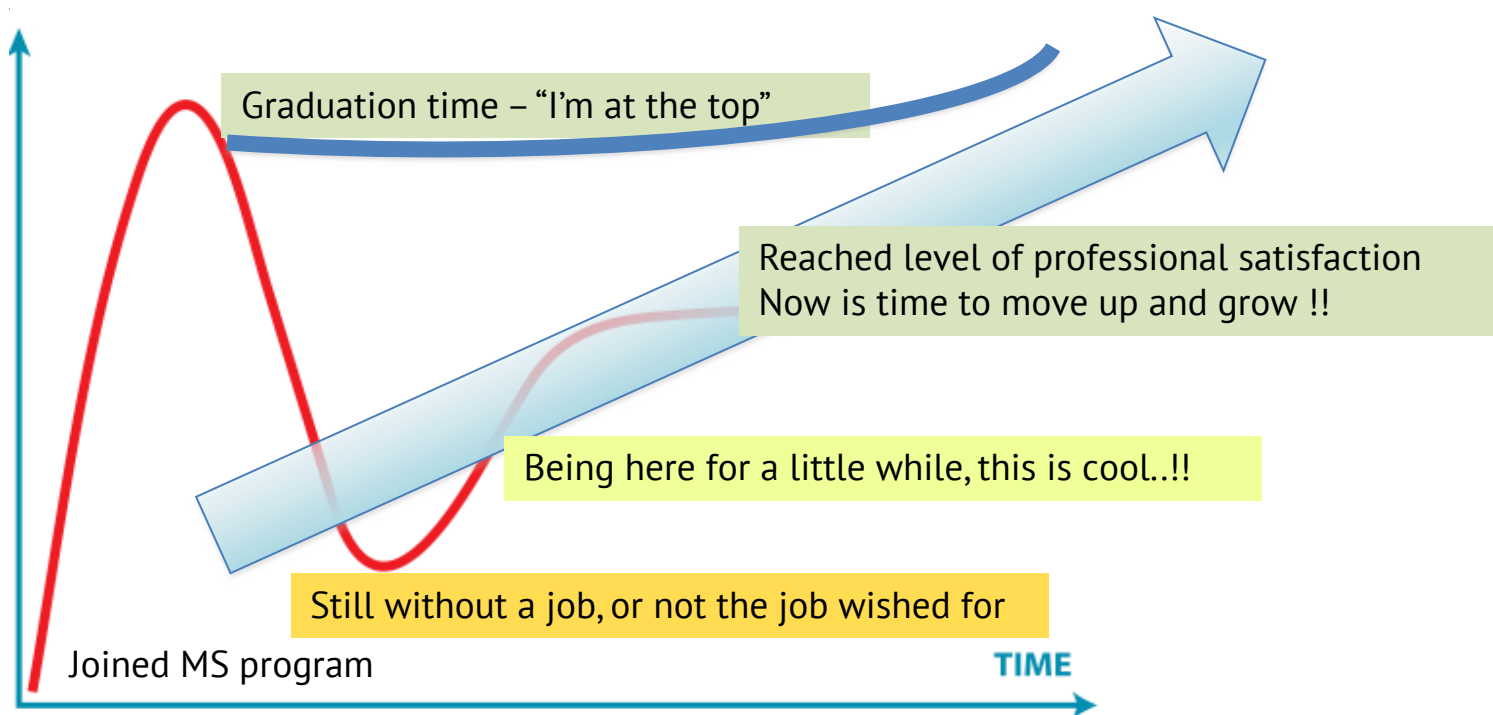
# The Gartner Hype Cycle for New Products



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# The MS Cycle



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# Career: Performing and Growing

## You and Your Manager

- Know expectations and opportunities of your position
- Define clear goals and set expectations for performance
- Communicate your progress

## Being Good

- Align with the objectives of the organization
- Understand how to leverage team, and vice-versa
- Balance between being nice and making a point

## Growth Path

- Be visible to peers, your manager, your manager's manager
- Actively participate in meetings (sit at the table, not in the back)
- Take on stretch assignments to grow visibility and capabilities
- Meet other people in the organization over lunch/coffee, job shadows
- Find or ask for a mentor (formal or informal)
- TAKE RISKS



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# Career: More About Growth

- **You own your own career**
- **Be pro-active about your career plans**
  - You can change your mind any time
  - The first job most likely will not be your only job
- **Ask frequent, actionable feedback (manager, peers)**
- **Talk to people at the next level about what they do and what is expected**
- **Volunteer to take on roles above your current position**
- **Find advocates to build a case for promotion**



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# Many successful executives have MS degrees

- Virginia "Ginni" Rometty, former IBM CEO -- BS in CE/EE
- Satya Nadella, Microsoft CEO – MS in CS, MBA
- Sundar Pichai, Alphabet (Google) CEO – MS in Materials Science/Engineering, MBA
- Jeff Bezos, Amazon CEO – BS in EE/CS

**Successful business and technical leaders also come from MS level**



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# PERSPECTIVES ON PHD PROGRAM



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# Experience of the PhD

Pick Advisor and  
move into doing  
research →

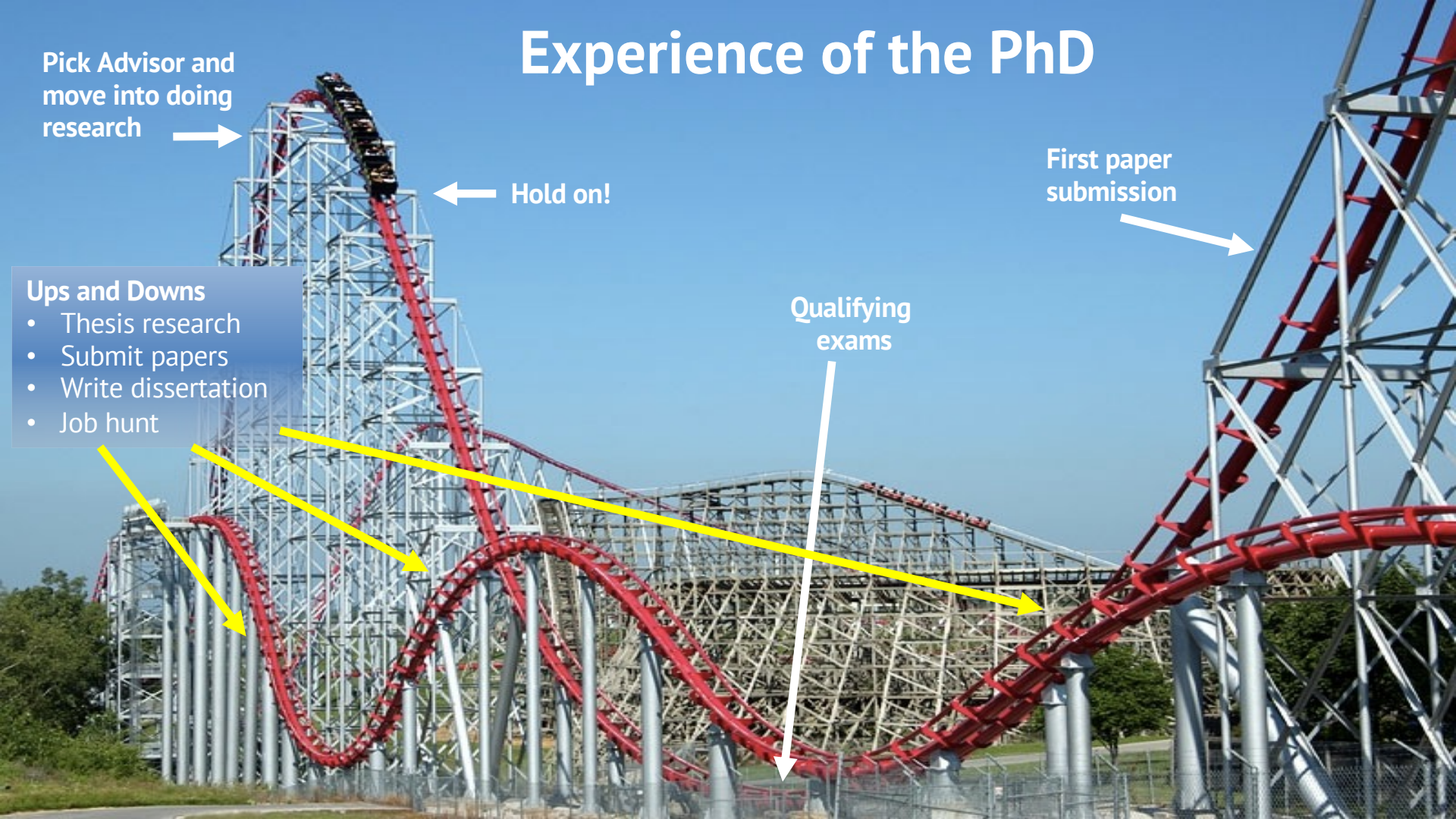
← Hold on!

First paper  
submission →

## Ups and Downs

- Thesis research
- Submit papers
- Write dissertation
- Job hunt

Qualifying  
exams



# Lessons from the PhD Roller Coaster

- The ride is similar for most people
  - You are qualified for the ride. It's scary for everyone!
  - You aren't alone. Share your experiences!
- It takes externally applied energy for the uphill
  - Your advisor will be a key person
  - Seek support from many sources (technical, emotional)
- There are a lot of downhill periods
  - Frustration and doubt are guaranteed...
  - Things can/will go wrong!
- Momentum is important
  - Keep moving forward!
  - No side trips to distract!



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# Academic Career Ladder

- Professorial Ranks
  - Assistant: Tenure-track, 5-7 years
  - Associate: Usually with tenure (life-time appointment)
  - Full: University-level service expected
  - Chaired Professor: Endowed
- Administrative Ranks
  - Department Chair, Dean, Provost, President
- Instructor – teaching and service
- Postdoctoral/Research Associate – research



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# What can I do to prepare for a PhD job in industry?

- Complete a project(s)
  - Industry has shifted considerably to applied research
- Get an internship(s)
  - Try out a corporate culture, job type, industry
  - Find mentors/supporters of your career
  - Publish your work with co-authors
- Acquire key skills
  - Build your professional network, communications, negotiation, making yourself visible
- Check your competition
  - Who is graduating soon in your field from other (top) schools?
  - Who works at this company?



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# What can I do now to prepare for an academic job?

- Research
  - Apprenticeship: learn from advisor, doing it, and others
  - **Excel in research (especially if you want to land at R1 university)**
  - Grant writing (ask your advisor for old proposals)
  - Corporate connections for funding, student job placement
  - Take Post-doc position (more apprenticeship while you build your CV)
- Teaching
  - Teaching experience, teaching assistantship, teach some even if you don't have to
  - Professor-in-training programs, course
- Service
  - Engage in student organization/support groups
  - Working on department committees
  - Volunteering at conferences



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# Moving Between Industry and Academia

## From University to Industry

- Experience in developing IT systems, solutions, applications, etc.
- Visibility and knowledge throughout industry

## From Industry to University

- Strong publications record
- Visibility in research community
- Leader of recognized projects or products
- Experience in securing external funding, managing large projects



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# CLOSING REMARKS