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U.S. DEPARTMENT OF ENERGY
Office of Science

Black Lives Count: Toward Accountability in Efforts to Diversify Computing

Damian Rouson

Exascale Computing Project Seminar, 25 October 2022

Outline

- Background & Motivation
- Data & Analysis
- Solutions & More Data
- Conclusions

Background

Background

www2.lbl.gov/today/2005/Mar/25-Fri/03-25-2005.html

LBL Careers - Jobs | Submission List | Inbox (409) - rouson@lbl.gov - B... | Hire Request Form | Today at Berkeley Lab: March 25,...

Today at Berkeley Lab

Friday, March 25, 2005

CALENDAR

Today

10 a.m.
Human Resources
Property Management: Part Two
Bldg. 69-Training Room

10:30 a.m.
Center for Beam Physics *The Electronuclear Fission Reactor and Neutrino Factory Based on Linear Collider*
Ilya Ginzburg, Novosibirsk
Bldg. 71-264

Noon
Employee Activities Assoc.
Yoga Class with Naomi Hartwig ($10/$12)
Bldg. 70-191

1 p.m.
Scientific Computing
Design Metrics in Quantum Turbulence Simulations: How Physics Influences Software Architecture
Damian Rouson, Naval Research Laboratory
Bldg. 50A-5132

IN THE NEWS

UIC NEWS BUREAU

DNA 'Packaging' Linked With Cancer

Bissell

New laboratory findings at the University of Illinois at Chicago suggest that what lies outside cancer cells is at least as important as the genes inside in explaining a tumor's malignancy. The molecules that surround a cell play a crucial role in altering the packaging of its genome, opening it up to the machinery that allows genes to be expressed, or closing it down, according to a study published in the April issue of the American Journal of Pathology. Researchers involved in the study include Berkeley Lab life scientist **Mina Bissell**. Full story.

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Compensation Training

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PARTICLE PHYSICS NEWS AND RESOURCES

Lab Scientists Help With MICE Project

Neutrino radiation.

In the quest to unravel the characteristics of the mysterious neutrino particle, scientists are building a unique engineering technology demonstrator at the Rutherford Appleton Laboratory in England. Known as MICE (Muon Ionisation Cooling Experiment), the experiment will prove one of the key requirements to produce intense beams of neutrinos at a dedicated Neutrino Factory to be built later this decade. **Mike Zisman**, with the Lab's Accelerator and Fusion Research Division, is the deputy spokesperson for this project, which recently received nearly $19 million in funding. AFRD physicist **Derun Li** and engineers **Steve Virostek** and Mike Green (now retired) are also working

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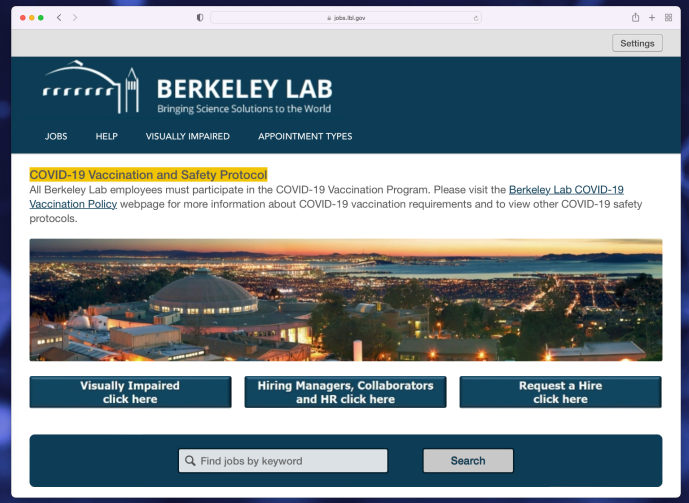

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2012

2013

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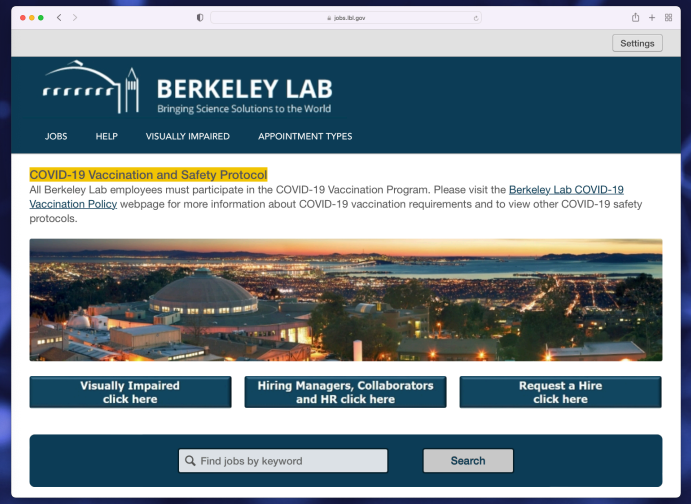

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Where is everybody?

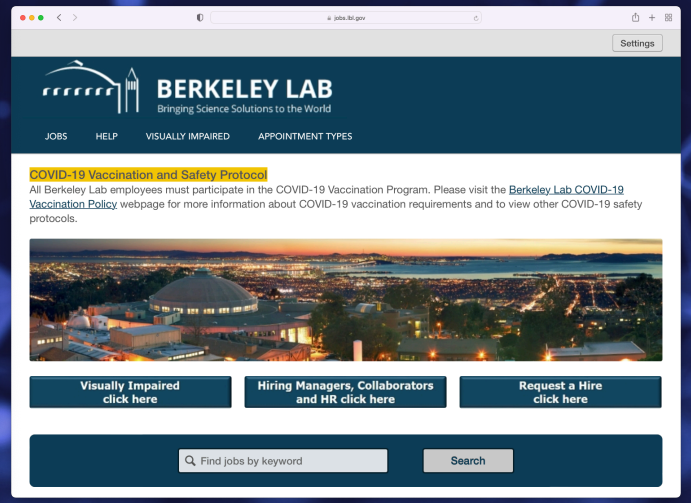
2005

2012

2013

2014-2020

Background



Where is everybody?

2005

2012

2013

2014-2020

2021

Motivation

www.whitehouse.gov/briefing-room/statements-releases/2

FACT SHEET: Biden-Harris Administration Releases Recommendations for Advancing Use of Equitable Data | The White House

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BRIEFING ROOM

FACT SHEET: Biden-Harris Administration Releases Recommendations for Advancing Use of Equitable Data

APRIL 22, 2022 • STATEMENTS AND RELEASES

The Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the federal government ("Equity EO") launched a whole-of-government effort to incorporate the principle of equity throughout the federal government. Recognizing that the ability to conduct equity assessments—i.e., to understand the impact of federal policies on equity outcomes—and identify and remove barriers to equitable access to government programs is contingent on gathering the necessary data, President Biden ordered the formation of the Equitable Data Working Group ("Working Group"). The President directed the Working Group to study existing federal data collection policies, programs, and infrastructure to identify inadequacies and provide recommendations that lay out a strategy for increasing data available for measuring equity and representing the diversity of the American people.

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FACT SHEET: Biden-Harris Administration Releases Recommendations for Advancing Use of Equitable Data | The White House

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These stakeholders and officials identified three priority uses for equitable data: **generating disaggregated statistical estimates to characterize experiences** of historically underserved groups using survey data; **increasing non-federal research and community access to disaggregated data** for the evidence-building that supports equity efforts; and **conducting robust equity assessments of federal programs** to identify areas for improvement. The Working Group also pursued a series of case studies to identify what progress could be made using existing program data to answer equity-centered questions in areas such as economic recovery and pandemic or environmental disaster response.

A Vision for Equitable Data

Equitable data are those that allow for rigorous assessment of the extent to which government programs and policies yield consistently fair, just, and impartial treatment of all individuals. Equitable data illuminate opportunities for targeted actions that will result in demonstrably improved outcomes for underserved communities. The following practices will allow us to **achieve our equitable data vision:**

Make Disaggregated Data the Norm While Protecting Privacy

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Motivation

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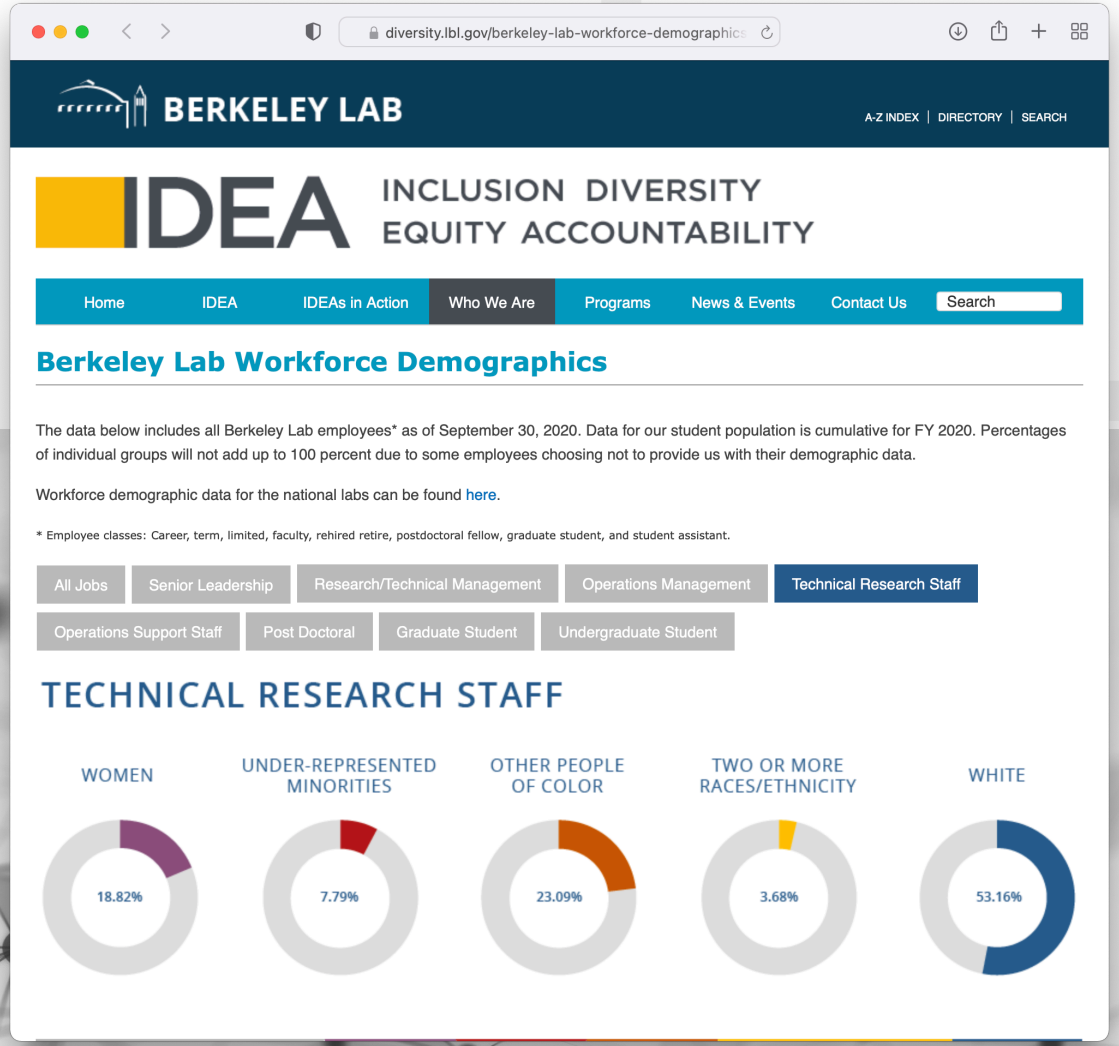
Aggregated Workforce Data



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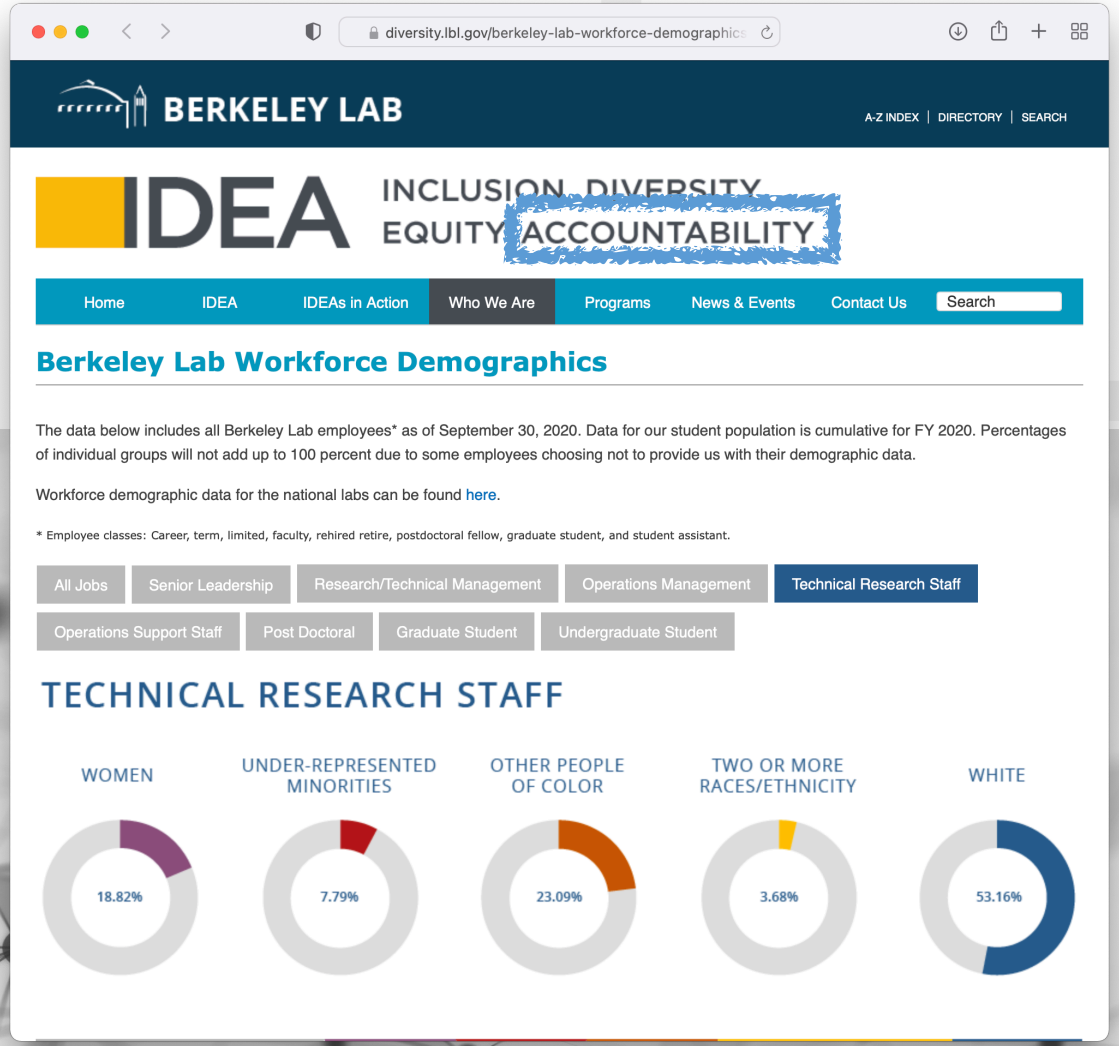

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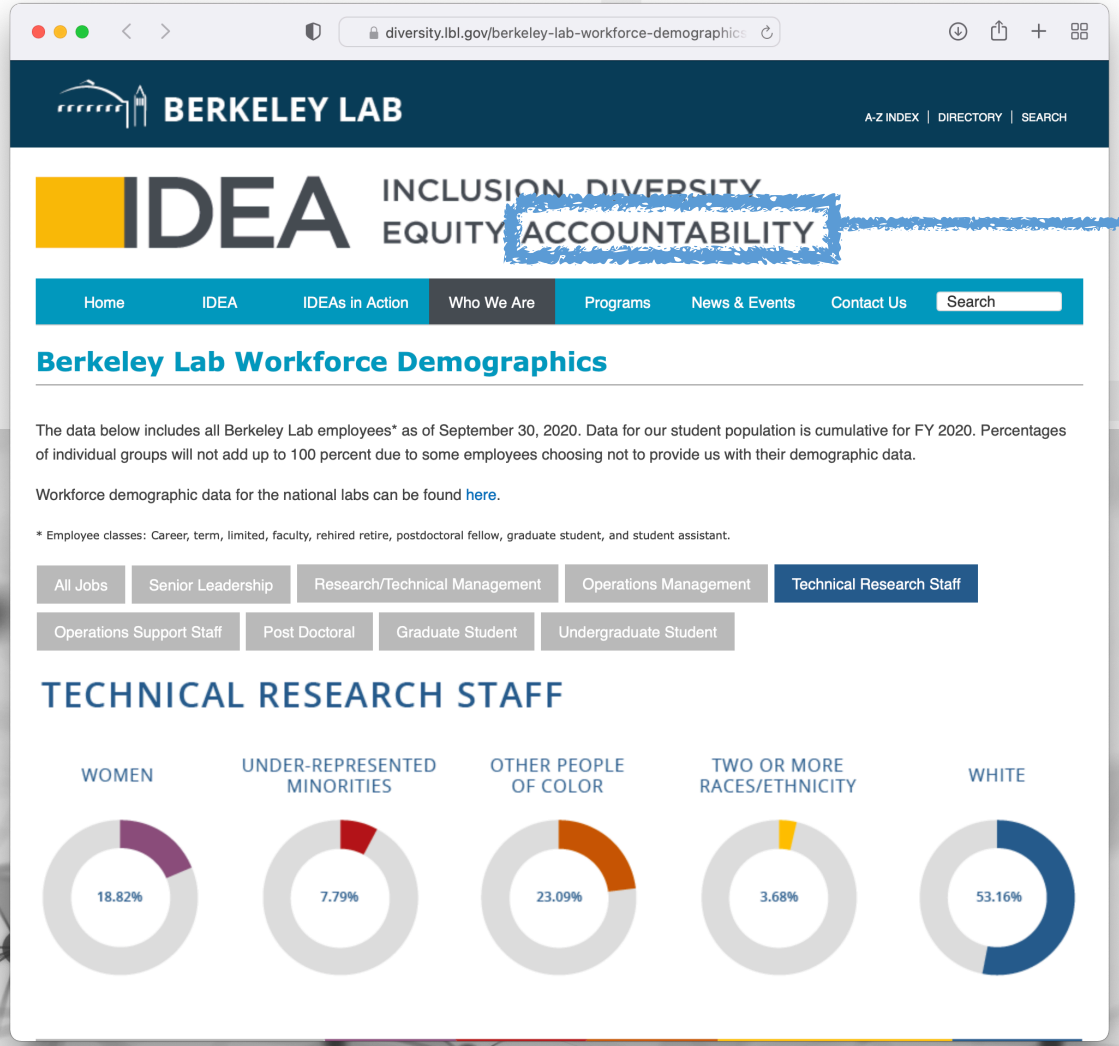

BLACK
LIVES
COUNT

Disaggregated Workforce Data

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DOE Laboratory DEI and Workforce Demographics

The Department of Energy's 17 National Laboratories are delivering on DOE's mission in discovery science, clean energy and energy independence, national security, and economic prosperity and global competitiveness by performing leading-edge research, using multidisciplinary research capabilities and large scale scientific tools that are the envy of the world. The DOE National Laboratories collectively employ over 50,000 people. In addition, the DOE laboratories are host to over 45,000 visiting scientists, students, and users of its scientific user facilities each year.
As leading institutions in transformative science and innovation, the DOE National Laboratories believe that success depends on the unique insights and perspectives enabled by a diverse workforce. The DOE National Laboratories are each engaged in diversity, equity, and inclusion initiatives focused on:

- Creating an inclusive work environment where a variety of differences and talents are leveraged to advance world-class science and innovation;
- Advancing the recruitment, development, and retention of a diverse and talented workforce;
- Preventing discrimination, bias, and harassment; and
- Expanding the science, technology, engineering, and mathematics (STEM) talent pipeline through STEM training programs and outreach.

The DOE National Laboratories publicly post the demographic data of their collective workforce to provide transparency and as a demonstration of their continued commitment to these initiatives.

To learn more about the DEI efforts of each of the DOE National Laboratories and or view their laboratory-specific workforce demographics, visit their websites:

Diversity and Inclusion at National Labs

Ames Laboratory
Argonne National Laboratory
Brookhaven National Laboratory
Fermi National Accelerator Facility
Lawrence Berkeley National Laboratory
Oak Ridge National Laboratory
Pacific Northwest National Laboratory
Princeton Plasma Physics Laboratory
SLAC National Accelerator Laboratory
Thomas Jefferson National Accelerator Facility
Idaho National Laboratory
National Renewable Energy Laboratory
National Energy Technology Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory
Sandia National Laboratory

Contact Office of Scientific Workforce Diversity, Equity, and Inclusion

Address
U.S. Department of Energy
SC-2.1/Forrestal Building
1000 Independence Ave., SW
Washington, DC 20585

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Idaho National Laboratory
National Renewable Energy Laboratory
National Energy Technology Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory
Sandia National Laboratory

Disaggregated Workforce Data

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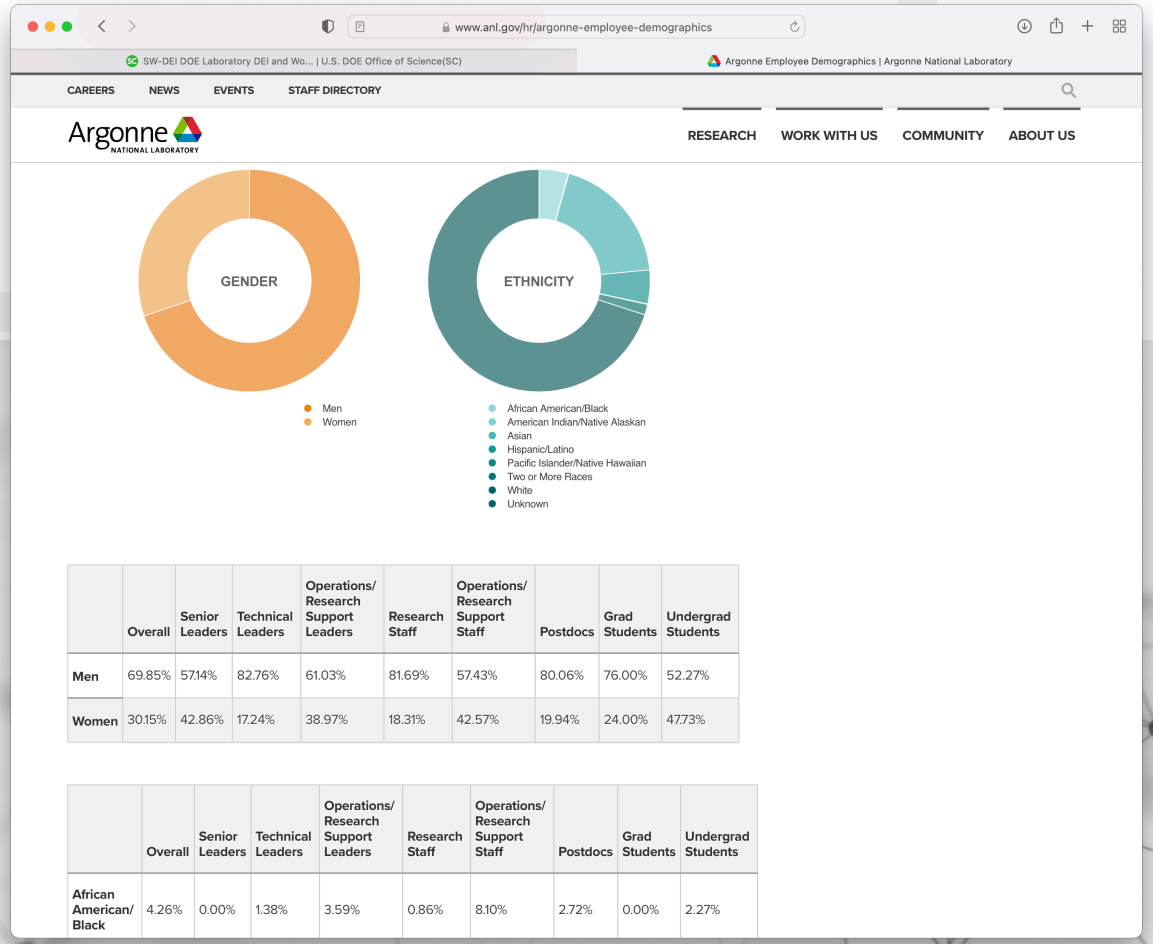
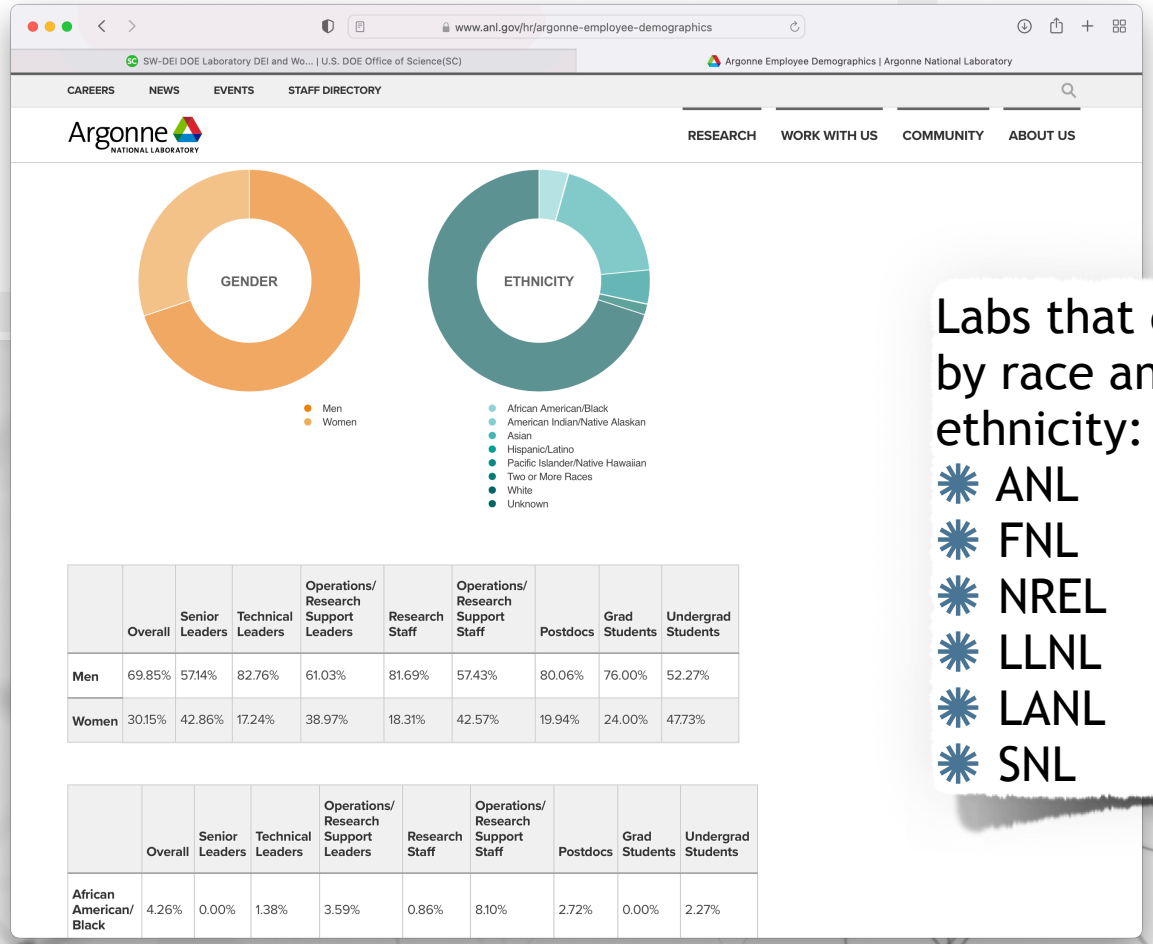


	Overall	Senior Leaders	Technical Leaders	Operations/ Research Support Leaders	Research Staff	Operations/ Research Support Staff	Postdocs	Grad Students	Undergrad Students
Men	69.85%	57.14%	82.76%	61.03%	81.69%	57.43%	80.06%	76.00%	52.27%
Women	30.15%	42.86%	17.24%	38.97%	18.31%	42.57%	19.94%	24.00%	47.73%

	Overall	Senior Leaders	Technical Leaders	Operations/ Research Support Leaders	Research Staff	Operations/ Research Support Staff	Postdocs	Grad Students	Undergrad Students
African American/ Black	4.26%	0.00%	1.38%	3.59%	0.86%	8.10%	2.72%	0.00%	2.27%

Disaggregated Workforce Data



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Labs that disaggregate by race and/or ethnicity:

- ANL
- FNL
- NREL
- LLNL
- LANL
- SNL

Disaggregated Pipeline Data

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Enrollments | Racial Gap | Campus Racial Incidents | Appointments | Awards | Grants | Books | HBCUs | Graduate Schools | Profess

Academic Disciplines Where African Americans Received Few or No Doctorates in 2019

Filed in Degree Attainments, Racial Gap, Research & Studies, STEM Fields on January 4, 2021

The National Science Foundation recently released its annual data on doctoral degree recipients in the United States. Data for the annual *Survey of Earned Doctorates* shows that in 2019 there were 2,512 African Americans who earned doctorates. They made up 7.1 percent of all doctorates awarded to U.S. citizens or permanent residents in the United States. But there are many fields where Blacks earned only a tiny percentage of all doctorates. In several specific fields, African Americans did not earn any doctorates.

For example, African Americans earned only one percent of all doctorates awarded in physics to U.S. citizens and permanent residents. Blacks earned 3.2 percent of all mathematics and statistics doctorates, 3.4 percent of all doctorates in computer science, 3.5 percent of all doctorates in chemistry, and only 4.2 percent of all doctorates awarded in engineering disciplines.

Disaggregated Pipeline Data

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Probability of 0% Representation Through Random Sampling

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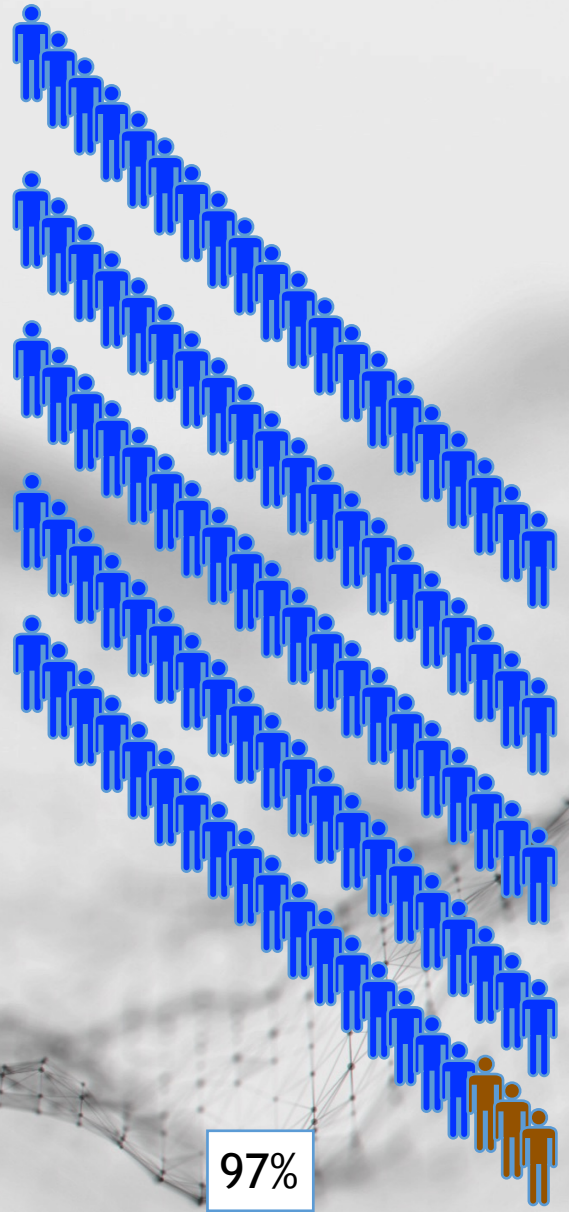

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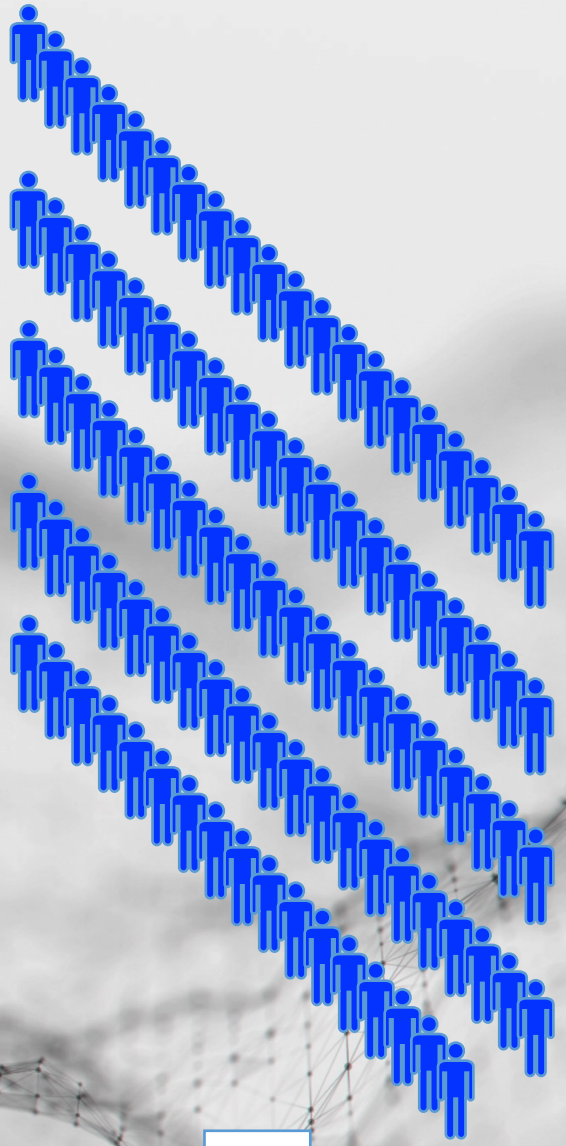

97%

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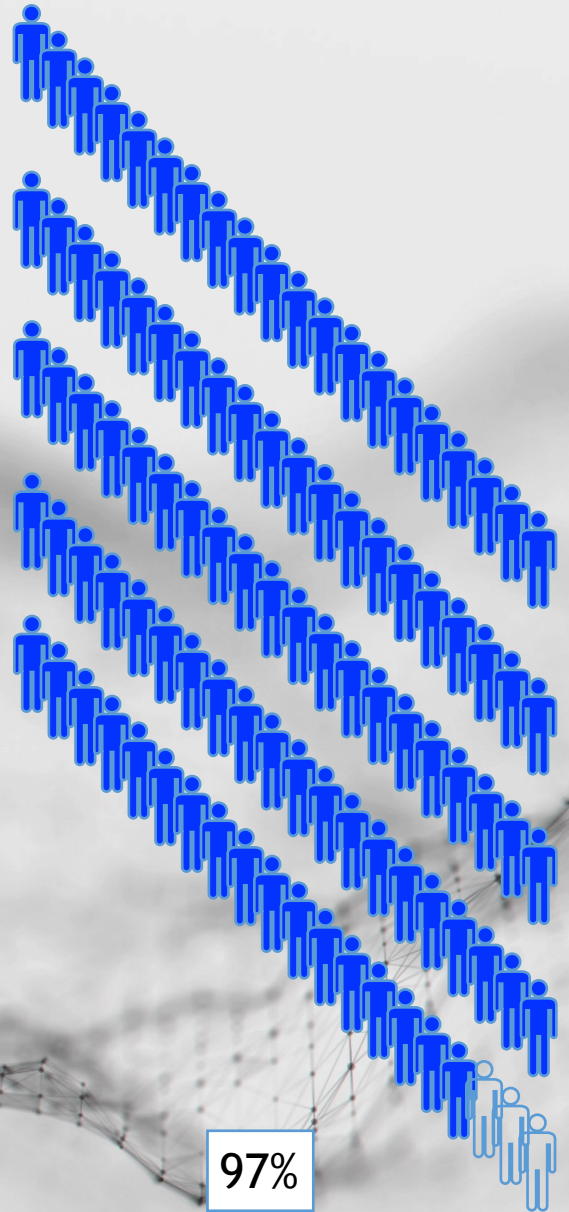

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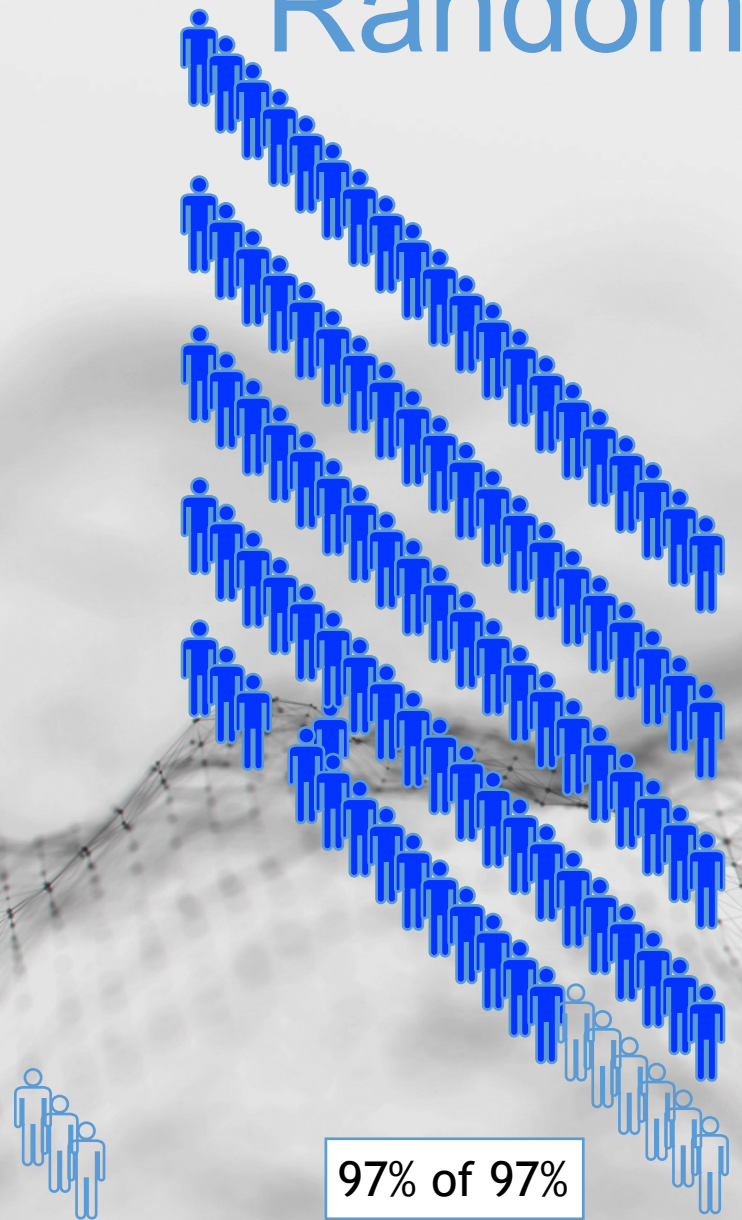

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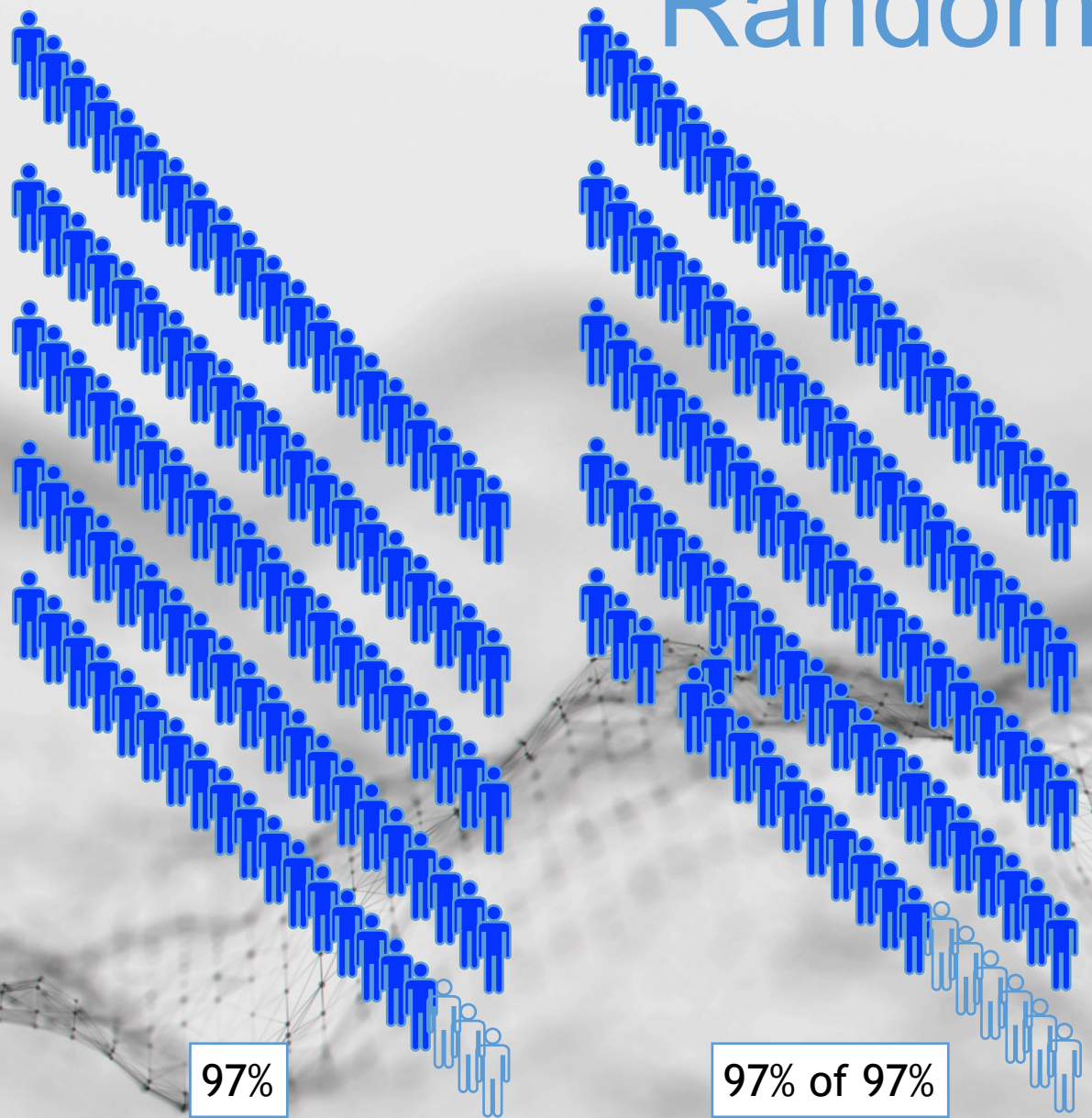

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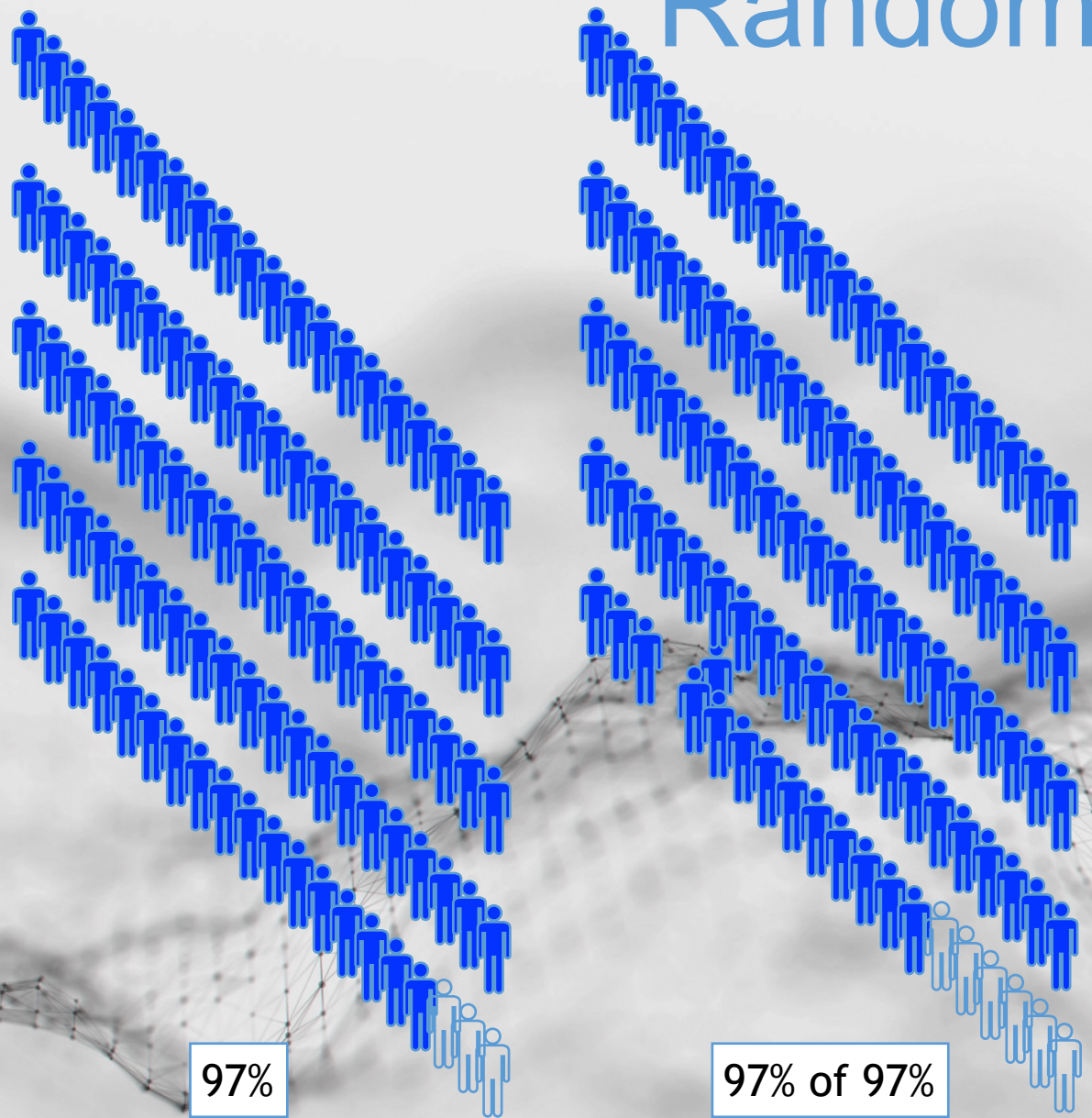

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$.97^{100} = 4.8\%$

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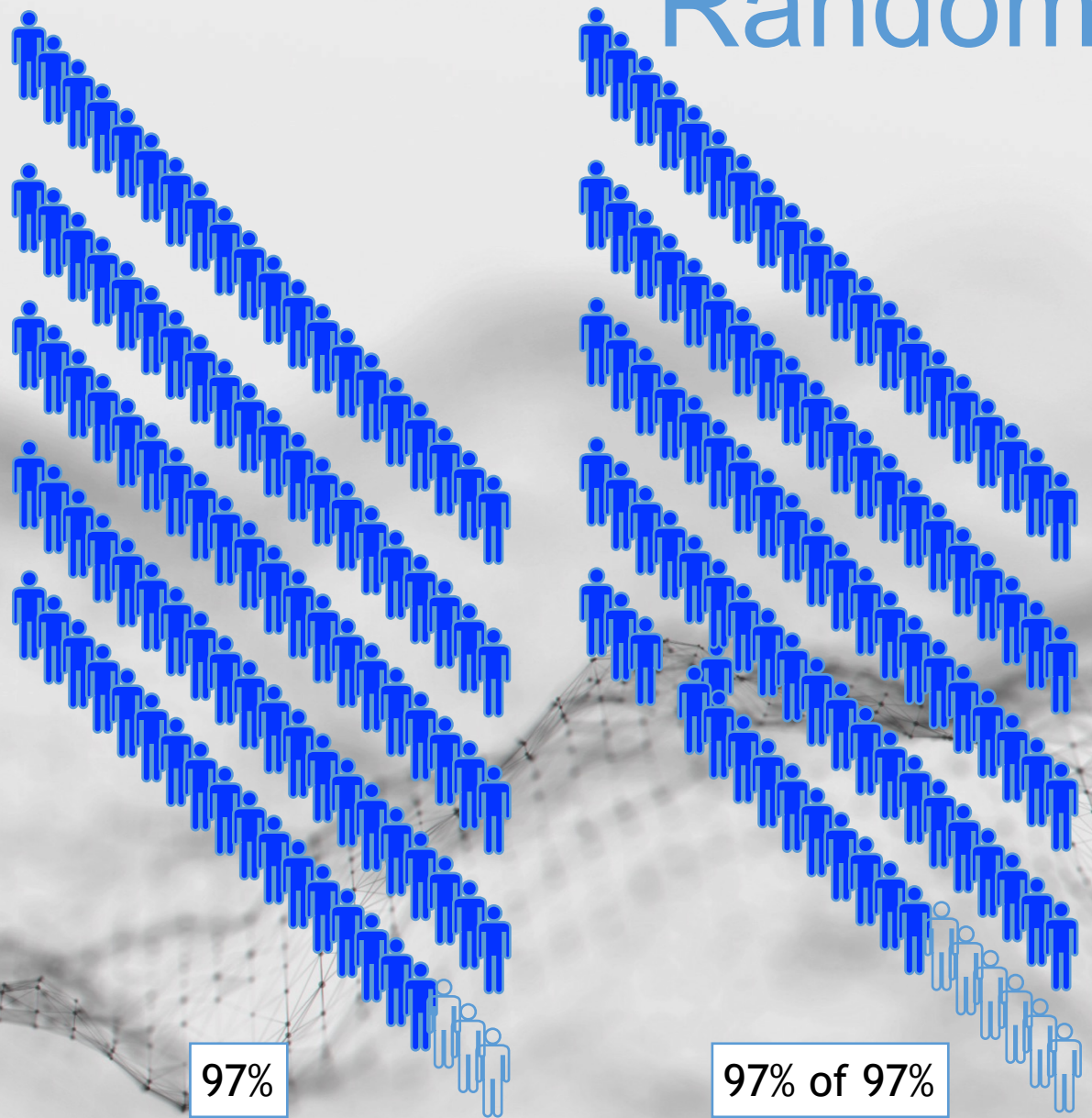

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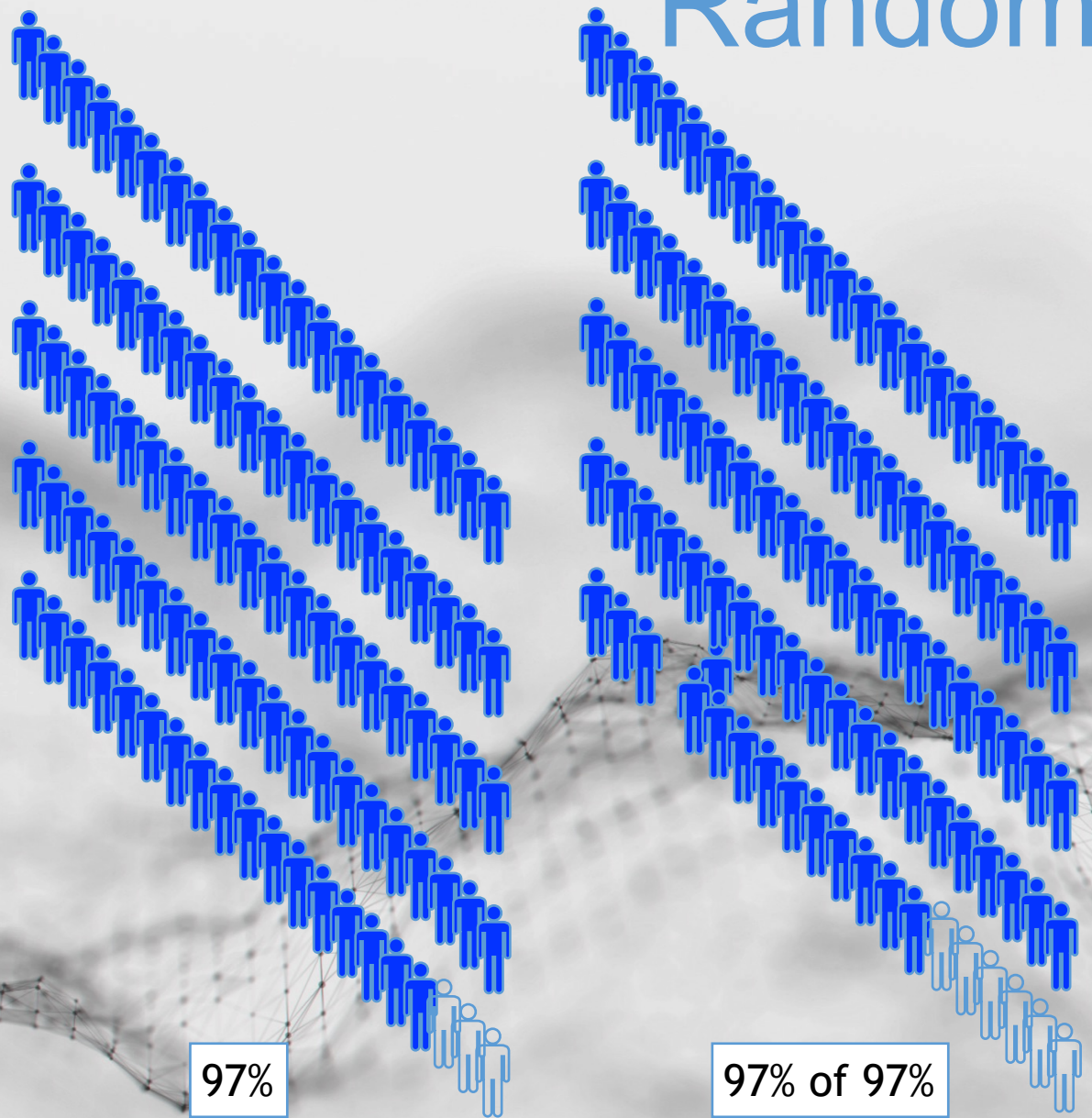
$.97^{100} = 4.8\%$

$.97^{200} = 0.2\%$

Probability of 0% Representation Through Random Sampling



…

$.97^{100} = 4.8\%$

$.97^{200} = 0.2\%$

$.97^{300} = 0.01\%$

Where Is Everybody?

en.wikipedia.org/wiki/Fermi_paradox

2 of 41 matches Contains where Done

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Fermi paradox

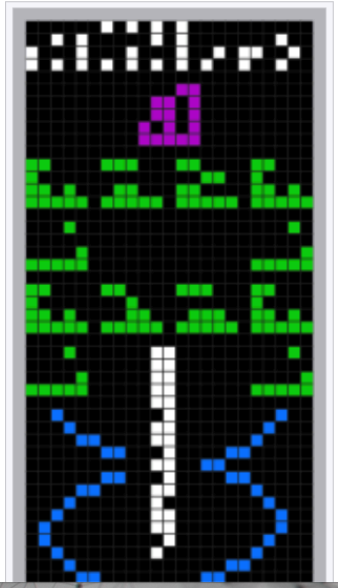
From Wikipedia, the free encyclopedia

This article is about the absence of clear evidence for space aliens. For a type of estimation problem, see Fermi problem.

The **Fermi paradox** is the conflict between the lack of clear, obvious evidence for extraterrestrial life and various high estimates for their existence.[1][2]

As a 2015 article put it, "If life is so easy, someone from somewhere must have come calling by now."[3]

Italian-American physicist Enrico Fermi's name is associated with the paradox because of a casual conversation in the summer of 1950 with fellow physicists Edward Teller, Herbert York and Emil Konopinski. While walking to lunch, the men discussed recent UFO reports and the possibility of faster-than-light travel. The conversation [illegible] until during lunch Fermi blurted ou[illegible] "But where is everybody?" (although the exact quote is uncertain).[illegible]



SETI:
Drake equation

$$N = f_p \cdot f_1 \cdot f_i \cdot f_c \cdot (n_e R_* L)$$

N	Number civilizations in our galaxy with which communication might be possible
f_p	Fraction of stars with planets
f_1	Fraction of those planets that develop life
f_i	Fraction of those planets that develop intelligent life (civilizations)
f_c	Fraction of civilizations that release detectable signals (technology)
n_e	Average number of planets that can support life per star with planets
R_*	Average star-formation rate
L	Length of time for which those civilizations release detectable signals

SATI

$$N = \overbrace{f_1 \cdot f_i \cdot f_c}^{\text{The Filters}} \cdot \overbrace{(f_p R_* L)}^{\text{The Pipeline}}$$

N	Number of African-American STEM Ph.D.'s in our galaxy whom you might hire
f_1	Fraction of AA STEM graduates who apply for your positions
f_i	Fraction of applicants who match specific technical/project/programmatic needs
f_c	Fraction of applicants who meet some measure of merit
f_p	Fraction of graduates in STEM fields
R_*	Average AA Ph.D. graduation rate
L	Average career length

Outline

- Background & Motivation
- Data & Analysis
- Solutions & More Data
- Conclusions

Good News: We Can Address Filters

Fraction of AA STEM graduates who apply for your positions:
- Expand beyond our networks,
- Go where underrepresented populations are overrepresented

Fraction of applicants who match specific technical/project/programmatic needs:
- Fund the hiring of top talent by means other the project money (Sandia's Early Career LDRD)

Fraction of applicants who meet some measure of merit
- Research indicates that quality increases with increased hiring of underrepresented groups

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By Keith H. Jackson

The National Society of Black Physicists (NSBP) has been concerned about the small number of African–Americans with career scientific staff appointments at Department of Energy funded national laboratories. NSBP has also been frustrated with the overall lack of participation of Historically Black Colleges and Universities (HBCUs) in DOE-funded scientific user facilities such as high energy physics and nuclear facilities, Synchrotron Light Sources, and the Spallation Neutron Source. As a result of these concerns, the Technical Executive Officer of NSBP began to collect data, which were placed before the American Physical Society Committee on Minorities (COM). The American Physical Society Committee on Minorities formally took up the issue but first wanted to verify the data provided by NSBP, and to expand the study to include Hispanic physicists. COM enlisted and received the full support of both the National Society of Black Physicists and the National Society of Hispanic Physicists (NSHP).

Our data show that in general African American Ph.D. physicists are less than 0.5% of the Ph.D. physicists employed at the DOE labs. African Americans make up nearly 2% of the physics faculties across the United States, including the faculties of HBCUs. Looking at data compiled by Professor Donna Nelson at University of Oklahoma, we find that the percentage of African-Americans on the faculties of the top 50 physics departments in the U.S. is much smaller (N=60 or 0.6% of total).

What do these numbers mean and what is the connection between the universities and the DOE-funded national laboratories? The DOE labs are government-owned but contractor-operated (GOCO) and the contractor/operators are universities that do not have a single African-American on their physics faculties. The hiring practices and recruiting of the universities are mirrored at the laboratories which they manage. The NSBP has several hypotheses about the reasons:

•Many university faculty have joint appointments with the national laboratories and serve on the scientific staff committees responsible for hiring.

•Graduate students from the managing university, and post-docs from established collaborators, have first shot at post-docs and staff scientist positions. If you are not part of that informal network there is precious little chance at getting any position at the laboratory.

•Many African-American physicists have a natural affinity to the idea of teaching at an HBCU. While this is undoubtedly true, this really leads to a self-fulfilling prophecy, that is in fact motivated by hiring practices at other universities and the DOE labs. That is, academic appointments at these institutions are more available to African-American physicists since appointments in "top-50" departments and at the DOE labs are not available.

•The bottom line is that the labs have not been inventive and aggressive in recruiting domestic African-American and Hispanic-American scientific talent. What more important mission could there be for an organization that would claim to be a national laboratory?

Many of our colleagues would assert the "pool" or "external availability" of American-Americans with Ph.D.'s in physics is small, and that they know of no African-American with a Ph.D. in physics who is unemployed. But there is, for example, a top-10 university that has graduated over 34 African-Americans with Ph.D.'s in physics since 1974. This university also manages a DOE-funded laboratory. There is not a single African-American physicist on its physics or applied physics faculty. This may not be surprising, but in addition there is not a single African-American Ph.D.-level physicist on the staff of the national laboratory or on the research staff of the university period! There is a common misconception that African Americans somehow have an "affirmative action advantage" when applying for jobs at the national laboratories. If that were true, the statistics would be much better across the labs.

NSBP has some proposals for immediate action to address the diversity problem at the national labs. The labs should become intimately involved with the NSBP and the NSHP and other minority professional societies. These organizations have annual meetings that consist of technical and business sessions. At these meetings the labs will find serious scientists with whom their scientific staff can form authentic collaborations, partnerships and student exchanges. They will also find many students looking for research opportunities and mentorship.

The national laboratories could also benefit from a site visit by a team composed of members of NSBP to review and give serious advice on the recruitment, hiring practices, workplace environment, and quality of scientific outreach activities of DOE labs. The members that make up these professional organizations possess considerable scientific expertise, and are well informed about science resources within minority communities.

The national laboratories should aggressively seek out and form research partnerships with faculty at HBCUs, Hispanic Serving Institutions (HSIs) and Tribal Colleges. AIP statistics reveal that 44% of African American students who earn a baccalaureate degree in the sciences do so at Historically Black Colleges and Universities, and most African-American physics professors are at HBCUs. Research partnerships between research-intensive institutions and HBCUs have historically paid great dividends in increasing the number of minority Ph.D. physicists. Each DOE lab should have active collaborations with HBCUs, HSIs and Tribal Colleges that include staff exchanges, *i.e.*, sending lab personnel to the schools as visiting professors, and having professors at the labs as guest scientists, along with students as fellows. Many [illegible] joint appointments [illegible] researchers.

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Idaho Natl Engineering Lab	27	0
Jefferson Lab	79	0
Lawrence Berkeley Natl Lab	187	2
Lawrence Livermore Natl Lab	642	5
Los Alamos Natl Lab	686	2
Oak Ridge Natl Lab	182	0
Pacific Northwest Lab	66	0
Princeton Plasma Physics Lab	94	0
Sandia Natl Lab	264	0
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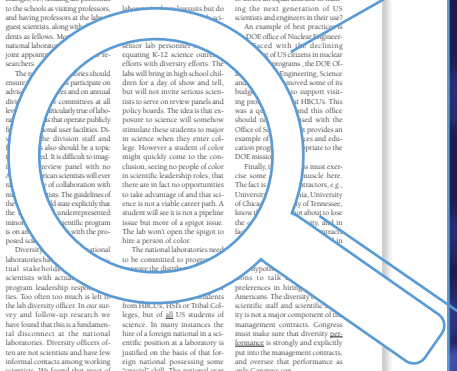

Keith H. Jackson

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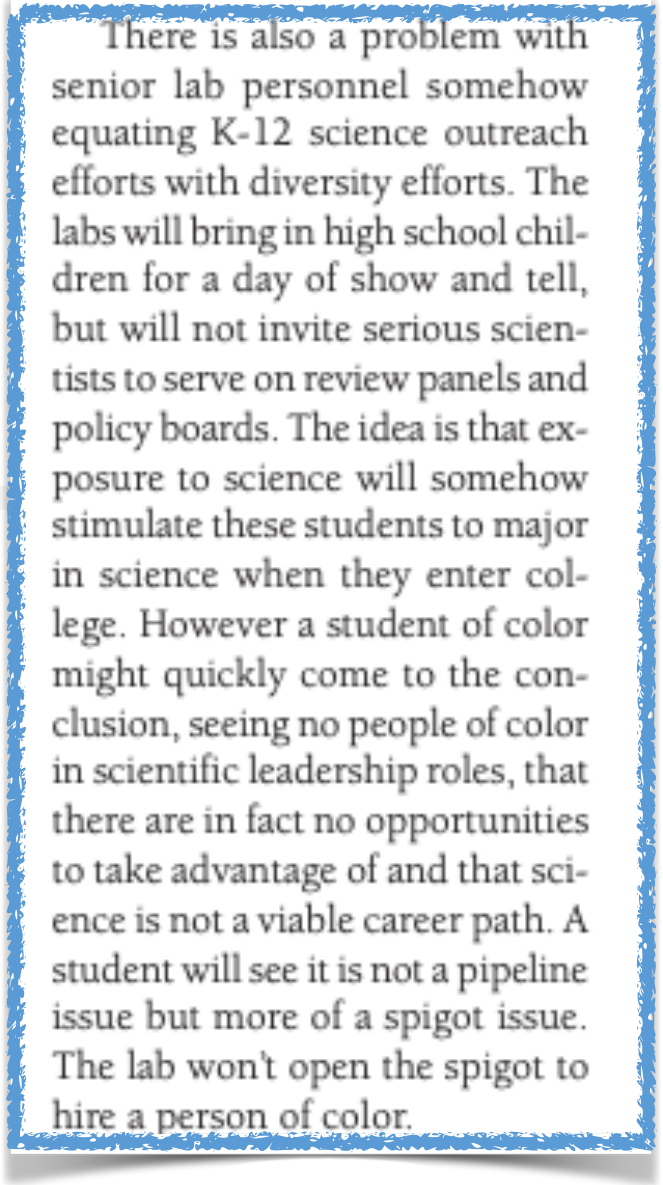

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The national laboratories should ensure that minorities participate on advisory committees and on annual divisional review committees at all levels. This is particularly true of laboratory divisions that operate publicly financed national user facilities. Diversity of the division staff and facility users also should be a topic to be reviewed. It is difficult to imagine how a review panel with no African-American scientists will ever raise the issue of collaboration with minority scientists. The guidelines of the review should state explicitly that the inclusion of underrepresented minorities in the scientific program is on an equal footing with the proposed science.

Diversity efforts at the national laboratories have to include the actual stakeholders, the senior scientists with actual hiring and program leadership responsibilities. Too often too much is left to the lab diversity officer. In our survey and follow-up research we have found that this is a fundamental disconnect at the national laboratories. Diversity officers often are not scientists and have few informal contacts among working scientists. We found that most of their job is to satisfy contractual obligations which may protect the laboratories from la[illegible] not help to diversify [illegible] entific workforce.

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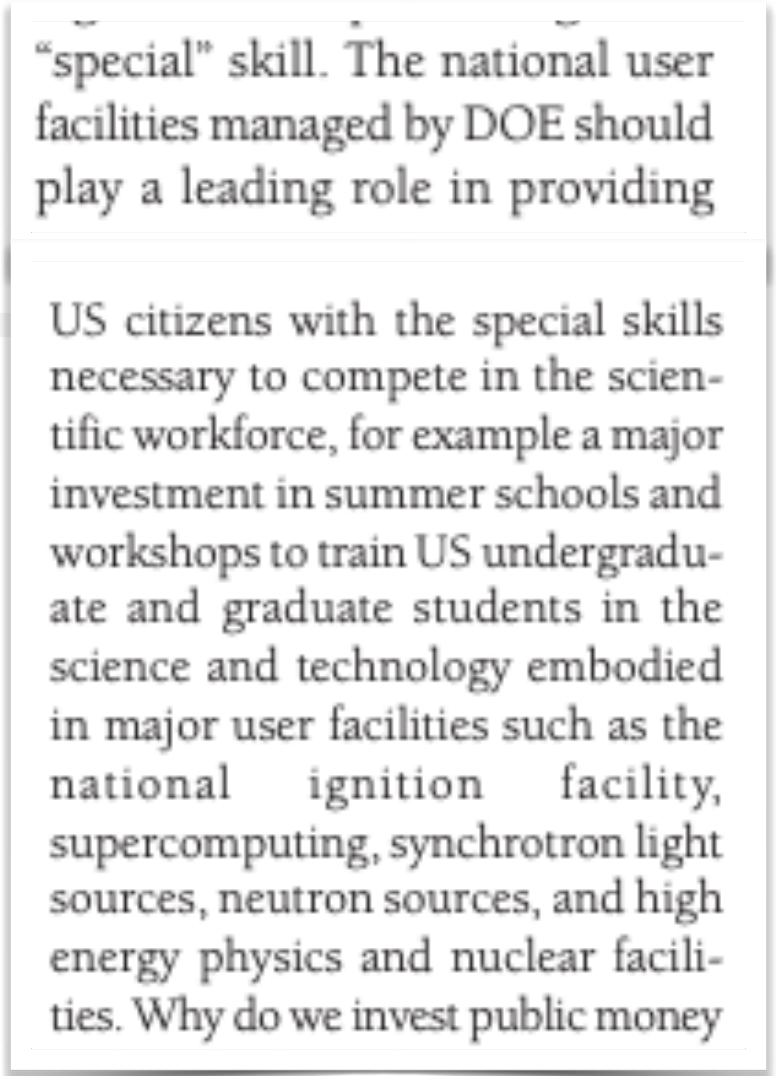

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Solutions

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THE BACK PAGE

The Status of the African-American Physicist in the Department of Energy National Laboratories

By Keith H. Jackson

The National Society of Black Physicists (NSBP) has been concerned about the small number of African–Americans with career scientific staff appointments at Department of Energy funded national laboratories. NSBP has also been frustrated with the overall lack of participation of Historically Black Colleges and Universities (HBCUs) in DOE-funded scientific user facilities such as high energy physics and nuclear facilities, Synchrotron Light Sources, and the Spallation Neutron Source. As a result of these concerns, the Technical Executive Officer of NSBP began to collect data, which were placed before the American Physical Society Committee on Minorities (COM). The American Physical Society Committee on Minorities formally took up the issue but first wanted to verify the data provided by NSBP, and to expand the study to include Hispanic physicists. COM enlisted and received the full support of both the National Society of Black Physicists and the National Society of Hispanic Physicists (NSHP).

Our data show that in general African American Ph.D. physicists are less than 0.5% of the Ph.D. physicists employed at the DOE labs. African Americans make up nearly 2% of the physics faculties across the United States, including the faculties of HBCUs. Looking at data compiled by Professor Donna Nelson at University of Oklahoma, we find that the percentage of African-Americans on the faculties of the top 50 physics departments in the U.S. is much smaller (N=60 or 0.6% of total).

What do these numbers mean and what is the connection between the universities and the DOE-funded national laboratories? The DOE labs are government-owned but contractor-operated (GOCO) and the contractor/operators are universities that do not have a single African-American on their physics faculties. The hiring practices and recruiting of the universities are mirrored at the laboratories which they manage. The NSBP has several hypotheses about the reasons:

- Many university faculty have joint appointments with the national laboratories and serve on the scientific staff committees responsible for hiring.
- Graduate students from the managing university, and post-docs from established collaborators, have first shot at post-docs and staff scientist positions. If you are not part of that informal network there is precious little chance at getting any position at the laboratory.
- Many African-American physicists have a natural affinity to the idea of teaching at an HBCU. While this is undoubtedly true, this really leads to a self-fulfilling prophecy, that is in fact motivated by hiring practices at other universities and the DOE labs. That is, academic appointments at these institutions are more available to African-American physicists since appointments in "top-50" departments and at the DOE labs are not available.
- The bottom line is that the labs have not been inventive and aggressive in recruiting domestic African-American and Hispanic-American scientific talent. What more important mission could there be for an organization that would claim to be a national laboratory?

Many of our colleagues would assert the "pool" or "external availability" of American-Americans with Ph.D.'s in physics is small, and that they know of no African-American with a Ph.D. in physics who is unemployed. But there is, for example, a top-10 university that has graduated over 34 African-Americans with Ph.D.'s in physics since 1974. This university also manages a DOE-funded laboratory. There is not a single African-American physicist on its physics or applied physics faculty. This may not be surprising, but in addition there is not a single African-American Ph.D.-level physicist on the staff of the national laboratory or on the research staff of the university period! There is a common misconception that African Americans somehow have an "affirmative action advantage" when applying for jobs at the national laboratories. If that were true, the statistics would be much better across the labs.

NSBP has some proposals for immediate action to address the diversity problem at the national labs. The labs should become intimately involved with the NSBP and the NSHP and other minority professional societies. These organizations have annual meetings that consist of technical and business sessions. At these meetings the labs will find serious scientists with whom their scientific staff can form authentic collaborations, partnerships and student exchanges. They will also find many students looking for research opportunities and mentorship.

The national laboratories could also benefit from a site visit by a team composed of members of NSBP to review and give serious advice on the recruitment, hiring practices, workplace environment, and quality of scientific outreach activities of DOE labs. The members that make up these professional organizations possess considerable scientific expertise, and are well informed about science resources within minority communities.

The national laboratories should aggressively seek out and form research partnerships with faculty at HBCUs, Hispanic Serving Institutions (HSIs) and Tribal Colleges. AIP statistics reveal that 44% of African American students who earn a baccalaureate degree in the sciences do so at Historically Black Colleges and Universities, and most African-American physics professors are at HBCUs. Research partnerships between research-intensive institutions and HBCUs have historically paid great dividends in increasing the number of minority Ph.D. physicists. Each DOE lab should have active collaborations with HBCUs, HSIs and Tribal Colleges that include staff exchanges, i.e., sending lab personnel to the schools as visiting professors, and having professors at the labs as guest scientists, along with their students as fellows. More importantly, national laboratories should pursue joint appointments with HBCU researchers.

The national laboratories should ensure that minorities participate on advisory committees and on annual divisional review committees at all levels. This is particularly true of laboratory divisions that operate publicly financed national user facilities. Diversity of the division staff and facility users also should be a topic to be reviewed. It is difficult to imagine how a review panel with no African-American scientists will ever raise the issue of collaboration with minority scientists. The guidelines of the review should state explicitly that the inclusion of underrepresented minorities in the scientific program is on an equal footing with the proposed science.

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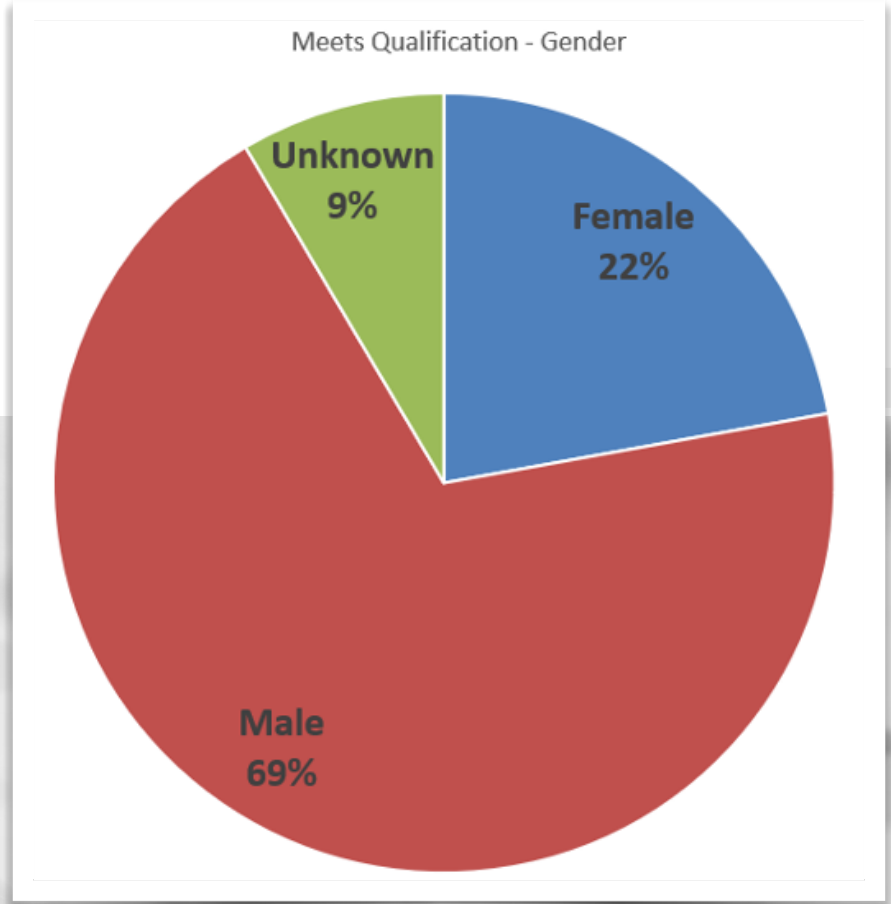
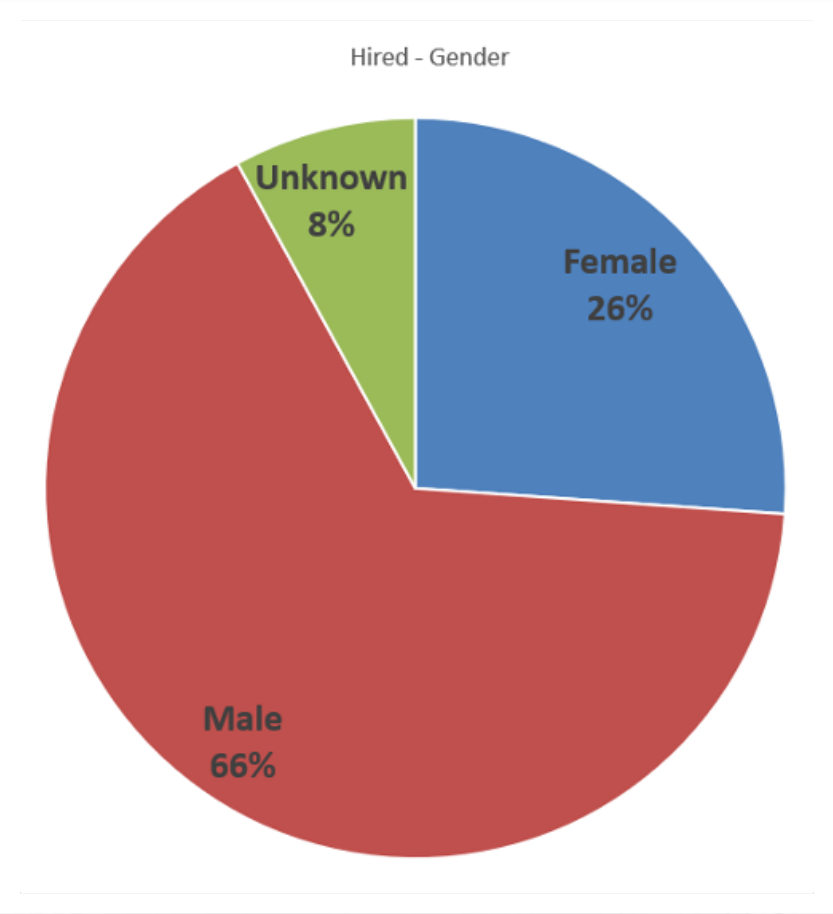
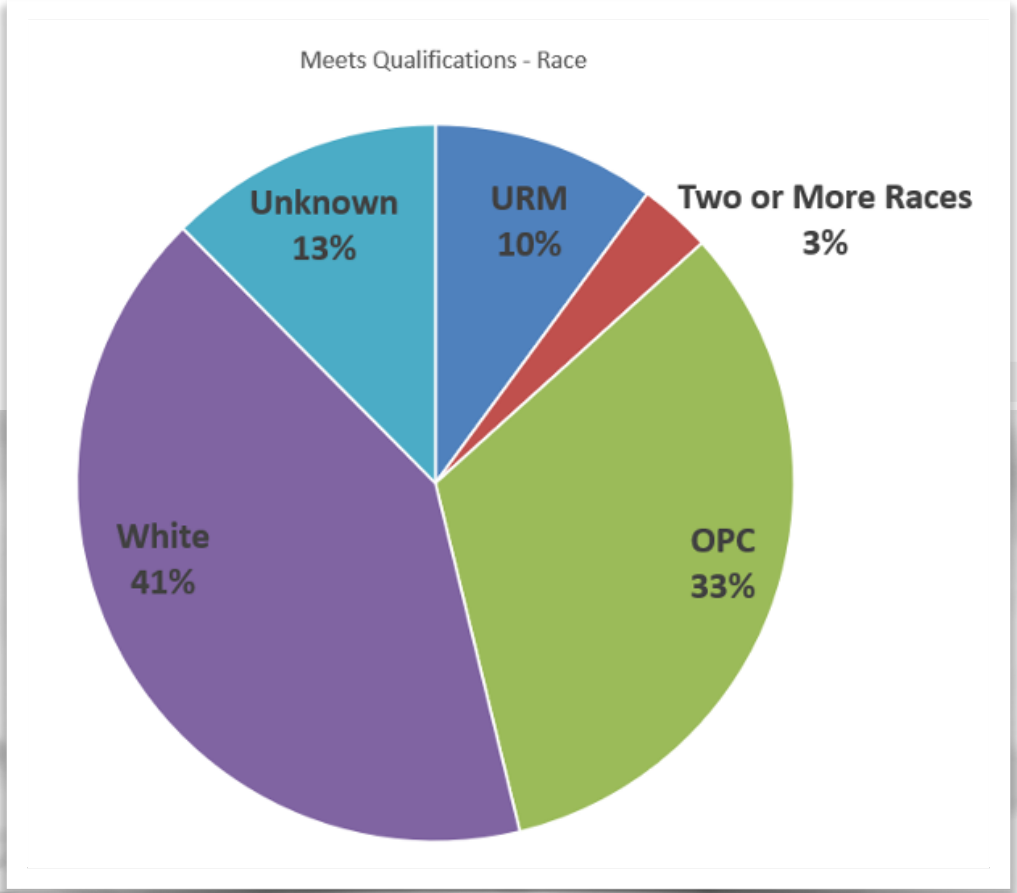
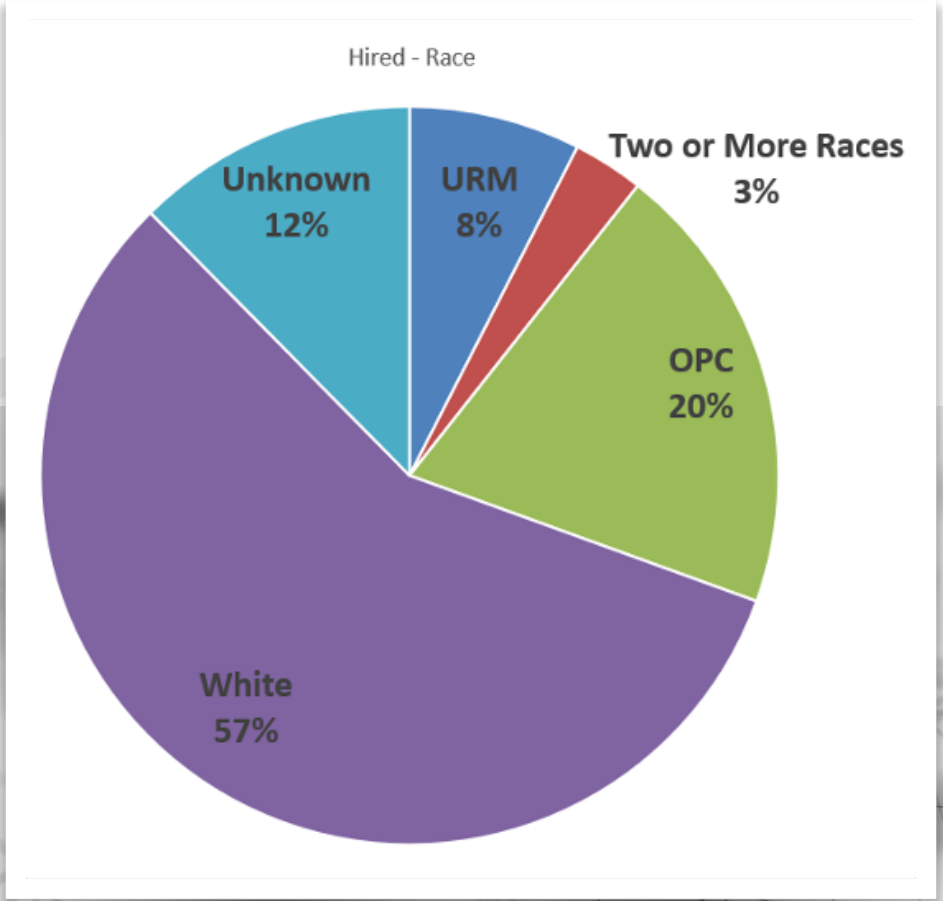




Berkeley Lab CS Area 2017-2021 hiring demographics

The Leaky Pipeline Problem





Berkeley Lab CS Area 2017-2021 hiring demographics

Solutions in Action

2015 - 2022

2015-2022

BERKELEY LAB

David Brown Mary Ann Leung Silvia Crivelli

Sustainable Research Pathways (SRP)

- Build relationships centered on research collaborations
- Recruit
  - Faculty working with underrepresented students
  - Students from underrepresented backgrounds
- Provide opportunities for staff scientists
  - Research collaborations
  - Learn/contribute to diversity and inclusion efforts
- Supplement existing D&I Laboratory programs

HPCwire Workforce Diversity and Inclusion Award 2021

Leung ASCAC presentation, July 2021

2022-

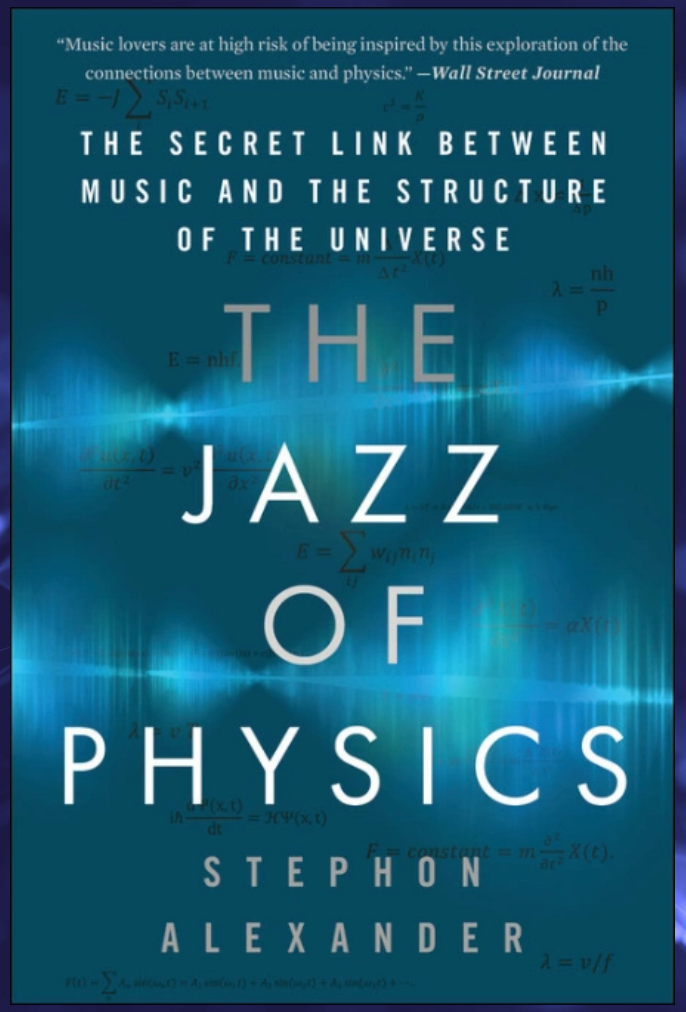
2022 -

ECP EXASCALE COMPUTING PROJECT

Mary Ann Leung, Lois Curfman-Mcinnes, Dan Martin, Ashley Barker, Julia White, Erik Draeger

Sustainable Research Pathways for HPC (SRP-HPC)

- Expands SRP into a multi-lab program throughout the ECP community.
- Integrates participants into the broader ECP community through research presentations at the ECP Annual Meeting starting in 2023.
- Normalizes inclusion partly through Guided Affinity Groups and engaging DEI exercises open to all at the ECP Annual Meeting, other planned activities
- Blends the benefits of SRP with the Broader Engagement (BE) program led by Sustainable Horizons Institute (SHI) at SIAM CSE.



A Diverse Workforce Does Work Differently…

"… Then, out of the blue, Salam says to Jim: 'One day, when your people do physics, it will be like jazz.'
What a great compliment, an affirmation and acknowledgment of the improvisational, inclusive, cultural, and intellectual contributions of this music called jazz."

—Stephon Alexander (*The Jazz of Physics*, p. 231) quoting physics Nobel laureate Abdus Salam as relayed by physicist Jim Gates.

"It occurred to me by intuition, and music was the driving force behind that intuition. My discovery was the result of musical perception."
— Albert Einstein (when asked about his theory of relativity)

… And Does Different Work

https://collegeville.github.io/CW20/

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Collegeville Workshop 2020

CW20 brings community members together to advance developer productivity for scientific software

View On GitHub

This project is maintained by Collegeville

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Details

- Workshop Survey
- Agenda Overview
  - Tuesday, July 21 Detailed Agenda
  - Wednesday, July 22 Detailed Agenda
  - Thursday, July 23 Detailed Agenda
- Resources
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HOME > BLOG > Increasing Productivity by Broadening Participation in...

Increasing Productivity by Broadening Participation in Scientific Software Communities

SHARE

ALEXANDRA BALLOW, A STUDENT AT YOUNGSTOWN STATE UNIVERSITY WHO WAS A PARTICIPANT IN THE BROADER ENGAGEMENT PROGRAM AT SIAM CSE19, PRESENTING HER WORK TO PAUL HOVLAND OF ARGONNE NATIONAL LAB. ALEXANDRA PREVIOUSLY PARTICIPATED IN THE SUSTAINABLE RESEARCH PATHWAYS PROGRAM.

PUBLISHED SEP 25, 2020

AUTHOR MARY ANN LEUNG, DAMIAN ROUSON, AND LOIS CURFMAN MCINNES

TOPICS BETTER COLLABORATION ↳STRATEGIES FOR MORE EFFECTIVE TEAMS ↳FUNDING SOURCES AND PROGRAMS

bssw.io/blog_posts/increasing-productivity-b

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Numerous studies have shown that diverse organizations, teams, and communities perform more creatively and effectively—and thus are more productive. While some efforts are already under way to broaden participation in high-performance computing (HPC) and computational science and engineering (CSE), we observe that our communities could benefit by increasing emphasis on sustainable strategies to advance diversity and inclusion.

Lois Curfman McInnes: Mary Ann and Damian, many thanks for providing your perspectives as leaders who are working to broaden participation of under-represented groups in high-performance scientific computing. I am hoping to learn more about how individuals and groups can take steps forward within our own spheres of influence to broaden participation and thereby to help the community as a whole advance in productivity.

Lois: What are your backgrounds?

Damian Rouson: My training is in computational fluid dynamics. As a consultant, educator, and researcher, I have long aimed to adapt leading-edge software engineering practices to computational science and engineering applications. I'm passionate about advancing development practices in modern Fortran. As an African-American, I see my adopting an underdog language as partly an extension of being outside the dominant culture in STEM fields. At a time 20 years ago when most people who were passionate about improving scientific software development were adopting other languages, I found that an ability to embrace difference and combat stigma along one obvious dimension, ethnicity, makes it feel natural to swim upstream or outside the mainstream along another dimension: programming language choice.

Mary Ann Leung: My training is in computational quantum mechanics simulations on HPC systems. As a woman of color, a first generation scientist, and a non-traditional student, I found the need for and became interested in diversity in science during school. I got involved in diversity initiatives and founded a few campus organizations focused on diversity and inclusion as well as career and professional development. I later ended up migrating my career to workforce development where my passion for the people side of science could be realized.

Lois: Why is broadening participation important for improving productivity – of software developers and high-performance computational science overall?

Mary Ann: CSE/HPC developer productivity can be advanced by engaging a broader set of individuals for several important reasons. First off, CSE and HPC are inherently complex and require teamwork, creative solutions, and collaboration. Research indicates that diverse teams *are* more innovative. Additionally, the workforce in general is becoming more diverse, and by not including members of underrepresented groups, we are missing out on potential new developers with new ideas and approaches.

Lois: What are some issues that organizations should consider in order to create

Programming Languages Are For Humans

Expanding the Scientific Software Development Community Necessitates Studying Cognitive and Social Issues in Programming-Language Learning and Bias

Damian Rouson*, Brad Richardson** and Ondřej Čertík***, Renée Blake****

*Computer Languages & Systems Software Group, Lawrence Berkeley National Laboratory (rouson@lbl.gov)

**Research Software Engineer, Archaeologic Inc. and Sourcery Institute (brad@archaeologic.codes)

***Computational Physics and Methods, Los Alamos National Laboratory (certik@lanl.gov)

****Department of Linguistics and Social & Cultural Analysis, New York University (renee.blake@nyu.edu)

Challenge: The call for position papers notes that the development of scientific software has leveraged a diverse community — including domain scientists, applied mathematicians, and computer scientists — to achieve tremendous advances in the models, computer architectures, and software that support scientific discovery. The call envisions expanding upon these successes by nurturing collaborations between computational scientists, cognitive scientists, social scientists, and software engineers to study the software development process itself. This paper, co-authored by computational scientists, a social scientist, and a research software engineer, focuses on programming languages. We identify two challenges as necessary conditions for growing the community that develops scientific software and advancing the community's practices:

1. We must better understand cognitive issues around how developers learn programming languages.
2. We must better understand how to ensure language inclusivity in AI-driven development.

Opportunity: Confronting the above two challenges offers an opportunity to examine several of the questions posed in the call for position papers, including the questions this paper addresses.

How can we best integrate social and cognitive sciences into scientific software activities? Social and cognitive scientists have published an extensive body of literature examining the effectiveness of various strategies for learning second languages. For example, neuroscience and social-science scholars who studied adults learning to speak and understand an artificial language found that among research subjects who exhibited high levels of proficiency after either an "explicit, classroom-like, or implicit, immersion-like training," the implicitly trained group demonstrated more native-like neural processing after a several-month break in instruction [1]. The scientific community's increasing adoption of interpreted programming languages such as python and Julia, which offer interactive, immersive modes of use, presents an opportunity for comparative study of learning interactive languages versus learning the compiled languages that remain prevalent in high-performance computing. Better understanding one experience might inform and improve the other.

How will AI-driven development tools affect best practices for scientific software development and use? How can we study changes in culture affecting scientific software development and use? How are scientific software developers and users atypical from other larger software communities? The intersection of these three questions exposes fruitful

territory for inquiry into how scientific software development communities can ensure that AI-driven development of scientific software provides a productive development experience for a community working in diverse programming languages. Surveys of real-world AI applications have identified important problems related to bias and fairness and have created a taxonomy for fairness definitions [2]. Scientific software developers' work inherently involves a related atypical and subtle paradox: we communicate through code that aims to instruct computers despite the actual target of source code being humans [3]. Hence, one can easily miss the analogy between programming-language biases and broader societal biases that marginalize groups who speak in coded language forms. To wit, a recent study of the use of Aviation English (AE) code by non-native English speakers in avionic transmissions demonstrated the AE speakers' disadvantaged status relative to the conversational English of native English-speaking pilots and air controllers, despite AE's utility. [4] We assert that similar biases exist between programming language communities and it will be important to assure that such biases do not creep into AI-driven development in the manner that other forms of bias have infected other AI applications.

Timeliness: Recent work has demonstrated that even compiled languages can provide an interactive experience similar to those of interpreted language. LFortran, for example, is a modern, open-source, interactive Fortran compiler built atop the LLVM compiler infrastructure. [5] In addition to its mode that resembles an interpreter, LFortran can compile to binaries. Similarly, the jupyter-CAF-kernel project offers an interactive experience with parallel Fortran 2018 running in the cloud [6]. Jupyter-CAF-kernel leverages the open-source GNU Fortran compiler and OpenCoarrays parallel runtime library. LFortran and jupyter-CAF-kernel were developed with newcomers in mind. These tools offer an opportunity to study cognitive issues related to learning an interpreted versus a compiled language *without* varying the language. Moreover, working with social scientists offers the opportunities to ensure fairness in AI-driven development tools might help to ensure a fair and inclusive environment across the family of languages that scientific software developers write.

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How will AI-driven development tools affect best practices for scientific software development and use? How can we study changes in culture affecting scientific software development and use? How are scientific software developers and users atypical from other larger software communities? The intersection of these three questions exposes fruitful

territory for inquiry into how scientific software development communities can ensure that AI-driven development of scientific software provides a productive development experience for a community working in diverse programming languages. Surveys of real-world AI applications have identified important problems related to bias and fairness and have created a taxonomy for fairness definitions [2]. Scientific software developers' work inherently involves a related atypical and subtle paradox: we communicate through code that aims to instruct computers despite the actual target of source code being humans [3]. Hence, one can easily miss the analogy between programming-language biases and broader societal biases that marginalize groups who speak in coded language forms. To wit, a recent study of the use of Aviation English (AE) code by non-native English speakers in avionic transmissions demonstrated the AE speakers' disadvantaged status relative to the conversational English of native English-speaking pilots and air controllers, despite AE's utility. [4] We assert that similar biases exist between programming language communities and it will be important to assure that such biases do not creep into AI-driven

Timeliness: Recent work has demonstrated that even compiled languages can provide an interactive experience similar to those of interpreted language. LFortran, for example, is a modern, open-source, interactive Fortran compiler built atop the LLVM compiler infrastructure. [5] In addition to its mode that resembles an interpreter, LFortran can compile to binaries. Similarly, the jupyter-CAF-kernel project offers an interactive experience with parallel Fortran 2018 running in the cloud [6]. Jupyter-CAF-kernel leverages the open-source GNU Fortran compiler and OpenCoarrays parallel runtime library. LFortran and jupyter-CAF-kernel were developed with newcomers in mind. These tools offer an opportunity to study cognitive issues related to learning an interpreted versus a compiled language *without* varying the language. Moreover, working with social scientists offers the opportunities to ensure fairness in AI-driven development tools might help to ensure a fair and inclusive environment across the family of languages that scientific software developers write.

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Programming Languages Are Human Languages: Bias Exists

www.cs.virginia.edu/~evans/cs655/

University of Virginia, Department of Computer Science
CS655: Programming Languages, Spring 2001

How do we tell truths that might hurt?

Edsger W.Dijkstra, 18 June 1975
from https://www.cs.utexas.edu/users/EWD/ewd04xx/EWD498.PDF

Sometimes we discover unpleasant truths. Whenever we do so, we are in difficulties: suppressing them is scientifically dishonest, so we must tell ther but telling them, however, will fire back on us. If the truths are sufficiently impalatable, our audience is psychically incapable of accepting them and w will be written off as totally unrealistic, hopelessly idealistic, dangerously revolutionary, foolishly gullible or what have you. (Besides that, telling such truths is a sure way of making oneself unpopular in many circles, and, as such, it is an act that, in general, is not without personal risks. Vide Galileo Galilei.....)

Computing Science seems to suffer severely from this conflict. On the whol it remains silent and tries to escape this conflict by shifting its attention. (Fo instance: with respect to COBOL you can really do only one of two things: fi the disease or pretend that it does not exist. Most Computer Science Departments have opted for the latter easy way out.) But, Brethern, I ask yo is this honest? Is not our prolonged silence fretting away Computing Scienc intellectual integrity? Are we decent by remaining silent? If not, how do we speak up?

To give you some idea of the scope of the problem I have listed a number o such truths. (Nearly all computing scientists I know well will agree without hesitation to nearly all of them. Yet we allow the world to behave as if we di not know them....)

- Programming is one of the most difficult branches of applied mathematics; the poorer mathematicians had better remain pure mathematicians.
- The easiest machine applications are the technical/scientific computations.
- The tools we use have a profound (and devious!) influence on our thinking habits, and, therefore, on our thinking abilities.
- FORTRAN --"the infantile disorder"--, by now nearly 20 years old, is hopelessly inadequate for whatever computer application you have in mind today: it is now too clumsy, too risky, and too expensive to use.

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You Can Write FORTRAN in any Language

A recent user-submitted CodeProject article took an interesting perspective on the VB.NET/C# divide by proposing that the **culture of Visual Basic** is not conducive to professional software development:

> We've seen that the cultures of VB and C# are very different. And we've seen that this is no fault of the programmers that use them. Rather this is a product of the combination of factors that collectively could be called their upbringing -- business environment, target market, integrity and background of the original language developers, and a myriad other factors.

2005

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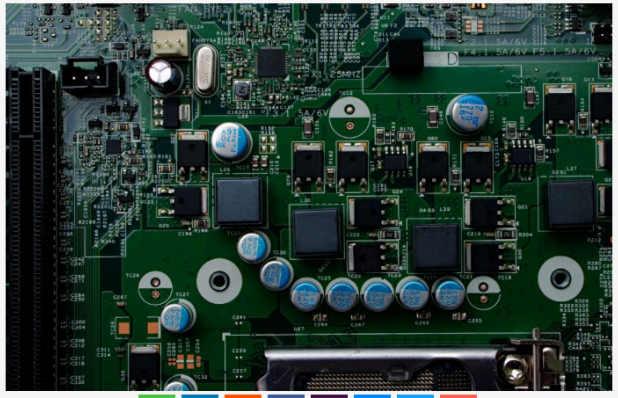
Real programmers write Java like FORTRAN

by Frank Becker 05 January 2021



I'm a Java coder and I work on high speed trading systems. I know that people dispute whether Java is the best language for really low latency work, but my experience is that it is absolutely viable. I have seen optimized Java code that is only about 20-30% slower than very, very optimized C code and this is pretty awesome. The application was able to respond to market signals within single digit microseconds every time.

Real programmers can write FORTRAN in any language. The issue with Java isn't that you can't write low latency code. It's that you are left almost completely without tools. There's very little you can use from Java standard libraries. You're therefore left scratching your head about how to solve even the simplest problem like managing memory without something coming and suddenly creating a lot of latency where you don't want it to happen.

If you can code a FORTRAN-like Java, you can overcome this. And Java has multiple advantages, as follows:

1. Java is a simpler language than C++, but it allows for easy object modelling, which is not available in plain C. The smaller feature set of the language also helps the developers stay focused on the logic of the application rather than on expressing their technical superiority through application of all the bells and whistles available in the standard (which often makes C++ code hard to read and improve by others).

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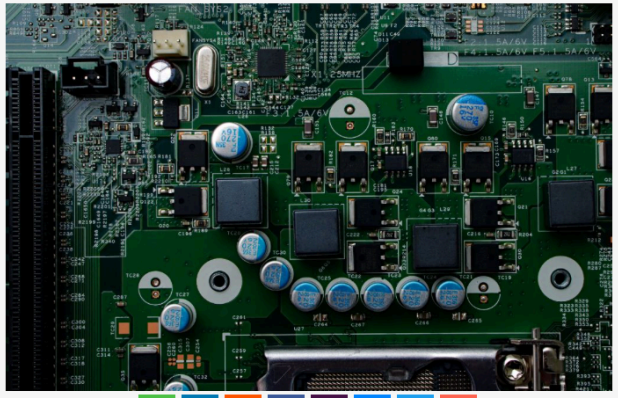

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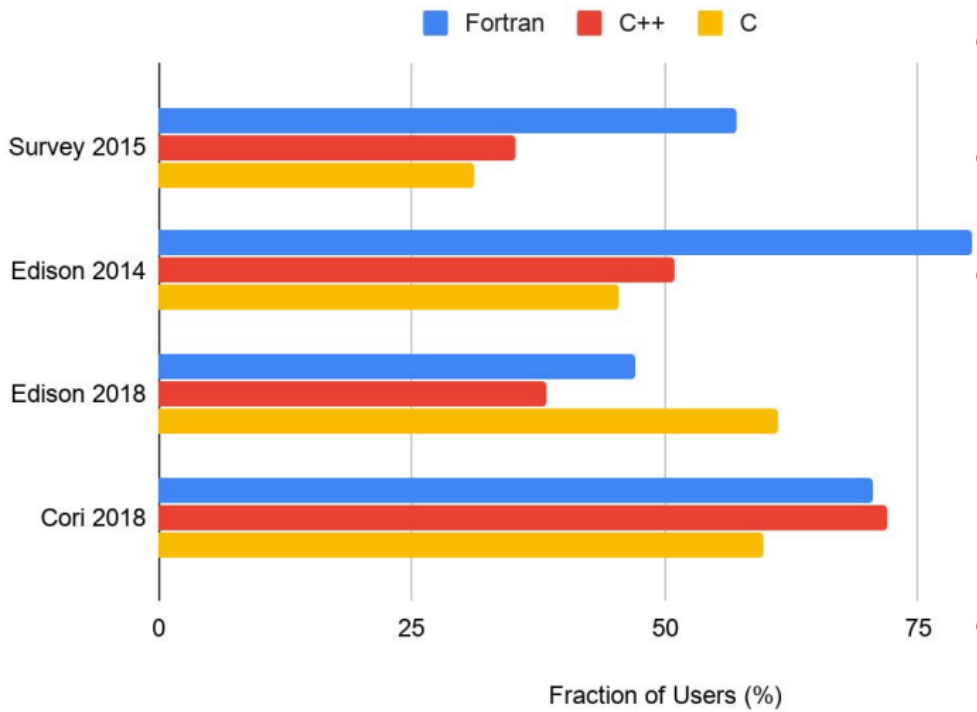
Rumors of Fortran's Demise Are Greatly Exaggerated

Compiled languages used at NERSC



Totals exceed 100% because some users rely on multiple languages.

- Fortran remains a common language for scientific computation.
- Noteworthy increases in C++ and multi-language
- Language use inferred from runtime libraries recorded by ALTD. (previous analysis used survey data)
  - ALTD-based results are mostly in line with survey data.
  - No change in language ranking
  - Survey underrepresented Fortran use.
- Nearly ¼ of jobs use Python.

Intersectionality

Prof. Kimberle Crenshaw
UCLA School of Law

University of Chicago Legal Forum

Volume 1989 | Issue 1 Article 8

Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics

Kimberle Crenshaw
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Google Scholar citations > 27K

Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics

Kimberle Crenshaw†

One of the very few Black women's studies books is entitled *All the Women Are White, All the Blacks Are Men, But Some of Us are Brave*.[1] I have chosen this title as a point of departure in my efforts to develop a Black feminist criticism[2] because it sets forth a problematic consequence of the tendency to treat race and gender as mutually exclusive categories of experience and analysis.[3] In this talk, I want to examine how this tendency is perpetuated by a single-axis framework that is dominant in antidiscrimination law and that is also reflected in feminist theory and antiracist politics.

I will center Black women in this analysis in order to contrast the multidimensionality of Black women's experience with the single-axis analysis that distorts these experiences. Not only will this juxtaposition reveal how Black women are theoretically erased, it will also illustrate how this framework imports its own theoretical limitations that undermine efforts to broaden feminist and an-

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† Acting Professor of Law, University of California, Los Angeles Law School.

[1] Gloria T. Hull, et al, eds (The Feminist Press, 1982).

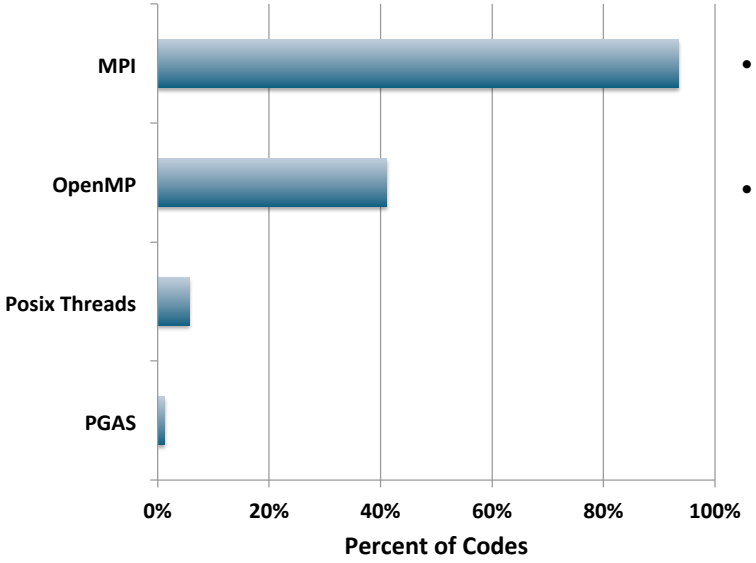
[2] For other work setting forth a Black feminist perspective on law, see Judy Scales-Trent, *Black Women and the Constitution: Finding Our Place, Asserting Our Rights (Voices of Experience: New Responses to Gender Discourse)*, 24 Harv CR-CL L Rev 9 (1989); Regina Austin, *Sapphire-Bound!*, forthcoming in Wisc Women's L J (1989); Angela Harris, *Race and Essentialism in Feminist Legal Theory* (unpublished manuscript on file with author); and Paulette M. Caldwell, *A Hair Piece* (unpublished manuscript on file with author).

[3] The most common linguistic manifestation of this analytical dilemma is represented in the conventional usage of the term "Blacks and women." Although it may be true that some people mean to include Black women in either "Blacks" or "women," the context in which the term is used actually suggests that often Black women are not considered. See, for example, Elizabeth Spelman, *The Inessential Woman* 114-15 (Beacon Press, 1988) (discussing an article on Blacks and women in the military where "the racial identity of those identified as 'women' does not become explicit until reference is made to Black women, at which point it also becomes clear that the category of women excludes Black women"). It seems that if Black women were explicitly included, the preferred term would be either "Blacks and white women" or "Black men and all women."

Resist!
(Juggernauts)

Nearly all projects rely on MPI for distributed memory parallel programming.

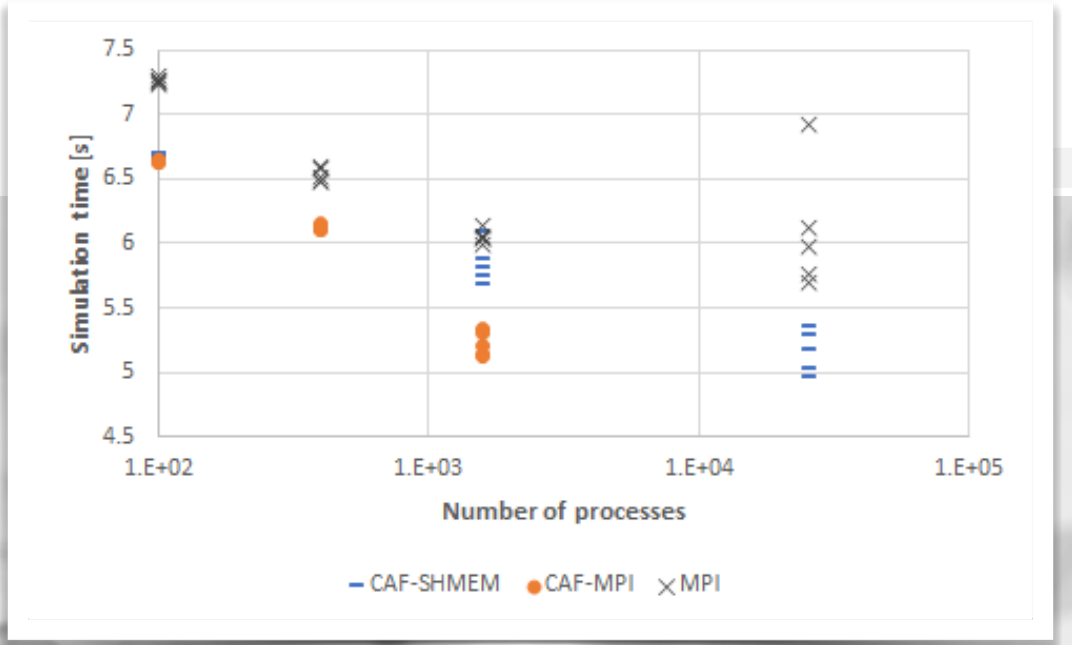
Fraction of codes using various parallel programming models.



- Based on user survey of codes used. Not weighted by core hours.
- Total exceeds 100% because some codes use multiple languages.
- 40% of projects *report* using OpenMP.

Diversity of Thought Yields Measurable Benefits

Climate Model: CAF vs MPI



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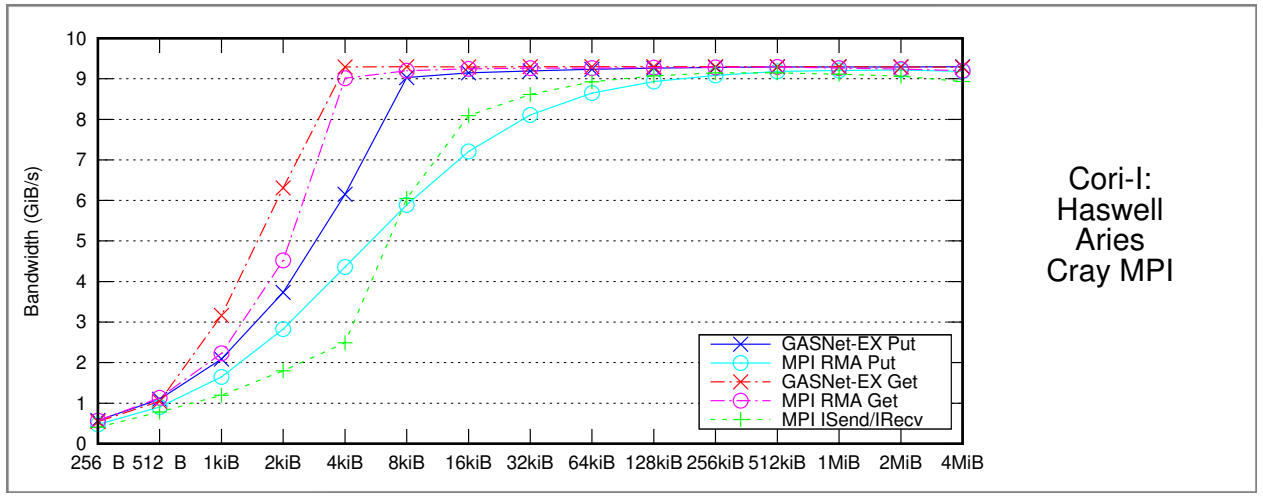
Microbenchmark: GASNet-EX vs MPI



Cori-I:
Haswell
Aries
Cray MPI

D. Bonachea and P. H. Hargrove, "GASNet-EX: A High- Performance, Portable Communication Library for Exascale," in *Proceedings of Languages and Compilers for Parallel Computing (LCPC'18)*, ser. LNCS, vol. 11882. Springer, October 2018, doi:10.25344/S4QP4W.

Conclusions

- Black lives count so count black lives: disaggregate.
- The odds against randomly achieving a significant skew relative to the pipeline distribution are astronomical.
- Skew is deterministic and therefore solvable.
- A diverse workforce does work differently and does different work.
- Programming languages are human languages. Bias can be intersectional.
- Inclusivity requires a diversity of thought. Combat stigma and resist juggernauts.