



An Analysis into the Demographics of Physics and STEM Education

Devin Kodsi (He/Him)

APS Education and Diversity Intern

Dr. Christine O'Donnell, Education and Diversity Program Manager

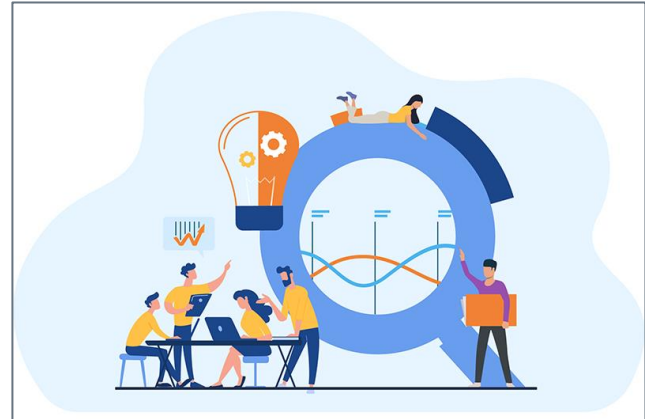
About Me

- The University of Alabama- Tuscaloosa
- Aerospace Engineering & Physics
- Interests in the application of mathematics and physics in space exploration
- Love to learn!



Roles & Responsibilities

- **Updating APS “Physics Graphs & Statistics”**
- Developing consistent table formats for Excel files
- Updating “Top Educators” and “MSI” lists
- Working with marketing to create infographics
- **Old vs. New STEM analysis**



08.2 Statement on Diversity in Physics

Physicists must make the field more inclusive to ensure a robust future for science and technology in the United States, drawing on the many varied voices and talents in our diverse society. APS recognizes that the health of the physics discipline is best served by addressing the equally important goals of improving access to opportunities in physics to the betterment of all people while also engaging the vast intellectual potential that resides in groups underrepresented in physics.

Accordingly, APS members, and the physics community more broadly, should work to increase the numbers of members from underrepresented groups in physics at all career stages. Barriers to participation in physics by underrepresented groups, although not always explicit, remain strong and pervasive. APS members are encouraged to become familiar with the barriers to improved representation [1-4], to take active roles in organizational and institutional efforts to bring about such change, and to encourage and support others engaged in this kind of activity.

Graphs, Tables, & Spreadsheets, Oh My!

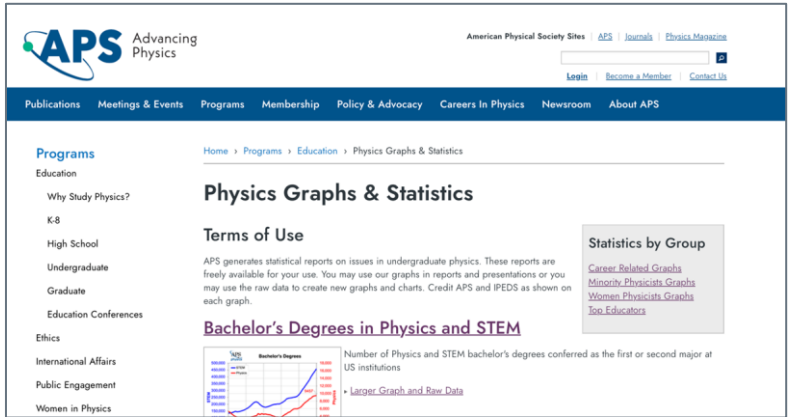
- APS Physics Education Statistics

- IPEDS by NCES

Link




IPEDS Integrated Postsecondary Education Data System



APS Advancing Physics

American Physical Society Sites | APS | Journals | Physics Magazine

Publications Meetings & Events Programs Membership Policy & Advocacy Careers in Physics Newsroom About APS

Home > Programs > Education > Physics Graphs & Statistics

Programs

Education

Why Study Physics?

K-8

High School

Undergraduate

Graduate

Education Conferences

Ethics

International Affairs

Public Engagement

Women in Physics

Physics Graphs & Statistics

Terms of Use

APS generates statistical reports on issues in undergraduate physics. These reports are freely available for your use. You may use our graphs in reports and presentations or you may use the raw data to create new graphs and charts. Credit APS and IPEDS as shown on each graph.

Bachelor's Degrees in Physics and STEM

Number of Physics and STEM bachelor's degrees conferred as the first or second major at US institutions

• [Larger Graph and Raw Data](#)

Statistics by Group

- [Career Related Graphs](#)
- [Minority Physics Graphs](#)
- [Women Physics Graphs](#)
- [Top Educators](#)

What is IPEDS?

IPEDS is the Integrated Postsecondary Education Data System. It is a system of interrelated surveys conducted annually by the U.S. Department of Education's National Center for Education Statistics (NCES). IPEDS gathers information from every college, university, and technical and vocational institution that participates in the federal student financial aid programs. The Higher Education Act

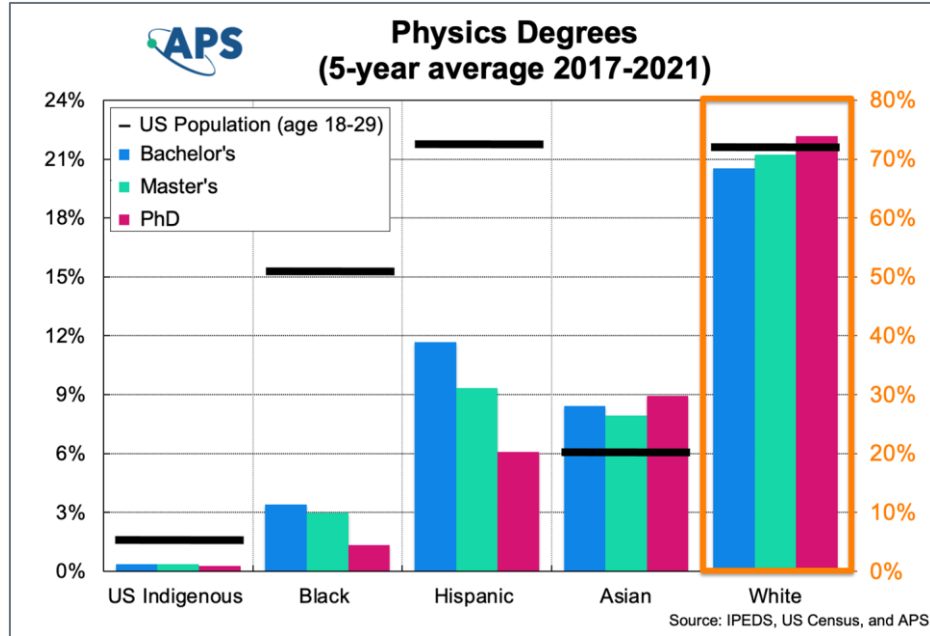
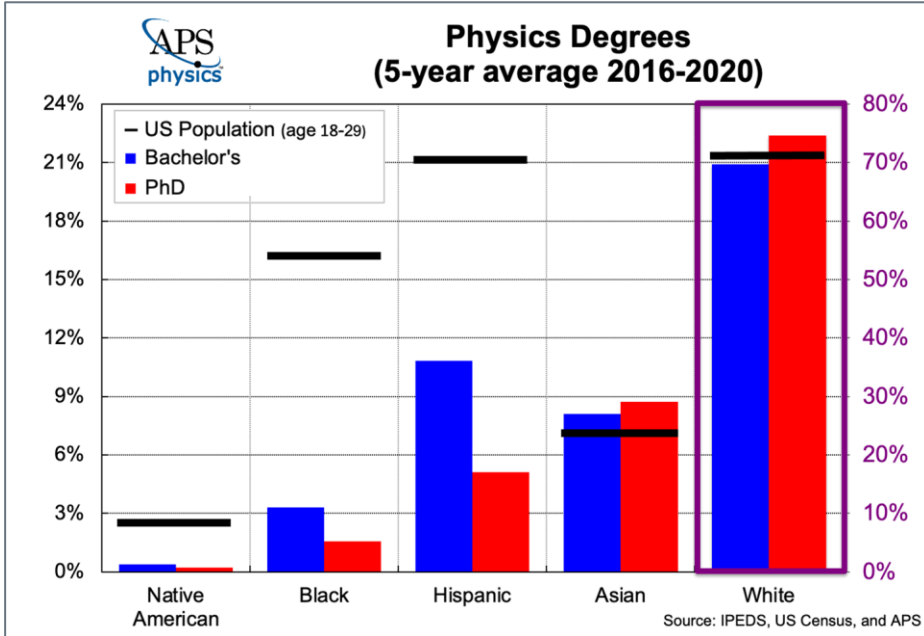


- Überspreadsheets from past intern roles
 - Gender, race, ethnicity
- Updating data for 2021 and “STEM”
 - Reformatting of tables

Institutional Characteristics														1995	1996	1997	1998
Unit#	Institution	State	CloseY	Local	Size	Carneg	Degre	Statu									
TOTALS:										4181	4039	3748	3793				
100663	University of Alabama at Birmingham	AL		City: Midsl	Four-year,	Doctoral U	PhD			3	1	3	2				
100706	University of Alabama in Huntsville	AL		City: Midsl	Four-year,	Doctoral U	PhD			12	7	5	7				
100751	The University of Alabama	AL		City: Small	Four-year,	Doctoral U	PhD			4	8	3	1				
100812	Athens State University	AL		Town: Frin	Four-year,	Baccalaure	None			3	3	4	3				
100858	Auburn University	AL		City: Small	Four-year,	Doctoral U	PhD			7	6	4	5				
100937	Birmingham-Southern College	AL		City: Midsl	Four-year,	Baccalaure	Bach			2	1		1				
101480	Jacksonville State University	AL		Suburb: Sn	Four-year,	Master's Cc	None				3						
101879	University of North Alabama	AL		City: Small	Four-year,	Master's Cc	Bach			5	5	5	1				
102049	Samford University	AL		Suburb: La	Four-year,	Doctoral/P	Bach			1	1	3	1				
102094	University of South Alabama	AL		City: Midsl	Four-year,	Doctoral U	Bach			1		2					
102270	Stillman College	AL		City: Small	Four-year,	Baccalaure	None	HBCU APS-		4	5	2					
102298	Talladega College	AL		Town: Dist	Four-year,	Baccalaure	None	HBCU APS-		2	2	2	2				
102368	Troy University	AL		Town: Rem	Four-year,	Master's Cc	Bach	APS-BSI									
102377	Tuskegee University	AL		Town: Dist	Four-year,	Master's Cc	Bach	HBCU APS-		10	5	7	4				
102614	University of Alaska Fairbanks	AK		Suburb: Sn	Four-year,	Doctoral U	PhD	ANNH NAS		2	3	3					
104151	Arizona State University Campus Immersion	AZ		City: Midsl	Four-year,	Doctoral U	PhD			13	15	14	16				
104179	University of Arizona	AZ		City: Large	Four-year,	Doctoral U	PhD	HSI APS-HS		15	17	13	16				
104586	Embry-Riddle Aeronautical University-Prescott	AZ		Rural: Frin	Four-year,	Baccalaure	Bach										
104717	Grand Canyon University	AZ		City: Large	Four-year,	Doctoral/P	None										
105330	Northern Arizona University	AZ		City: Small	Four-year,	Doctoral U	PhD	HSI		4	9	2	4				
106245	University of Arkansas at Little Rock	AR		City: Midsl	Four-year,	Doctoral U	Bach			2	4	5	1				
106397	University of Arkansas	AR		City: Small	Four-year,	Doctoral U	PhD			2	3	1	10				
106412	University of Arkansas at Pine Bluff	AR		City: Small	Four-year,	Baccalaure	None	HBCU APS-					3				
106458	Arkansas State University	AR		City: Small	Four-year,	Doctoral U	Bach			2	1	3	2				
106467	Arkansas Tech University	AR		Town: Rem	Four-year,	Master's Cc	Bach										
106485	University of Arkansas at Monticello	AR		Town: Rem	Four-year,	Master's Cc	None	APS-BSI		2	1	2	2				
106704	University of Central Arkansas	AR		City: Small	Four-year,	Doctoral/P	Bach			1	3						
107044	Harding University	AR		Town: Dist	Four-year,	Doctoral/P	Bach				1	2					
107071	Henderson State University	AR		Town: Dist	Four-year,	Master's Cc	Bach			3	5		1				
107080	Hendrix College	AR		City: Small	Four-year,	Baccalaure	Bach			3	7	2	6				
107512	Ouachita Baptist University	AR		Town: Dist	Four-year,	Baccalaure	Bach			2		3	1				
107558	University of the Ozarks	AR		Town: Rem	Four-year,	Baccalaure	None										
107983	Southern Arkansas University Main Campus	AR		Town: Rem	Four-year,	Master's Cc	Bach						1				
109785	Asusa Pacific University	CA		Suburb: La	Four-year,	Doctoral U	Bach	HSI APS-HS, ANAPISI									

1	Years: 2017-2021		
2	Race & Ethnicity (standardized): Black, Non-Hispanic, American Indian or Alaska Native, Asian or Pacific Islander, Hispanic or Latino		
3	Level of Degree or Other Award: Bachelor's, Master's, and PhD		
4	Academic Discipline, 6-digit Classification of Instructional Program (CIP): 13.1329 Physics Teacher Education, 14.1201 Eng		
5			
6			
7	Academic Discipline (standard)	Race & Ethnicity (standardized)	2017
8	Physics- Bachelor's	American Indian or Alaska Native	22
9		Asian	606
10		Black or African American	266
11		Hispanic or Latino	806
12		Native Hawaiian or Other Pacific Islander	5
13		White	5766
14		Temporary resident/Nonresident alien	714
15		Grand total	8860
16		Total EXCLUDING temporary residents	8,146
17			
18			
19			
20	Academic Discipline (standard)	Race & Ethnicity (standardized)	2017
21	Physics- Master's	American Indian or Alaska Native	3
22		Asian	124
23		Black or African American	49
24		Hispanic or Latino	106
25		Native Hawaiian or Other Pacific Islander	3

- Generating and rebranding graphs (18)
- Updating website with Asana



Out with the Old & In with the New (STEM)

STEM Definition¹:
CIP codes according to IPEDS

Communications Technologies/Technicians and Support Services:
 10.01 Communications Technology/Technician
 10.02 Audiovisual Communications Technology/Technician
 10.99 Communication Technologies/Technicians and Support Services

Computer and Information Sciences and Support Services:
 11 (all should be included)

Engineering:
 14 (all should be included)


Engineering Technologies and Engineering-related Fields:
 15 (all should be included)

Biological and Biomedical Sciences:
 26 (all should be included)

Mathematics and Statistics:



Homeland Security Investigations
 National Security Division
 Student and Exchange Visitor Program



U.S. Immigration
 and Customs
 Enforcement

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DHS STEM Designated Degree Program List
Last Updated: July 12, 2023

PLEASE NOTE: The 2022 DHS STEM Designated Degree Program List has been archived. Stakeholders should refer to the most up-to-date version of the last at [ICE.gov/SEVIS/Schools](https://ice.dhs.gov/SEVIS/Schools) under the DHS STEM Designated Degree Program List and CIP Code Nomination Process header.

The U.S. Department of Homeland Security (DHS) STEM Designated Degree Program List is a complete list of fields of study that DHS considers to be science, technology, engineering or mathematics (STEM) fields of study for purposes of the 24-month STEM optional practical training extension described at 8 CFR 214.2(f). Under 8 CFR 214.2(f)(10)(i)(C)(2), a STEM field of study is one "included in the Department of Education's Classification of Instructional Programs taxonomy within the two-digit series containing engineering, biological sciences, mathematics, and physical sciences, or a related field. In general, related fields will include fields involving research, innovation, or development of new technologies using engineering, mathematics, computer science, or natural sciences (including physical, biological, and agricultural sciences)."

Accordingly, this list designates the following four primary CIP series at the 2-digit CIP code level: Engineering (14), Biological and Biomedical Sciences (26), Mathematics and Statistics (27) and Physical Sciences (40). Any new additions to those areas will automatically be included on this STEM Designated Degree Program List.

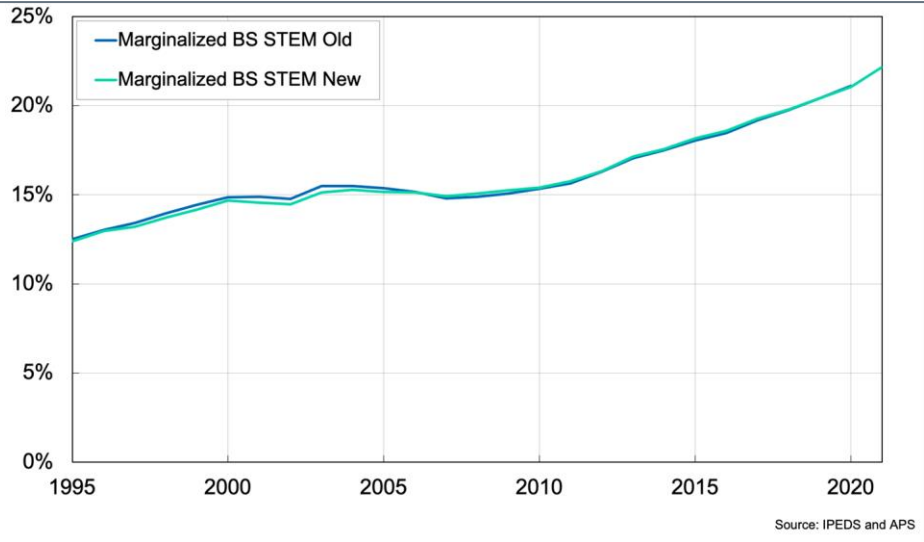
This list also includes CIPs from the following 18 related CIP series at the 6-digit CIP code level: Agricultural/Animal/Plant/Veterinary Science and Related Fields (01); Natural Resources and Conservation (03); Architecture and Related Services (04); Communication, Journalism and Related Programs (09); Communications Technologies/Technicians and Support Services (10); Computer and Information Sciences and Support Services (11); Education (13); Engineering/Engineering-Related Technologies/Technicians (15); Military Science, Leadership and Operational Art (28); Military Technologies and Applied Sciences (29); Multi-/Interdisciplinary Studies (30); Science Technologies/Technicians (41); Psychology (42); Homeland Security, Law Enforcement, Firefighting and Related Protective Services (43); Social Sciences (45); Transportation and Materials Moving (49); Health Professions and Related Programs (51); and Business, Management, Marketing and Related Support Services (52).

CIP Code Two-Digit Series	2020 CIP Code	CIP Code Title
01	01.0308	Agroecology and Sustainable Agriculture.
01	01.0901	Animal Sciences, General.
01	01.0902	Animal and Animal Products.

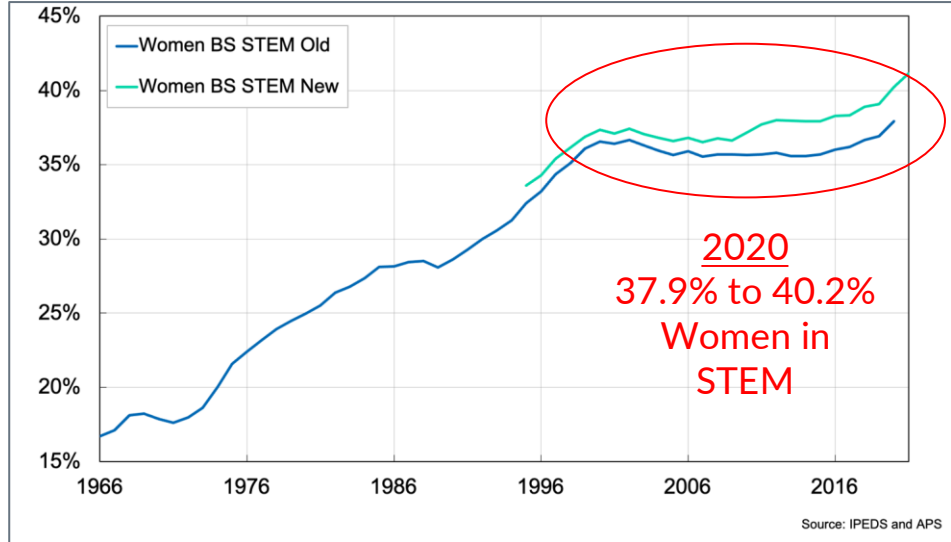
Old- 2011 NCES report, based on ICE definition of STEM

New- 2022 DHS report + STEM teacher education

Old vs. New STEM Marginalized Bachelor's



Old vs. New STEM Women Bachelor's





- Pivot tables with raw STEM data
- Differences between old and new (Totals, Women, and Men)
- Final Bachelor's table

2-Digit CIP Code Title	Number of BS Degrees Included (Old to New STEM)	Percentage Women (From Number of Degrees Included)
AGRICULTURAL/ANIMAL/PLANT/VETERINARY SCIENCE AND RELATED FIELDS.	11013	71.13%
NATURAL RESOURCES AND CONSERVATION.	19795	58.72%
ARCHITECTURE AND RELATED SERVICES.	2578	47.21%
COMMUNICATION, JOURNALISM, AND RELATED PROGRAMS.	6288	59.13%
COMMUNICATIONS TECHNOLOGIES/TECHNICIANS AND SUPPORT SERVICES.	2699	54.65%
EDUCATION.	3796	63.83%
MULTI/INTERDISCIPLINARY STUDIES.	14098	60.90%
PSYCHOLOGY.	15213	78.02%
HOMELAND SECURITY, LAW ENFORCEMENT, FIREFIGHTING AND RELATED PROTECTIVE SERVICES.	2424	66.87%
SOCIAL SCIENCES.	14978	38.47%
TRANSPORTATION AND MATERIALS MOVING.	3710	11.75%
HEALTH PROFESSIONS AND RELATED PROGRAMS.	5613	70.44%
BUSINESS, MANAGEMENT, MARKETING, AND RELATED SUPPORT SERVICES.	8164	41.05%

Why Does this Matter?

- Continual effort to diversify
- Different avenues of aid
- Data can help to bring awareness through current state of society
- Greater understanding, greater awareness, greater advocacy for change





Thank You!



Christine O'Donnell- for helping me navigate through the data, providing the resources for my success, and aiding my development as a mentor!

Kathryne Woodle and Michael Wittmann- for providing perspectives and feedback from past roles and guiding me toward more analytical viewpoints!

Brad Conrad, Mikayla Cleaver, and Kayla Stephens- for giving us the chance to take part in such a formative and lasting experience!

Everyone at APS- for making this summer one to remember and helping me grow through your impact!



Questions?

Email:

dakodsi@crimson.ua.edu

dkodsi1@gmail.com

LinkedIn:

www.linkedin.com/in/devin-kodsi



Bonus Slides!



More STEM Stats: The More the Merrier!

STEM Master's Degrees

2-Digit CIP Code Title	Number of MS Degrees Included (Old to New STEM)	Percentage Women (From Number of Degrees Included)
AGRICULTURAL/ANIMAL/PLANT/VETERINARY SCIENCE AND RELATED FIELDS.	1731	59.39%
NATURAL RESOURCES AND CONSERVATION.	3694	59.56%
ARCHITECTURE AND RELATED SERVICES.	3312	52.17%
COMMUNICATION, JOURNALISM, AND RELATED PROGRAMS.	2200	69.55%
COMMUNICATIONS TECHNOLOGIES/TECHNICIANS AND SUPPORT SERVICES.	387	48.06%
EDUCATION.	11222	72.82%
MULTI/INTERDISCIPLINARY STUDIES.	6105	57.15%
PSYCHOLOGY.	3380	74.97%
HOMELAND SECURITY, LAW ENFORCEMENT, FIREFIGHTING AND RELATED PROTECTIVE SERVICES.	1241	58.58%
SOCIAL SCIENCES.	4131	43.14%
TRANSPORTATION AND MATERIALS MOVING.	590	19.66%
HEALTH PROFESSIONS AND RELATED PROGRAMS.	4225	65.09%
BUSINESS, MANAGEMENT, MARKETING, AND RELATED SUPPORT SERVICES.	25912	41.42%

STEM PhD Degrees

2-Digit CIP Code Title	Number of PhD Degrees Included (Old to New STEM)	Percentage Women (From Number of Degrees Included)
AGRICULTURAL/ANIMAL/PLANT/VETERINARY SCIENCE AND RELATED FIELDS.	770	49.48%
NATURAL RESOURCES AND CONSERVATION.	570	52.63%
ARCHITECTURE AND RELATED SERVICES.	30	50.00%
COMMUNICATION, JOURNALISM, AND RELATED PROGRAMS.	57	49.12%
EDUCATION.	540	65.19%
MULTI/INTERDISCIPLINARY STUDIES.	378	50.79%
PSYCHOLOGY.	931	67.99%
HOMELAND SECURITY, LAW ENFORCEMENT, FIREFIGHTING AND RELATED PROTECTIVE SERVICES.	4	50.00%
SOCIAL SCIENCES.	953	31.79%
TRANSPORTATION AND MATERIALS MOVING.	20	20.00%
HEALTH PROFESSIONS AND RELATED PROGRAMS.	655	54.05%
BUSINESS, MANAGEMENT, MARKETING, AND RELATED SUPPORT SERVICES.	122	41.80%

Variety: The Spice of Data

- HBCU and HSI list update
- Filtering methods on Überspreadsheet

Education & Diversity

2022 Physics Degree-Granting Minority-Serving Institutions

Below is a list of all Minority-Serving Institutions (MSIs) in the US that provided physics degrees (Bachelors, Masters, and/or PhDs) between the 2015-2016 and 2019-2020 academic years inclusive. More information on Historically Black Colleges and Universities (HBCUs), including those that do not grant physics degrees, can be found [here](#). To generate the lists of physics degree-granting Predominantly Black Institutions (PBIs), Hispanic Serving Institutions (HSIs), Native American-Serving Nontribal Institutions (NASNTI), and Alaska Native and Native Hawaiian-Serving Institutions (ANNH), we use data from the FY 2022 [Eligibility Matrix by the Department of Education](#), which determines institution eligibility for these designations based on student enrollments and non-Federal cost-sharing requirements (see the link for more details). We include institutions that are both eligible for new funding per the Eligibility Matrix as well as institutions with open grants. Finally, we also provide lists based on only student enrollments (based on Fall 2019 counts, which were used in the FY 2022 Eligibility Matrix) for institutions with at least 25% enrollment by Black or African American students and for institutions with at least 25% enrollment by Hispanic students.

Historically Black Colleges and Universities (HBCUs):
28 institutions

Alabama A & M University Benedict College Clark Atlanta University Delaware State University Dillard University Elizabeth City State University Fisk University Florida Agricultural and Mechanical University Hampton University Howard University	Morehouse College Morgan State University Norfolk State University North Carolina A & T State University North Carolina Central University Prairie View A & M University South Carolina State University Spelman College Texas Southern University Tougaloo College Tuskegee University
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2023 Physics Degree-Granting Minority-Serving Institutions

Below is a list of all Minority-Serving Institutions (MSIs) in the US that provided physics degrees (Bachelors, Masters, and/or PhDs) between the 2016-2017 and 2021-2022 academic years inclusive. More information on Historically Black Colleges and Universities (HBCUs), including those that do not grant physics degrees, can be found [here](#). To generate the lists of physics degree-granting Predominantly Black Institutions (PBIs), Hispanic Serving Institutions (HSIs), Native American-Serving Nontribal Institutions (NASNTI), and Alaska Native and Native Hawaiian-Serving Institutions (ANNH), we use data from the FY 2022 [Eligibility Matrix by the Department of Education](#), which determines institution eligibility for these designations based on student enrollments and non-Federal cost-sharing requirements (see the link for more details). We include institutions that are both eligible for new funding per the Eligibility Matrix as well as institutions with open grants. Finally, we also provide lists based on only student enrollments (based on Fall 2020 counts, which were used in the FY 2022 Eligibility Matrix) for institutions with at least 25% enrollment by Black or African American students and for institutions with at least 25% enrollment by Hispanic students.

Historically Black Colleges and Universities (HBCUs):
28 institutions

Alabama A & M University Benedict College Clark Atlanta University Delaware State University Dillard University Elizabeth City State University* Fisk University Florida Agricultural and Mechanical University Hampton University Howard University Jackson State University Lane College	Morehouse College Morgan State University Norfolk State University North Carolina A & T State University North Carolina Central University South Carolina State University Spelman College Texas Southern University Tougaloo College Tuskegee University University of the District of Columbia* University of the Virgin Islands Virginia Union University
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- Top Educators Worksheets
- Institution-type filtering
- Different methods for each list, all in decreasing order, 3.33 limit

All BS													All Women				Percent Women					
G	H	I	J	K	L	M	N	O	P	Q	2019	2020	2021	3-Year Average	2019	2020		2021	3-Year Average			
1	UnID	Institution	2019	2020	2021	3-Year Average	2019	2020	2021	3-Year Average												
2	110583	California State Univ	43	53	37	44.33333333	11	13	6	10	23%											
3	228796	The University of Tex	14	12	21	15.66666667	6	6	12	8	51%											
4	110565	California State Univ	20	19	28	22.33333333	4	9	9	7.333333333	33%											
5	186584	Seton Hall University	18	28	19	21.66666667	3	13	6	7.333333333	34%											
6	191241	Fordham University	20	11	23	20	18	8	6	8	7.333333333	41%										
7	197869	Appalachian State Uni	31	27	27	28.33333333	7	5	7	6.333333333	22%											
8	204024	Miami University-Oxfr	22	24	11	19	8	5	3	5.333333333	28%											
9	228459	Texas State University	33	15	17	21.66666667	6	4	6	5.333333333	25%											
10	190567	CUNY City College	16	24	14	18	3	7	4	4.666666667	26%											
11	105330	Northern Arizona Univ	17	15	16	16	5	5	3	4.333333333	27%											
12	178602	University of Missouri	8	13	8	9.666666667	1	6	6	4.333333333	45%											
13	110608	California State Univ	17	18	14	16.33333333	5	6	1	4	24%											
14	122597	San Francisco State U	23	16	12	17	5	4	3	4	24%											
15	190594	CUNY Hunter College	9	14	16	13	2	5	5	4	31%											
16	227368	The University of Tex	23	12	11	15.33333333	6	4	2	4	26%											
17	164076	Towson University	19	24	13	18.66666667	3	7	1	3.666666667	20%											
18	181002	Creighton University	8	6	17	10.33333333	3	1	7	3.666666667	35%											
19	202134	Cleveland State Univ	8	11	8	9	4	4	3	3.666666667	41%											
20	212106	Duquesne University	7	16	13	12	3	2	6	3.666666667	31%											
21	184782	Rowan University	38	34	33	35	2	3	4	3	9%											
22	110592	California State Univ	5	16	8	9.666666667	1	5	2	2.666666667	28%											
23	165024	Bridgewater State Uni	14	8	12	11.33333333	1	5	2	2.666666667	24%											
24	190664	CUNY Queens College	10	11	15	12	3	2	3	2.666666667	22%											

APS and Public Awareness

- Infographics- IDEA, Bridge, and CUWiP
- Collaboration with APS Marketing
- Set of graphs for communication team

Vision



Example Graphs

