



Particle Physics Career Mentoring

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Outline

- **Why me ?**

- **Introduction**

What is career mentoring anyway ?

- **Particle Physics Career Path**

What you would do and when

- **Conclusions**



Why I am talking to you

- I received 2024 Meenakshi Narain Mentoring Award
 - From the American Physical Society
 - *“For implementing and leading a postdoctoral mentorship program that has greatly enriched the scholarly and professional lives of junior scientists at Fermilab.”*
- Meenakshi Narain
 - A founder of the PURSUE program you are in
 - Particle experimentalist and inspirational leader
 - Dedicated to mentoring, diversity and inclusion
 - I remember her care for young colleagues in my interactions with her at the Tevatron and CMS



Meenakshi Narain: 1964 - 2023

Mentoring

- What is a mentor ?
- Miriam Webster says . . .
 1. Mentor: a friend of Odysseus entrusted with the education of Odysseus's son Telemachus
 - Fascinating, but not quite what I had in mind . . .
 2. mentor:
 - a. trusted counselor or guide. “a mentor who, because he is detached and disinterested, can hold up a mirror to us— P. W. Keve”
 - Good definition, but “detached and disinterested” ?
 - b. tutor, **coach**
 - Now we are getting at what I had in mind . . .



Telemachus and Mentor (1956 image)

Career Mentoring

- Career counseling, guidance and especially **coaching** from those in your field can be valuable.
- Career mentors can help you get where you want to go in your career.
 - But where is that ?
- That depends on a more **important** question.
 - What do you want to do ?
 - Please, take your time figuring it out, and be sure.
- If the answer you arrive at is **particle physics** . . .
 - Then maybe the rest of this talk can help you
 - Strongly recommend you find your own career mentor

Good advice, always.



Traditional Career Path of Particle Physicist

“It’s the journey . . .”

- **Undergraduate Education (4 years, age 17-20)**
 - Formal Courses
 - Particle Physics Exposure (Internships, experiments, etc.)
- **Graduate Research (5-6 years, age 21-25)**
 - Formal Courses
 - Particle Physics PhD
 - Physics Analysis and Technical (Detector or Computing)
- **Postdoctoral Research (3-5 years, age 26-30)**
 - Published Results
 - Physics Analysis and Technical (Detector or Computing)
 - Demonstrations of Leadership
- **Assistant Professor or Scientist (5 years, age 31-35)**
 - Tenure-track positions at universities or labs
- **Full Professor or Scientist (~30 years, too old to trust?)**
 - **Tenured** researchers, permanent positions

“The Rake’s Progress”

~60%

You are here 👍

~60%

Only ~15
more
years
to go ! 😬

~20% !

~90% ?



Time off and finding oneself

- Time off for family is generally understood
 - For example, paternal and maternal leaves
 - Shouldn't affect your career prospects
 - At least, not at any place you want to work . . .
- Early changes in research are acceptable
 - Physics Theory → Particle Experiment
 - Yes, it happens a lot early in grad school
 - The field can support many more experimentalists
 - Engineering, Math, CS → Particle Experiment
 - Yes, often such undergrads become physics grads
 - Other (e.g. chemistry) → Particle Experiment
 - Not usually, perhaps in undergrad change of major . . .
- But pace and focus are measures of dedication
 - It is better to choose and stay on track if you can

A career for the Dedicated ?



“The years 1966 through 1995 are blank because I was on tour with the Grateful Dead.”

The New Yorker magazine, 1995

Timeline of exciting experiments along your career !



LHC Experiments at CERN (CMS, ATLAS, LHCb, ALICE)

FCCee ?

Muon and Neutrino Exp. at Fermilab

μ Collider Demonstrator at Fermilab ?

Worldwide Experiments Searching for Dark Matter and Other Physics

You will be a:

Graduate Student

Postdoc

Asst. Prof. / Sci.

Professor or Scientist

Technical research that's cutting edge

“It’s buussin . . .”

- **Develop technology for experiments**
 - Detectors to measure particle collisions
 - Computing systems to transport and analyze data
- **Experience essential to your career**
 - Allows you to lead it as a scientist / professor
 - Provides the tools you will use to do science
- **Skills also highly sought by industry**
 - Great companies want technology developers
 - Independent researchers, like you will learn to be
 - You’ll have great opportunities outside HEP

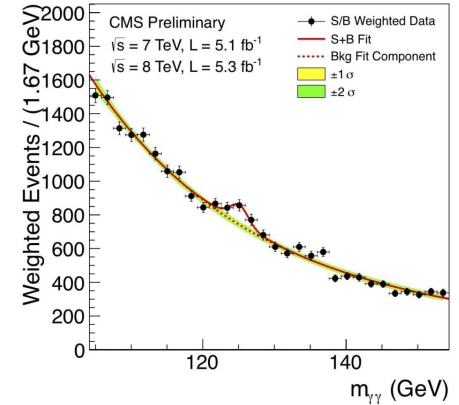
Fermilab CMS postdocs conducting technical research



Analyze, present, teach, repeat . . .

- You will learn the most advanced techniques of data analysis
 - Statistical analysis, machine learning and artificial intelligence
 - Highly valued by industry, many physicists do this for a career.
- You will learn to present your research
 - Effective communication skills invaluable to be a leader in any field
- You will learn to teach younger physicists
 - Preparing you to be a professor, instructor, or an effective co-worker

Higgs Discovery Analysis



Fermilab CMS Postdocs Teaching at CMS Data Analysis Schools (2019 – 2024)



Conclusions

- **Every young person can benefit from career mentoring**
 - Find your own career mentor, somebody you trust.
- **Most of you will go to grad school, maybe a postdoc**
 - Getting permanent research positions will be more challenging, but career mentoring can help.
- **Exciting opportunities await in particle physics**
 - Research that will train you for great careers at universities, laboratories, industry or government
- **Enjoy your journey, but don't take it alone.**



For Particle Physics