Career Paths of Engineering and Computer Science Doctoral Recipients

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We appreciate the work of our full team of collaborators who contributed to this project, including Maya Denton, Dr. Jessica Deters, Dr. Gabriella Fleming, and Hannah Glisson.

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Foreword

The purpose of this project is to help graduate programs think about the variety of career pathways that engineering and computer science graduate degree earners follow--and to help programs consider how they might better support graduate students who are interested in nonacademic careers in particular (i.e., government labs, industry, start-up, non-profit).

This first report from our project leverages NSF's Survey of Earned Doctorates (SED), which has collected information from research doctoral (Ph.D.) recipients from accredited institutions in the United States since 1957. The data are typically collected at the time of degree completion and generally constitute a greater than 90% response rate. **We summarize national-scale data in this report for PhD earners in engineering or computer science from 2015-2019 who have known post-graduate school employment.** In addition to sharing these national-scale patterns with graduate engineering leaders around the country, we also share institution-specific data for benchmarking purposes whenever sample sizes allow such data sharing.

The next project phase will interview associate deans, center directors, faculty, and alumni to understand how institutions and programs prepare Master's and doctoral students for non-academic careers and to gain insight on how graduates make career decisions. We welcome any program that would like to share their best practices with our team--**please contact a project leader if you are interested in participating** (David Knight, dbknight@vt.edu; Maura Borrego, maura.borrego@utexas.edu; Dustin Grote, dustingrote@weber.edu).

Executive Summary

- **Percentage of engineering doctoral recipients by employment sector**
  - 48.3% industry; 32.8% academia; 8.4% government; 6.1% non-U.S. position; 2.9% non-profit; 1.4% (other)

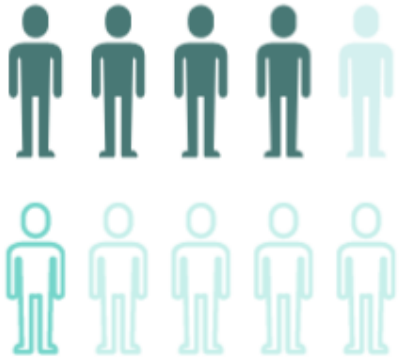
- **Engineering disciplines have different career sector patterns for doctoral alumni**
  - Industry: Computer Engineering (highest, 65%) . . . Environmental (lowest, 25%)
  - Academia: Bio/biomedical (52%) . . . Computer Engineering (22%)
  - Government: Astro/aerospace (25%) . . . Computer Science (4%)
  - Non-U.S. Position: Industrial (10%) . . . Astro/aerospace (4%)
  - Non-profit: Astro/aerospace (6%) . . . Materials Science and Engineering (MSE) (2%)

- **There are distinct patterns associated with demographics**
  - Compositional diversity by race (Black, Hispanic, Asian, White) differs across sectors
  - Academia is disproportionately higher for married women and women with dependents
  - Industry is disproportionately higher for unmarried men and men without dependents
  - A higher proportion of non-U.S. citizens are in industry sector jobs than U.S. citizens
  - Roughly equal proportions of U.S. citizens and non-U.S. citizens are in academia

Demographics of Respondents

Data source: Survey of Earned Doctorates, 2015-2019, PhD recipients in engineering or computer science with known employment

Gender



78%
MEN
n = 26520

22%
WOMEN
n = 7381

Race

- Asian (47%) n = 15587
- White (44%) n = 14824
- Hispanic (5%) n = 1614
- Black (2%) n = 825
- Other (2%) n = 578

First-Generation in College

24%
FIRST-GEN
n = 7721

76%
NOT FIRST-GEN
n = 24294

Citizenship

- U.S. Citizen n = 15023
- Non-U.S. Citizen n = 18768

Marital Status

- Married n = 18002
- Not Married n = 14537

Dependents

- Have Dependents n = 7319
- No Dependents n = 25074

EMPLOYMENT SECTORS ACROSS ENGINEERING AND COMPUTER SCIENCE

List of Disciplines

Astro/Aero: Aerospace, Aeronautical & Astronautical Engineering

Bio/BME: Bioengineering & Biomedical Engineering

ChE: Chemical Engineering

Civil: Civil Engineering

CompE: Computer Engineering

CS: Computer Science

Electrical: Electrical, Electronics, & Communications Engineering

Env: Environmental/Environmental Health Engineering

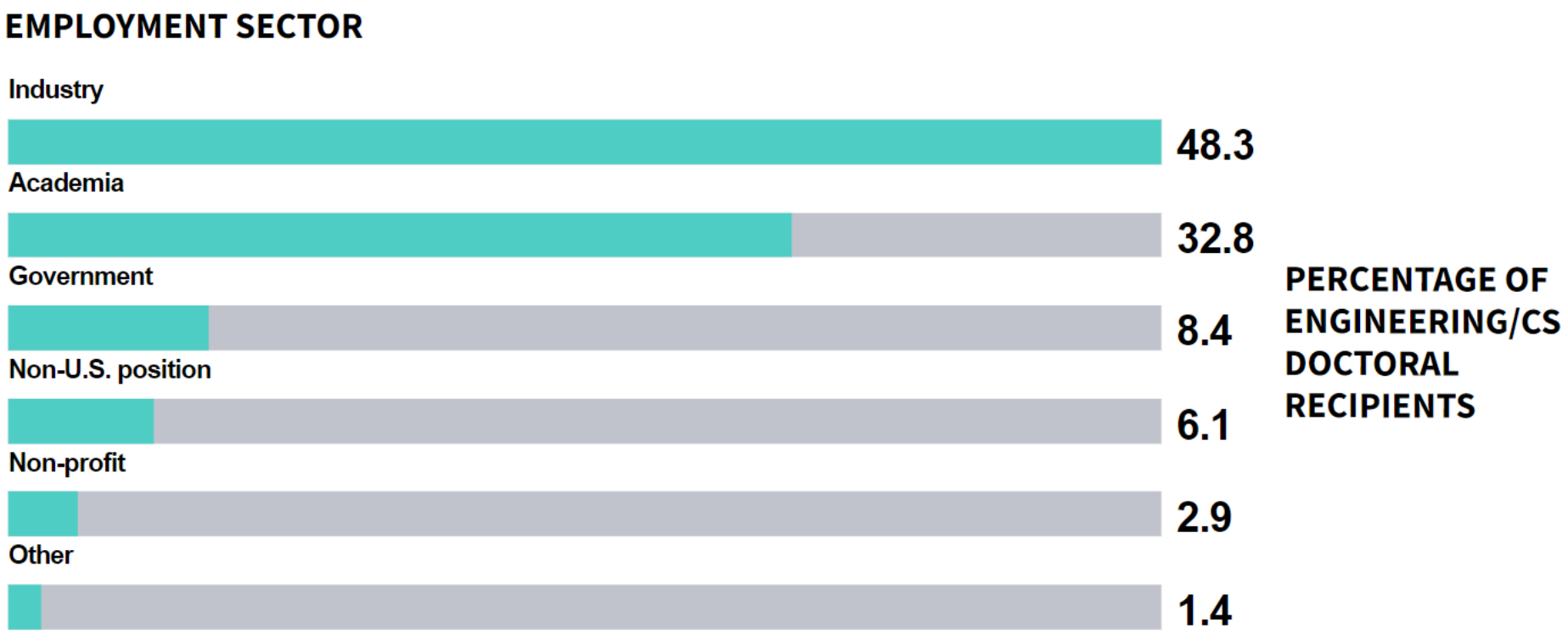
IE: Industrial & Manufacturing Engineering

MSE: Materials Science Engineering

ME: Mechanical Engineering

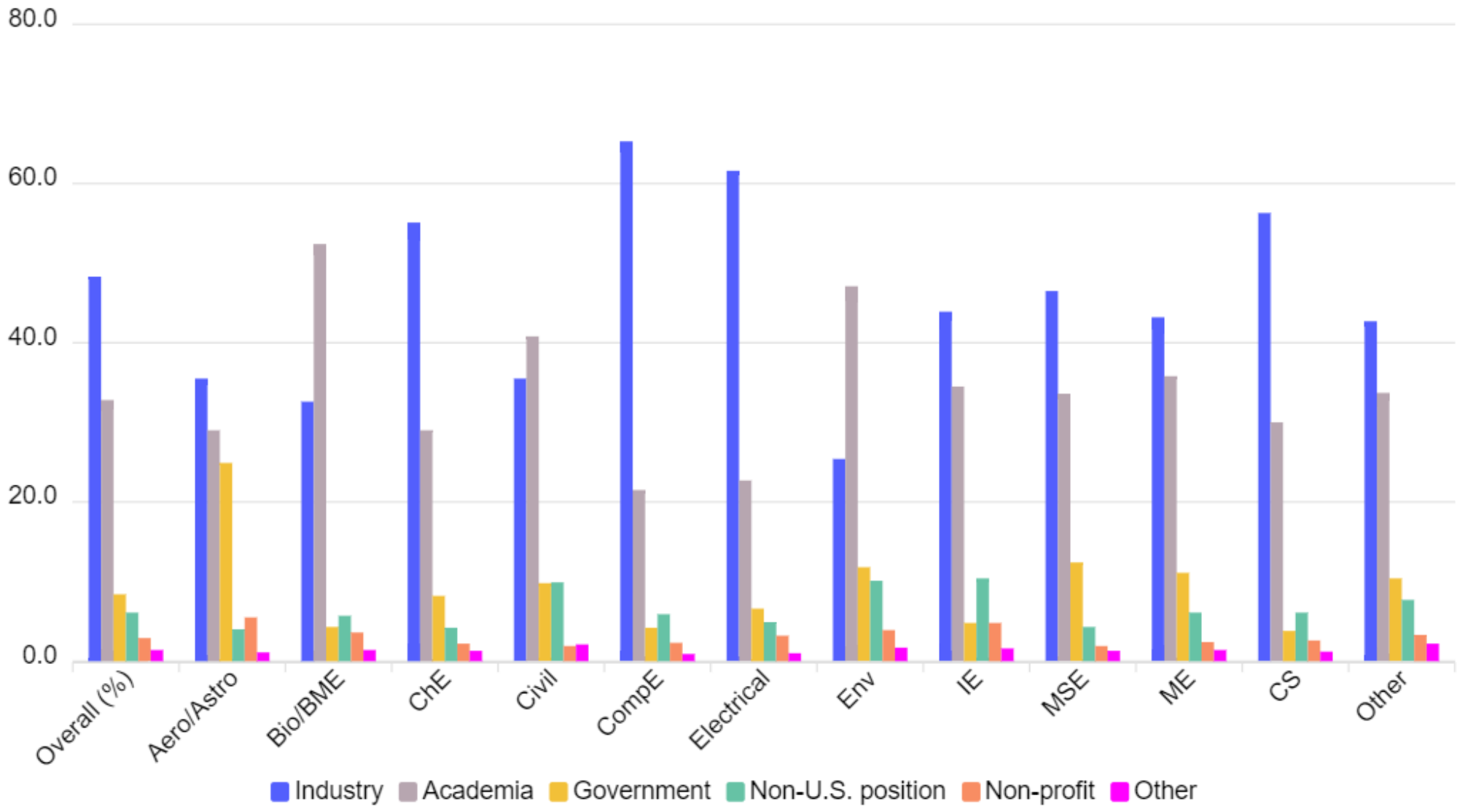
Percentage of Engineering/CS Doctoral Recipients in Each Employment Sector

Of doctoral recipients with employment, here's where they ended up right after graduate school



Employment Sector by Discipline

Of doctoral recipients with employment, here's where they ended up right after graduate school

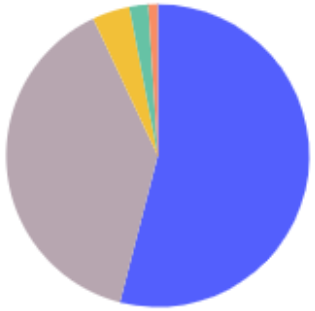


INDUSTRY

48% OF ALL ENGINEERING/CS PHDs are working in INDUSTRY

*employment right after grad school

WHO THEY ARE (demographics of PhD grads in INDUSTRY)



- 54% are Asian
- 39% are White
- 4% are Hispanic
- 2% are Black
- 1% Other

80% are MEN

20% are WOMEN

22% are FIRST-GEN

40% are U.S. CITIZENS

19% have KIDS

WHERE THEY'RE FROM (by % of grads in INDUSTRY)

Top 3

CompE	65%	of **CompE** PhDs are in industry
Electrical	62%	of **Electrical** PhDs are in industry
CS	56%	of **CS** PhDs are in industry

Bottom 3

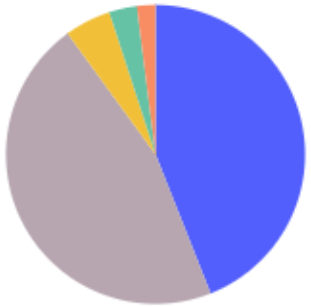
Civil	36%	of **Civil** PhDs are in industry
Bio/BME	33%	of **Bio/BME PhDs** are in industry
Env	25%	of **Env PhDs** are in industry

ACADEMIA

33% OF ALL ENGINEERING/CS PHDs are working in ACADEMIA

*employment right after grad school

WHO THEY ARE (demographics of PhD grads in ACADEMIA)



- 44% are Asian
- 46% are White
- 5% are Hispanic
- 3% are Black
- 2% Other

76% are MEN

24% are WOMEN

23% are FIRST-GEN

44% are U.S. CITIZENS

20% have KIDS

WHERE THEY'RE FROM (by % of grads in ACADEMIA)

Top 3

Bio/BME	52%	of **Bio/BME** PhDs are in academia
Env	47%	of **Env** PhDs are in academia
Civil	41%	of **Civil** PhDs are in academia

Bottom 3

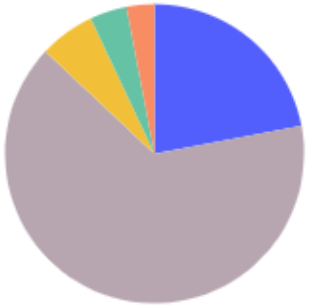
Astro/Aero	29%	of **Civil** PhDs are in academia
Electrical	23%	of **Electrical** PhDs are in academia
CompE	22%	of **CompE** PhDs are in academia

GOVERNMENT

8% OF ALL ENGINEERING/CS PHDs are working in GOVERNMENT

*employment right after grad school

WHO THEY ARE (demographics of PhD grads in GOVERNMENT)



- 22% are Asian
- 65% are White
- 6% are Hispanic
- 4% are Black
- 3% Other

79% are MEN

21% are WOMEN

20% are FIRST-GEN

81% are U.S. CITIZENS

27% have KIDS

WHERE THEY'RE FROM (by % of grads in GOVERNMENT)

Top 3

Astro/Aero	25%	of **Astro/Aero** PhDs are in government
MSE	12%	of **MSE** PhDs are in government
Env	12%	of **Env** PhDs are in government

Bottom 3

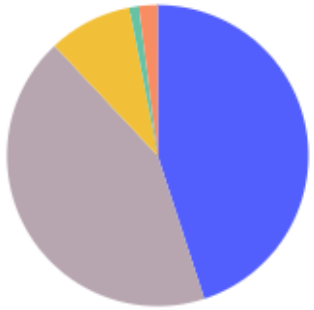
Bio/BME	4.3%	of **Bio/BME** PhDs are in government
CompE	4.2%	of **CompE** PhDs are in government
CS	3.8%	of **CS** PhDs are in government

NON-U.S. POSITION

6% OF ALL U.S. ENGINEERING/CS PHDs are working in NON-U.S. POSITIONS

*employment right after grad school

WHO THEY ARE (demographics of PhD grads in NON-U.S. POSITIONS)



- 45% are Asian
- 43% are White
- 9% are Hispanic
- 1% are Black
- 2% Other

78% are MEN

22% are WOMEN

31% are FIRST-GEN

17% are U.S. CITIZENS

39% have KIDS

WHERE THEY'RE FROM (by % of grads in NON-U.S. POSITIONS)

Top 3

IE	10%	of **IE** PhDs are in non-US roles
Env	10%	of **Env** PhDs are in non-US roles
Civil	9.9%	of **Civil** PhDs are in non-US roles

Bottom 3

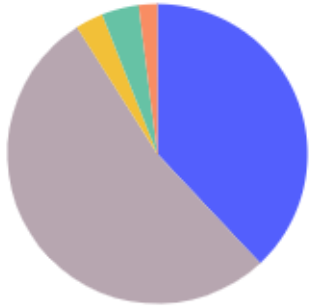
MSE	4%	of **MSE** PhDs are in non-US roles
Bio/BME	4.2%	of **Bio/BME** PhDs are in non-US roles
Astro/Aero	4.3%	of **Astro/Aero** PhDs are in non-US roles

NON-PROFIT

3% OF ALL ENGINEERING/CS PHDs are working in NON-PROFIT

*employment right after grad school

WHO THEY ARE (demographics of PhD grads in NON-PROFIT)



- 38% are Asian
- 53% are White
- 3% are Hispanic
- 4% are Black
- 2% Other

74% are MEN

26% are WOMEN

19% are FIRST-GEN

57% are U.S. CITIZENS

24% have KIDS

WHERE THEY'RE FROM (by % of grads in NON-PROFIT)

Top 3

Astro/Aero	5.5%	of **Astro/Aero** grads are in non-profit
IE	4.8%	of **IE** grads are in non-profit
Env	3.9%	of **Env** grads are in non-profit

Bottom 3

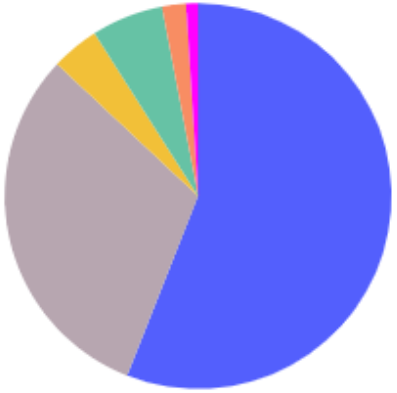
ChE	2.2%	of **ChE** grads are in non-profit
Civil	1.9%	of **Civil** grads are in non-profit
MSE	1.9%	of **MSE** grads are in non-profit

EMPLOYMENT SECTORS ACROSS DEMOGRAPHIC GROUPS

Employment Sector By Race

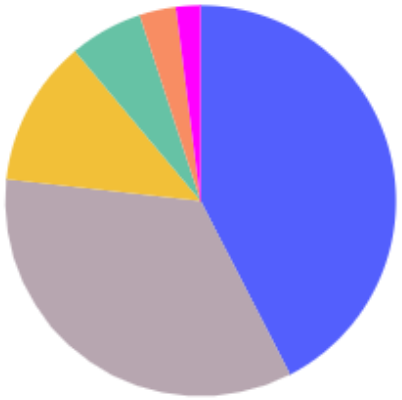
Percent of PhD recipients of the specified race who are employed in each specified sector following graduate school
e.g., 56% of ASIAN graduates are in industry; 34% of WHITE graduates are in academia

ASIAN



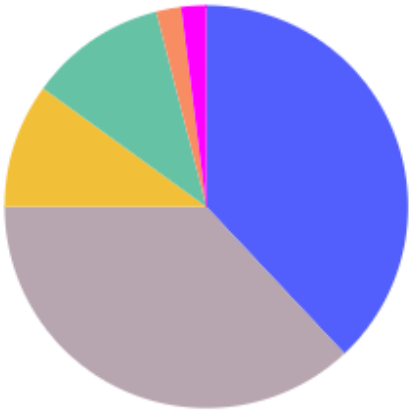
- Industry (56%)
- Academia (31%)
- Government (4%)
- Non-U.S. position (6%)
- Non-profit (2%)
- Other (1%)

WHITE



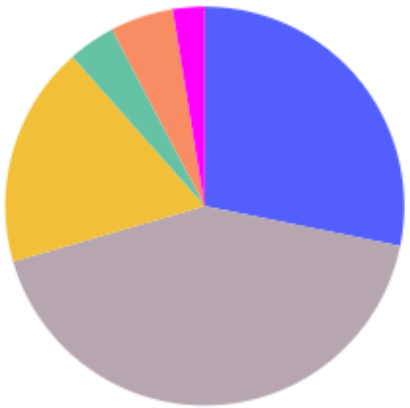
- Industry (42%)
- Academia (34%)
- Government (12%)
- Non-U.S. position (6%)
- Non-profit (3%)
- Other (2%)

HISPANIC



- Industry (38%)
- Academia (37%)
- Government (10%)
- Non-U.S. position (11%)
- Non-profit (2%)
- Other (2%)

BLACK

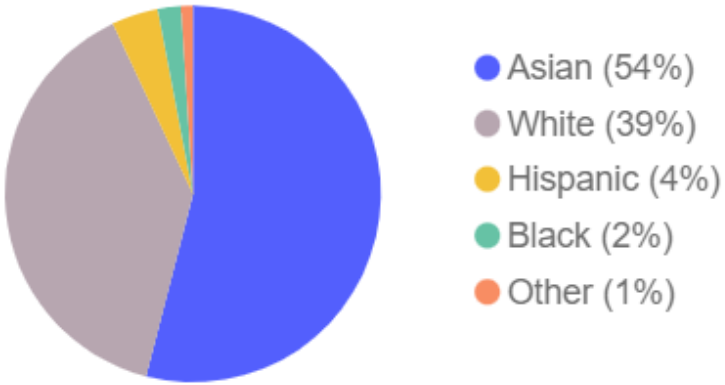


- Industry (22%)
- Academia (33%)
- Government (14%)
- Non-U.S. position (3%)
- Non-profit (4%)
- Other (2%)

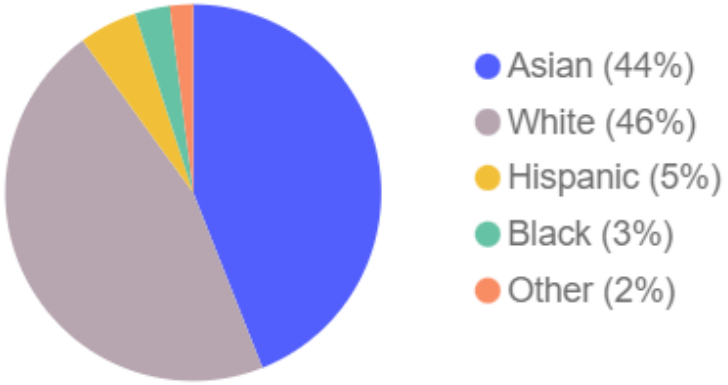
Employment Sector by Race

Of the engineering PhD recipients in each sector, here's the breakdown by race

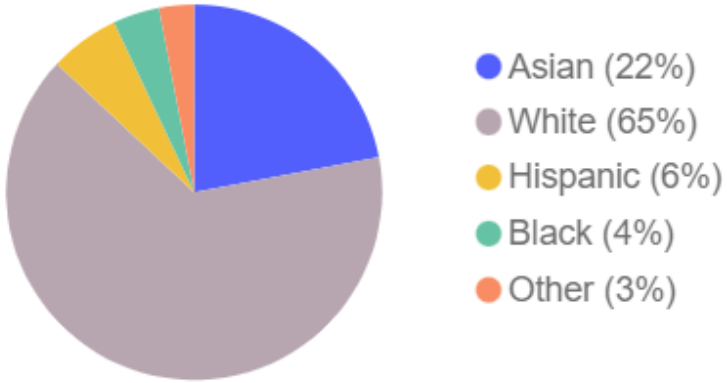
Industry



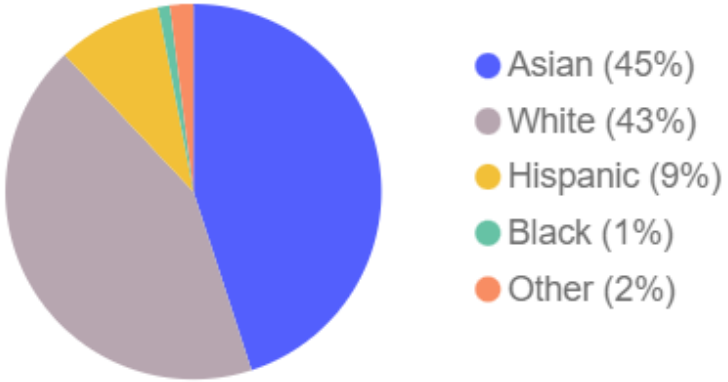
Academia



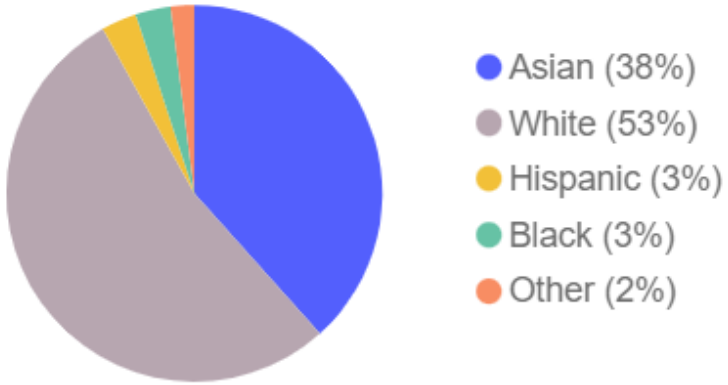
Government



Non-U.S.

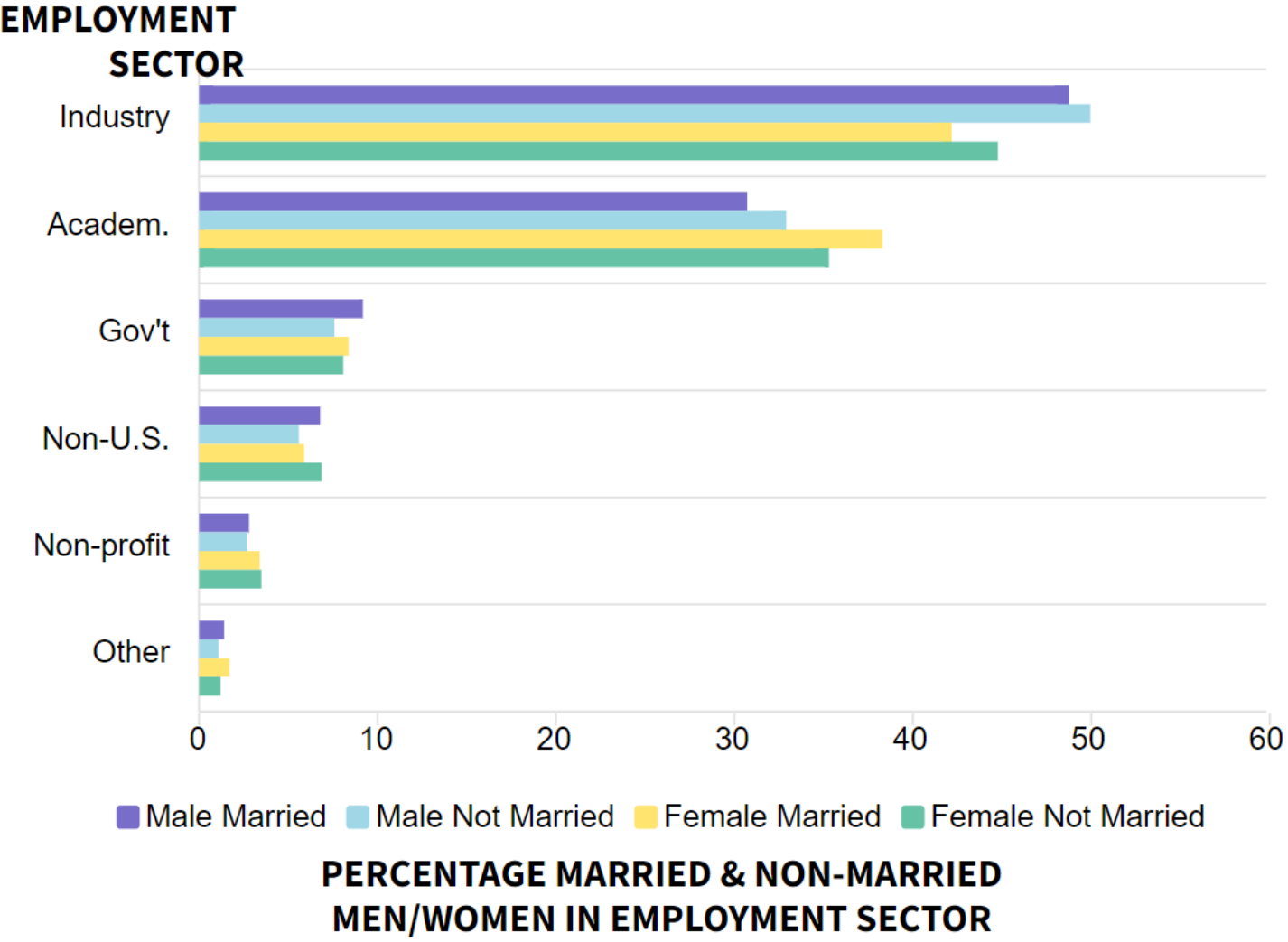


Non-Profit



Note: "Other" includes American Indian or Alaska Native; Native Hawaiian or other Pacific Islander; Multiple racial responses that cannot be prioritized into another category

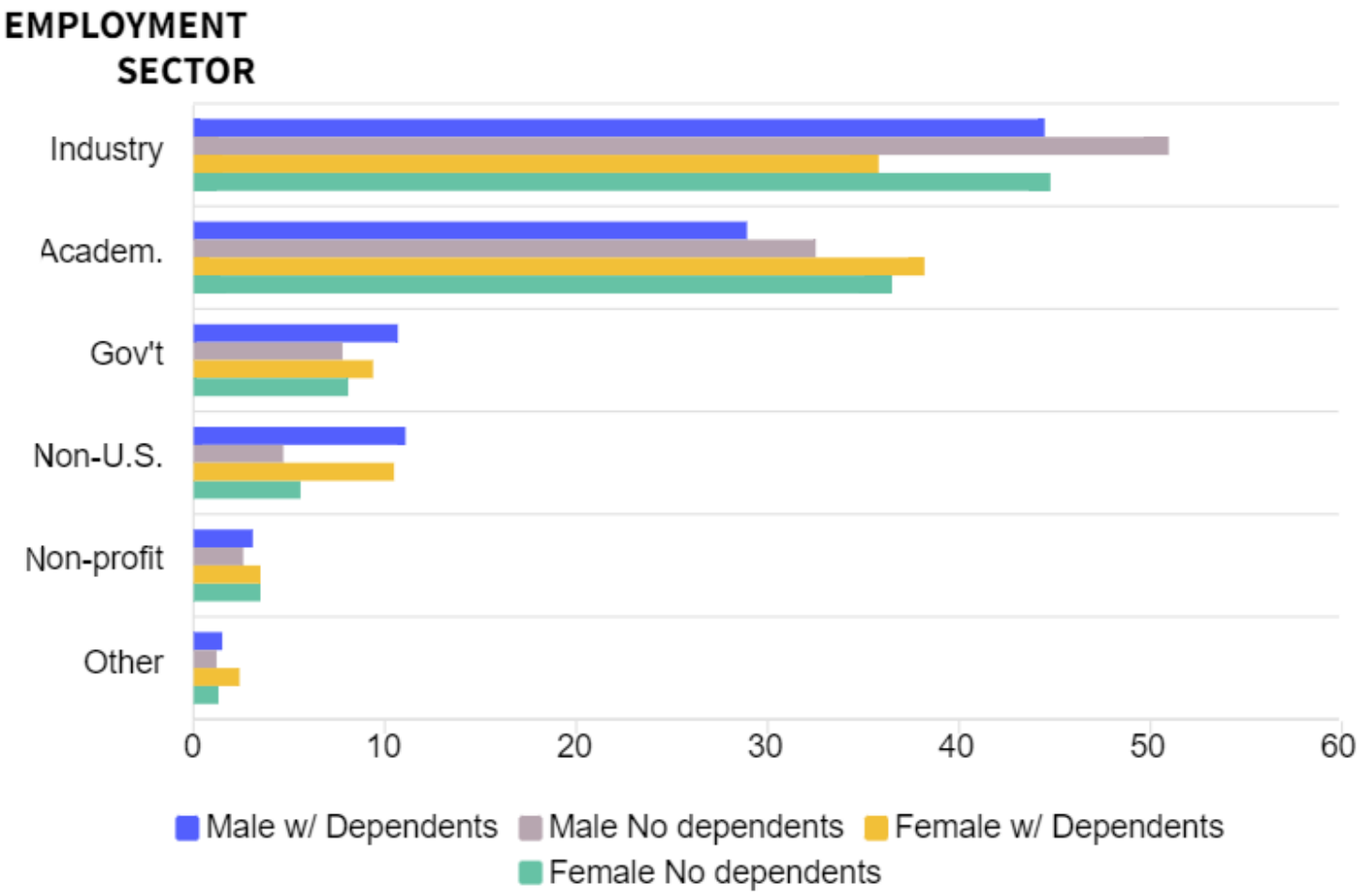
Sector by Gender and Marital Status of Engineering/CS PhDs



Overall Trends - Marital Status

- Gender/marital status composition is **reversed** for the **industry** sector and **academia**
- A higher proportion of **men**, overall, entered the **industry** sector
  - Unmarried men entered industry at a slightly higher rate than married men
  - Married and unmarried men both entered industry at a higher rate than married and unmarried women
- A higher proportion of **women** are in **academia**
  - Married women entered academia at a higher rate than unmarried women
  - Married and unmarried women both entered academia at a higher rate than married and unmarried men

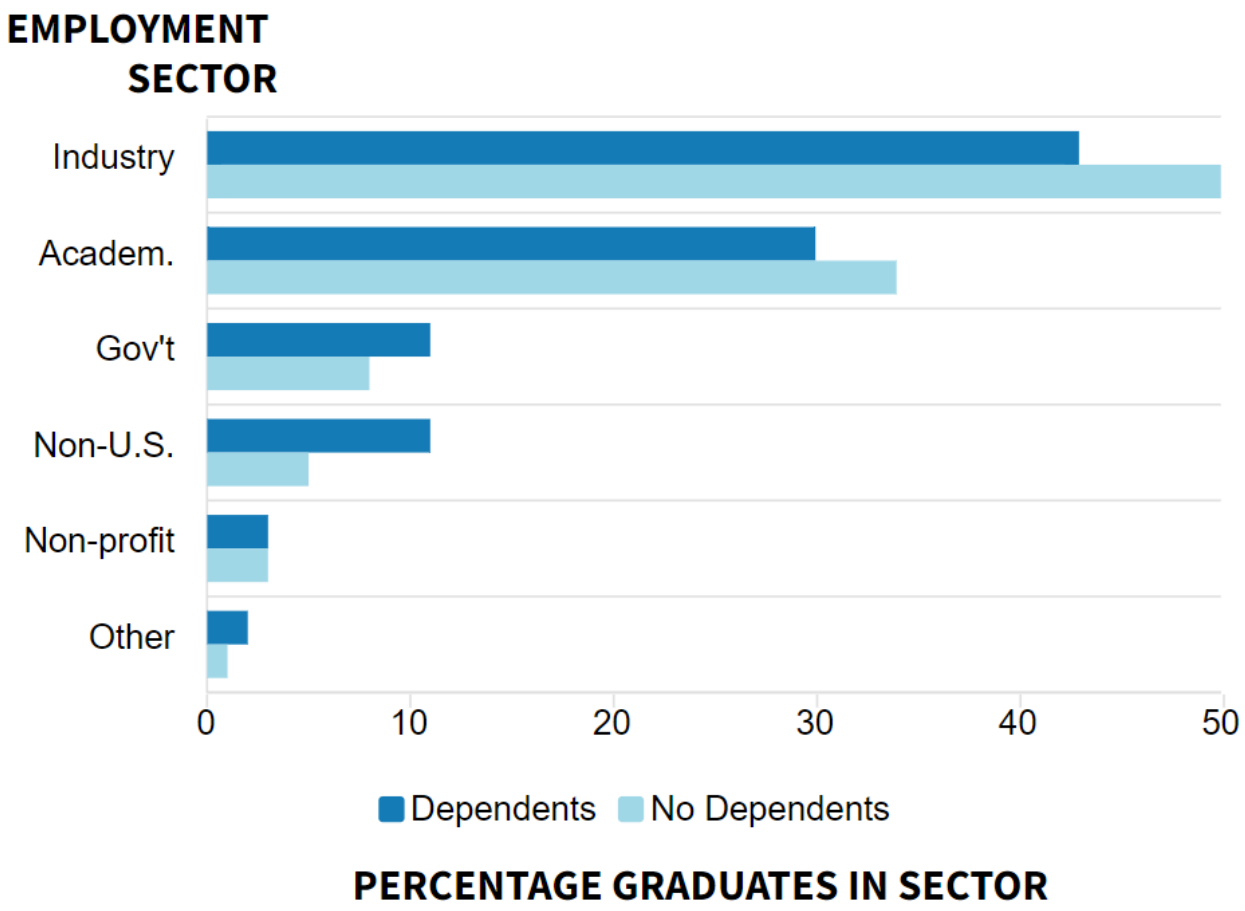
Sector by Gender and Dependents of Engineering/CS PhDs



Overall Trends - Gender & Dependents

- Employment sector trends based on **gender** and **dependents** are similar to gender/marital status trends: Gender/dependents trends are **reversed** for the **industry** sector and **academia**
- Men without dependents entered the industry sector at the highest rate (51%)
  - Women with dependents entered the industry sector at the lowest rate (36%)
- Women with dependents entered academia at the highest rate (38%)
  - Men with dependents entered academia at the lowest rate (29%)

Employment Sector by Dependents

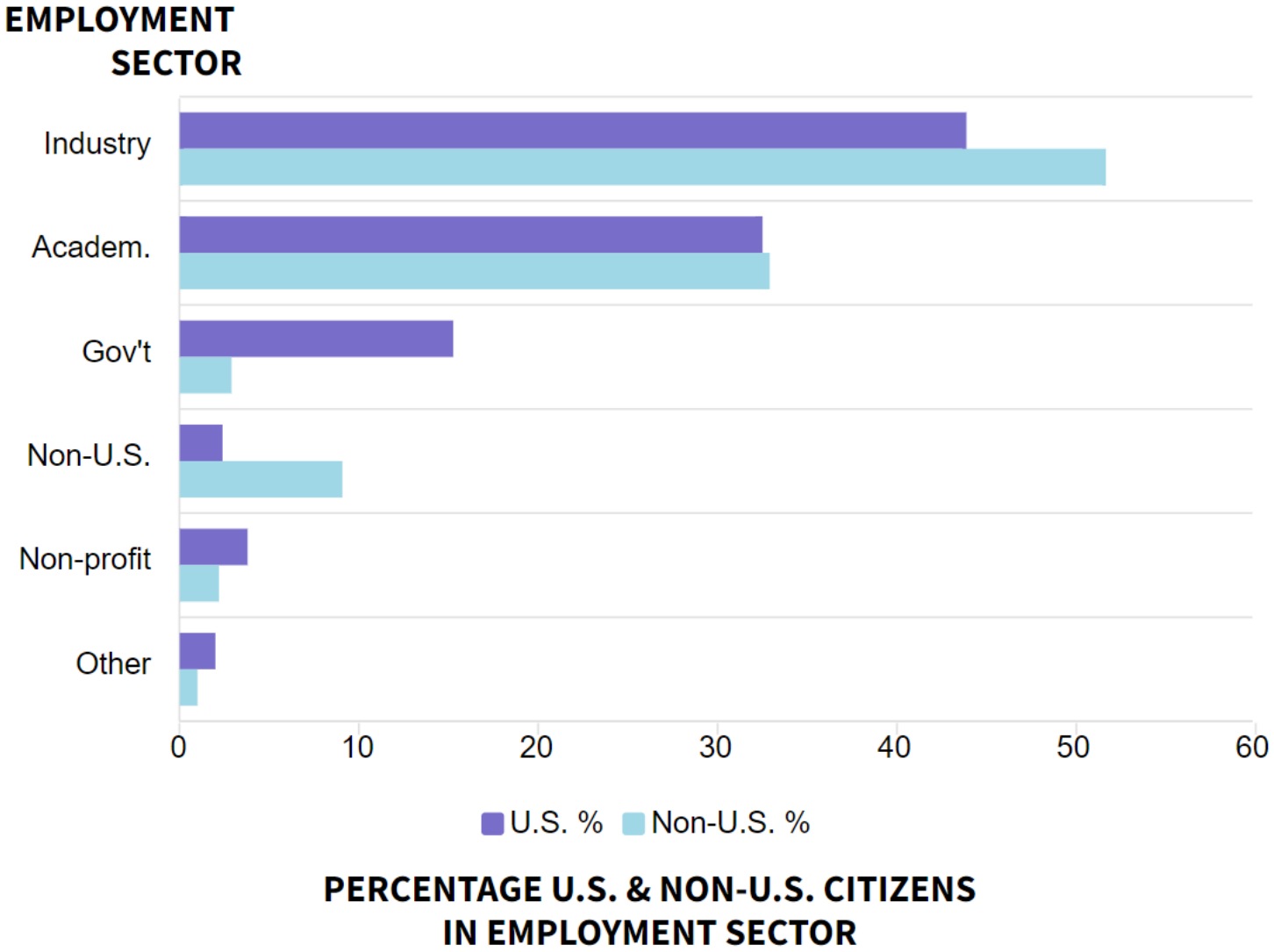


Overall Trends - Dependents

- There are higher proportions of graduates **without dependents** in **industry** and **academia**
  - 50% of grads without dependents are in industry versus only 43% of grads with dependents
  - 34% of grads without dependents are in acadmia (vs 30% with of grads with dependents)

- Graduates **with dependents** are found in **government, non-U.S. positions,** and **non-profit** roles at higher percentages than graduates without dependents

Sector by Citizenship of Engineering/CS PhDs



Overall Trends - Citizenship

- A higher proportion of non-U.S. citizen PhDs are in **industry** sector jobs (52%) than U.S. citizens (44%)
- Roughly equal proportions of U.S. citizen (33%) and non-U.S. citizen (33%) PhDs are in **academia**
- A higher proportion of PhDs who are U.S. citizens are in **government** sector jobs (15%) than PhDs who are not U.S. citizens (3%)
- Non-citizen PhDs entered **non-U.S. positions** at a higher rate (9%) than U.S. citizen PhDs (2%)

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