

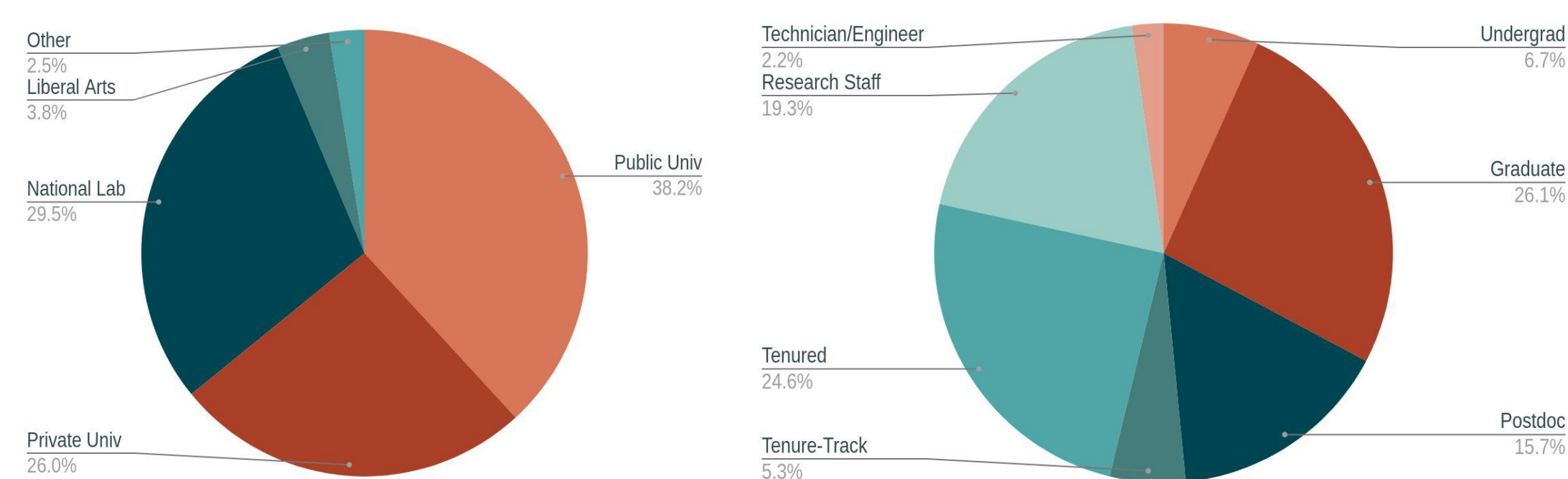
# Transforming U.S. Particle Physics Education

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Full Results: arXiv:2204.08983

## ABOUT THE SURVEY

- Ran a survey targeting particle physicists to learn:
  - Skills gained during undergrad + graduate education
  - Skills used during careers
  - How these skills were acquired
  - Preparation for careers
  - Undergraduate engagement in the particle physics community
- Demographics:
  - 357 responses: 24 undergrad, 333 grad+
  - Only respondents currently in the United States
  - Did not identify protected identity groups (sample size small)
  - Respondents almost entirely from colleges/universities + national labs; limited participation from industry professionals



## SAMPLE QUESTIONS

How satisfied do you feel with your (under-)graduate education in physics? In particle physics?

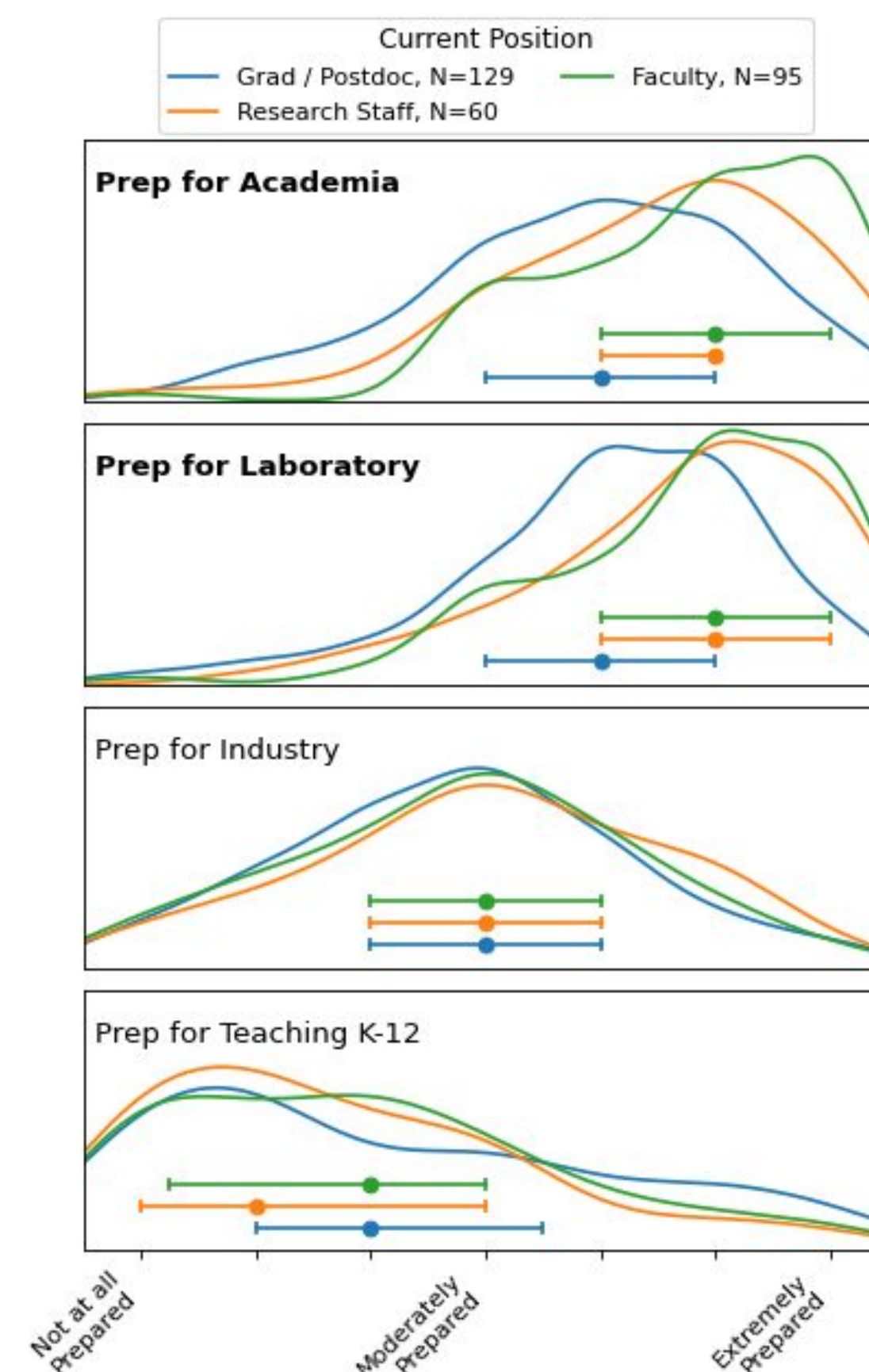
What was the primary mode of training you received for various skills, and how do you rate it? E.g. university course, online, summer school, peer learning, self-taught.

Some skills surveyed: statistics, programming, engineering, BSM theories, gravity, CV-writing, mentorship, teaching, writing

How well do you feel graduate school prepared for career paths: academia, national/private lab, industry, teaching K-12?

Undergrads only: When did you first have an opportunity to perform research? What type of opportunity was it?

## FINDINGS



## Graduate Students Only



- Survey respondents are mostly satisfied with their graduate education, but feel unprepared for careers outside academia + labs.
- Many respondents switched their career goals away from academia during graduate school. Many switched their research goals from HEP theory to HEP experiment.

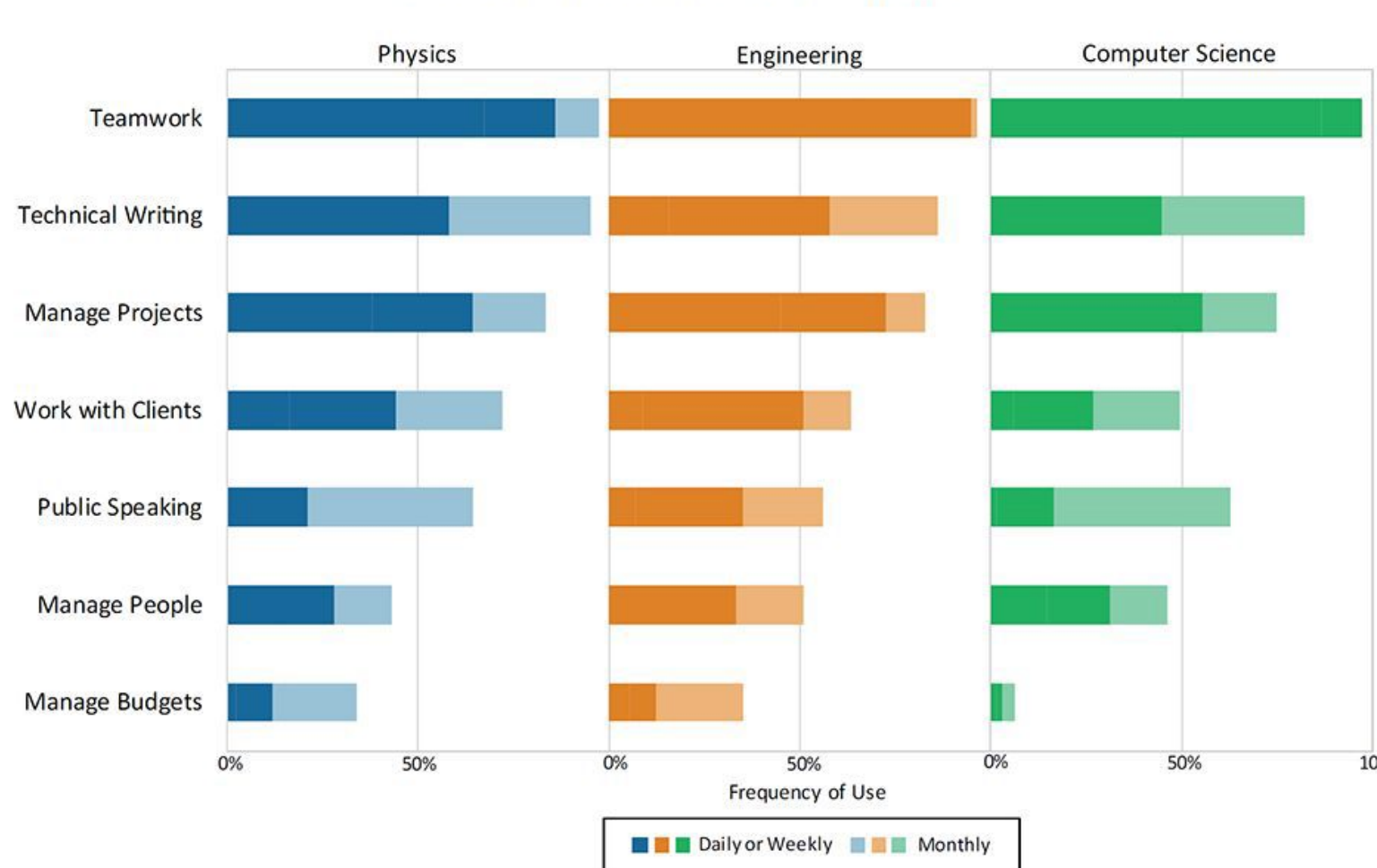
- Professional skills are more correlated with reported career preparation than technical skills.
- Professional skills are frequently gained through self-teaching rather than through training. Self-teaching is disfavored by respondents for all types of skills; formal modes like university courses are highly-rated for all skills.
- Very few survey respondents were undergraduates. We hypothesize this is due to low engagement of undergraduates in the community; they may not be on Snowmass email lists, experimental collaboration email lists, etc.

## RECOMMENDATIONS

- Train Students for Industry**
  - Departments should facilitate industry partnerships + internships
  - Formal development of skills in-demand beyond academia
- Normalize Non-Academic Paths**
  - Departments should provide a realistic view of common career paths post-PhD in particle physics, including breakdown of theory and experimental positions
  - Faculty should discuss the commonality of shifting to a non-academic career
- Formalize Professional Skills**
  - Support formal modes of training for skills that respondents don't like teaching themselves: technical presentations, scientific writing, mentoring, job applications
- Formalize Technical Skills**
  - Formal course in statistics as part of undergraduate / graduate curriculum
  - Support training opportunities like summer schools & workshops.
- Connect with Undergrads**
  - Funding agencies and professional societies should support networks like student conferences
  - Community should develop a mass communication network for undergraduate opportunities in HEPA.

## WHY SHOULD YOU CARE?

Interpersonal and Management Skills Used by New Physics PhDs Employed in Potentially Permanent Positions, Classes of 2015 & 2016 Combined



Only about half of physics PhDs go into academia

Need to train students for a broad variety of careers and teach multi-disciplinary skills beyond physics fundamentals and field-specific research tools

[1] Employment and Careers in Physics, Tech. Rep. (American Institute of Physics, 2020)  
 [2] R. Mulvey and J. Pold, Physics Doctorates: Skills Used and Satisfaction with Employment — American Institute of Physics, Tech. Rep. (AIP Statistical Research Center, 2020)  
 [3] A. M. Porter, Physics PhDs Ten Years Later: Success Factors and Barriers in Career Paths, Tech. Rep. (American Institute of Physics, 2019)

## EARLY-CAREER DRIVEN EFFORT



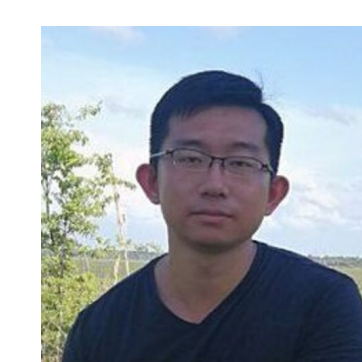
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