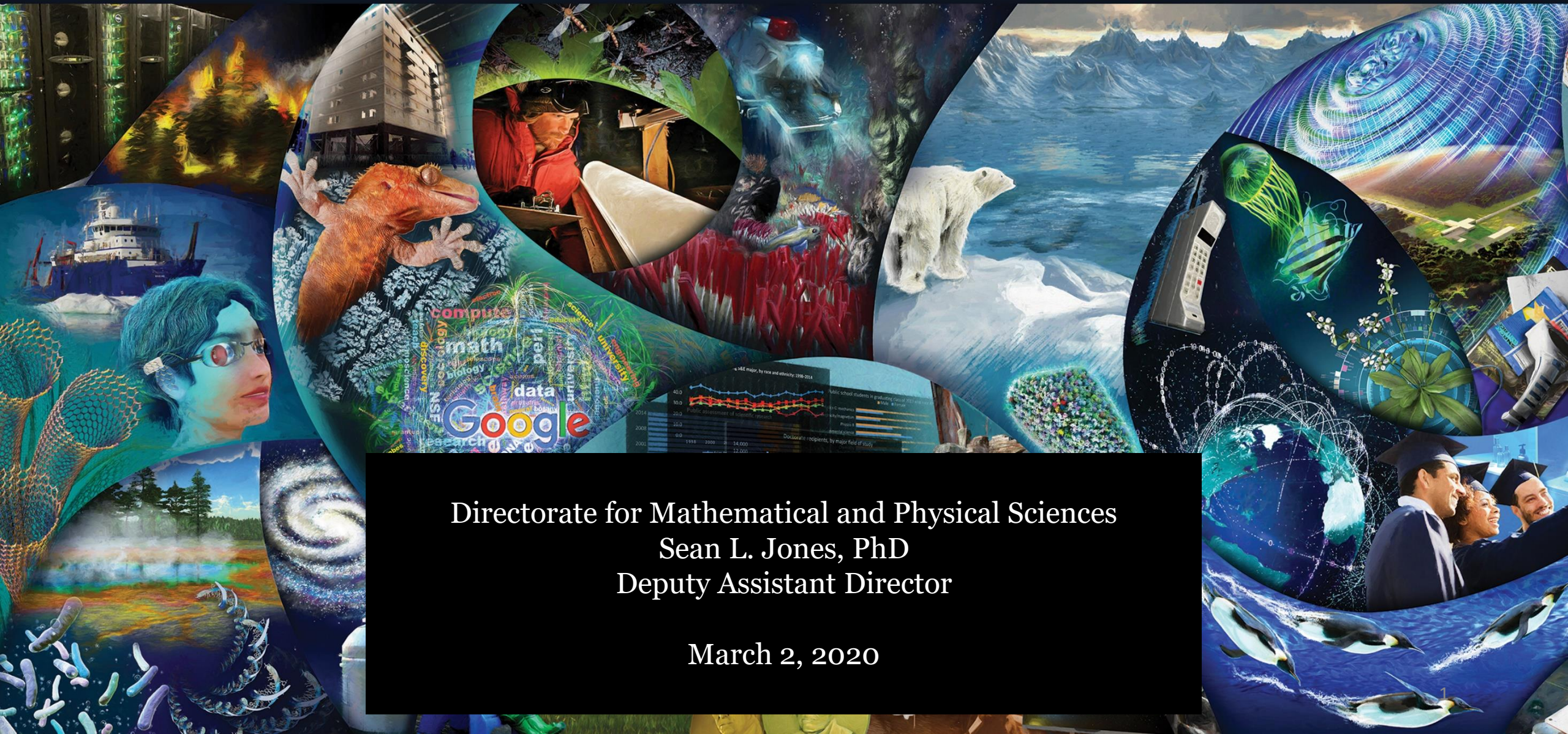




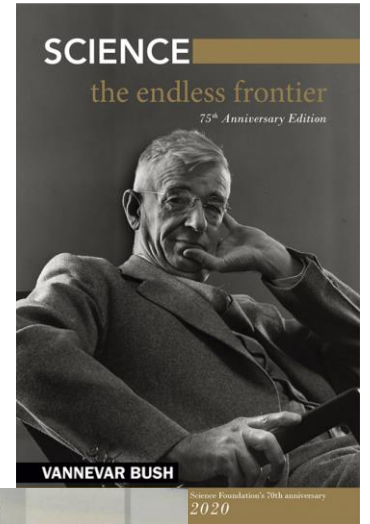
National Science Foundation NSAC March 2020



Directorate for Mathematical and Physical Sciences
Sean L. Jones, PhD
Deputy Assistant Director

March 2, 2020

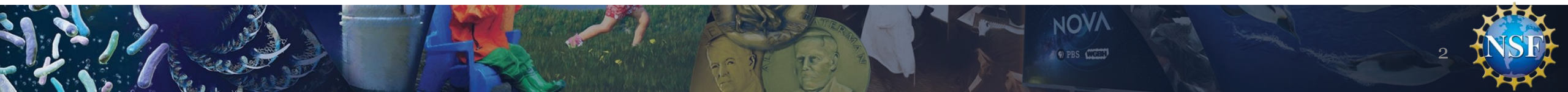
NSF 70 years



- On February 6-7, 2020 NSF hosted a symposium to kick off celebration of its 70 year anniversary (upcoming on May 10, 2020)
- Speakers included:
 - All living NSF Directors past and present
 - Kelvin Droegemeier and Michael Kratsios (OSTP)
 - Paul Dabbar (DOE)
 - Dario Gil (IBM)
 - Amy Harmon (New York Times)
 - Shep Doeleman of the EHT collaboration
 - Margaret Leinen, Director of Scripps Institute
 - and more...
- Watch the recorded livestream on NSF's YouTube:
<https://www.youtube.com/watch?v=DOFMrqNyjsY>



Winners of the NSF 2026 Idea Machine Competition



Recent and Upcoming Executive Changes at NSF



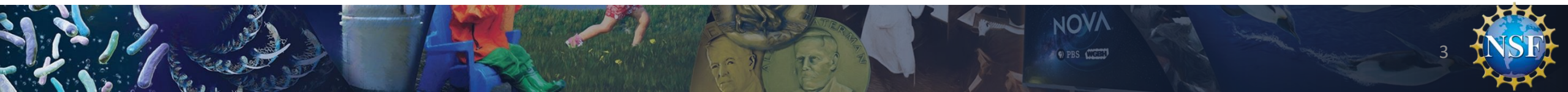
Dr. France Córdova
to leave NSF this month



Dr. Sethuraman
Panchanathan
(National Science Board
Member) named President
Trump's intended nominee as
next NSF Director

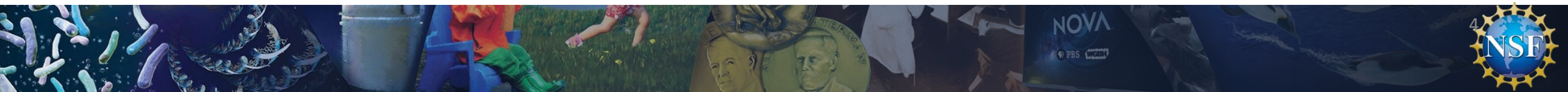
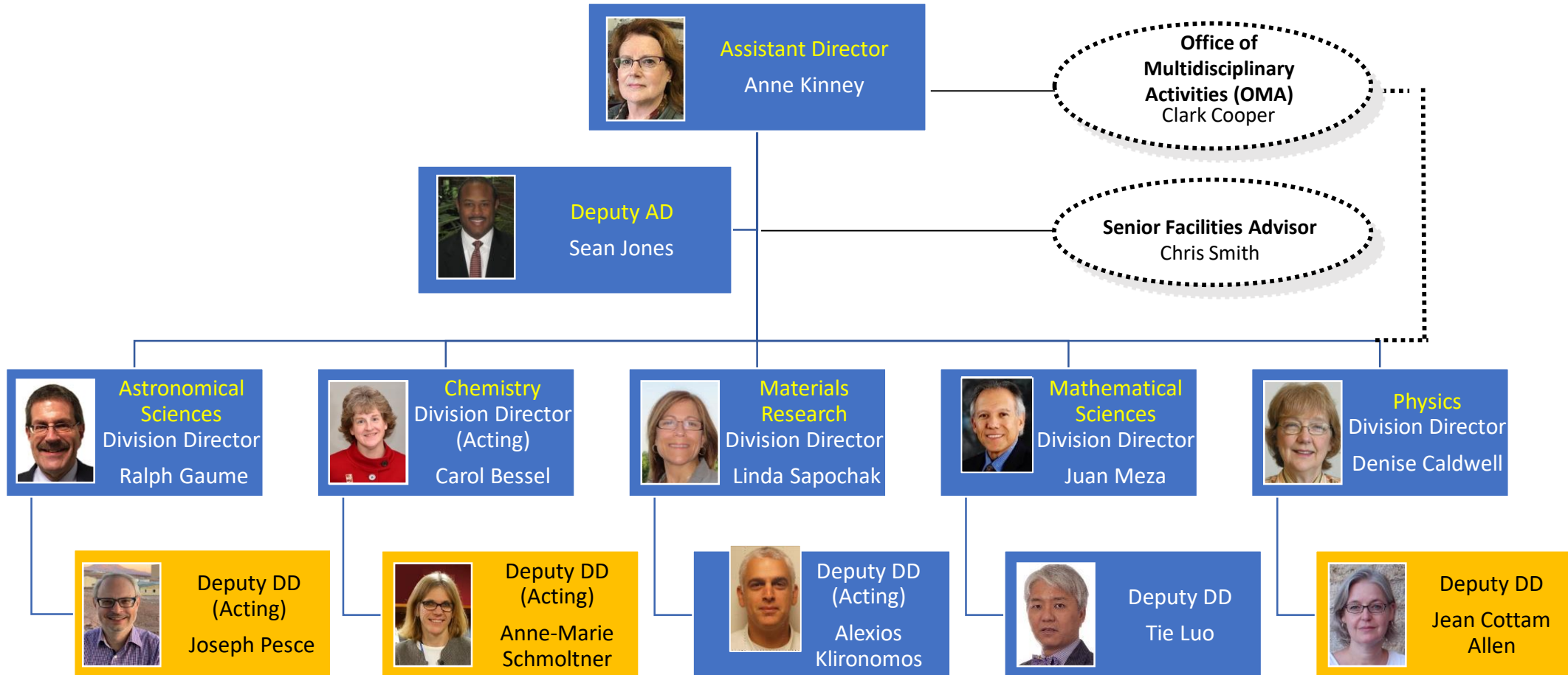


Dr. Margaret Martonosi
New Assistant Director for
Computer and Information
Science And Engineering
Directorate



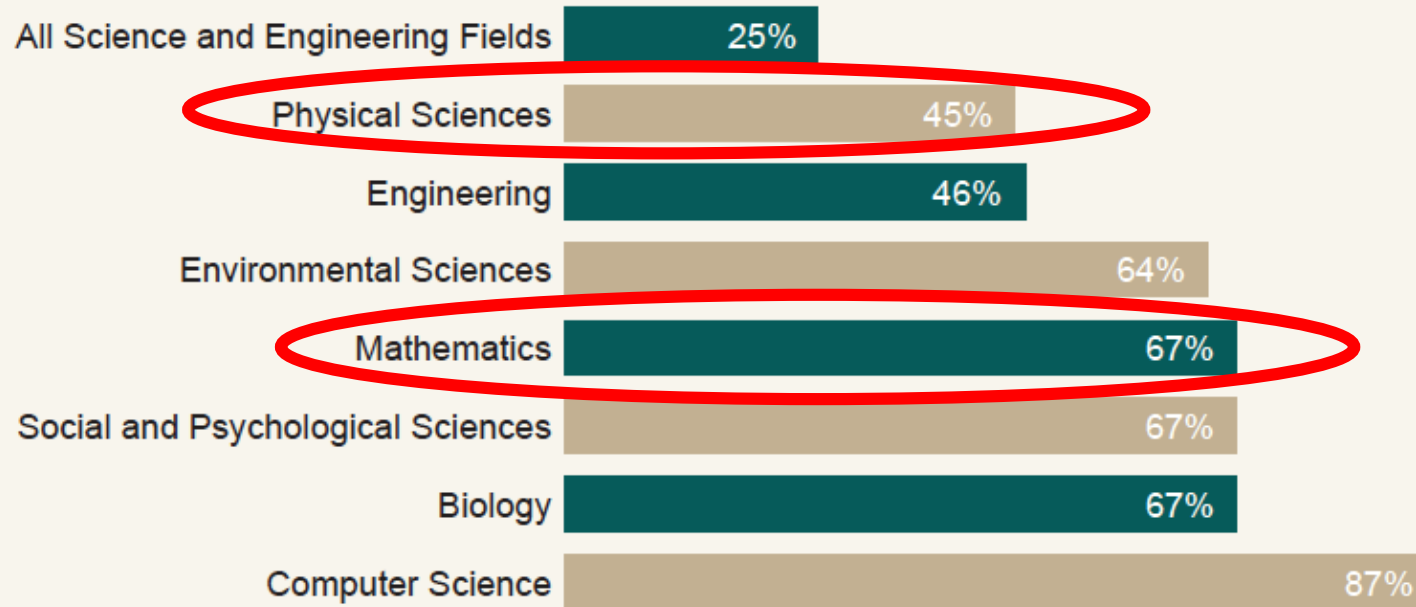
Directorate for Mathematical and Physical Sciences

As of 2/26/20



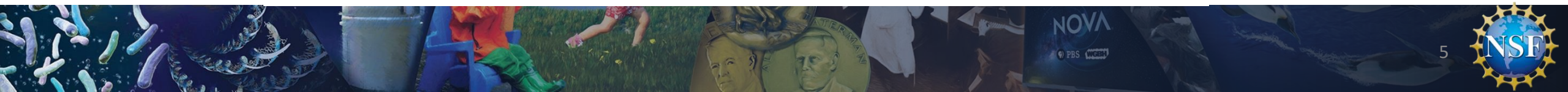
NSF by the Numbers

NSF Support of Academic Basic Research in Selected Fields (as a percentage of total federal support)



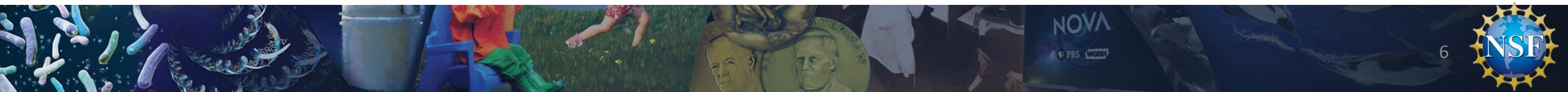
Note: Biology includes Biological Sciences and Environmental Biology. Biology and Psychological Sciences exclude National Institutes of Health.

Source: NSF/National Center for Science and Engineering Statistics, Survey of Federal Funds for Research & Development, FY 2017.

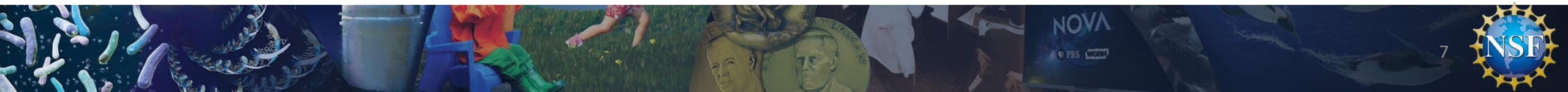
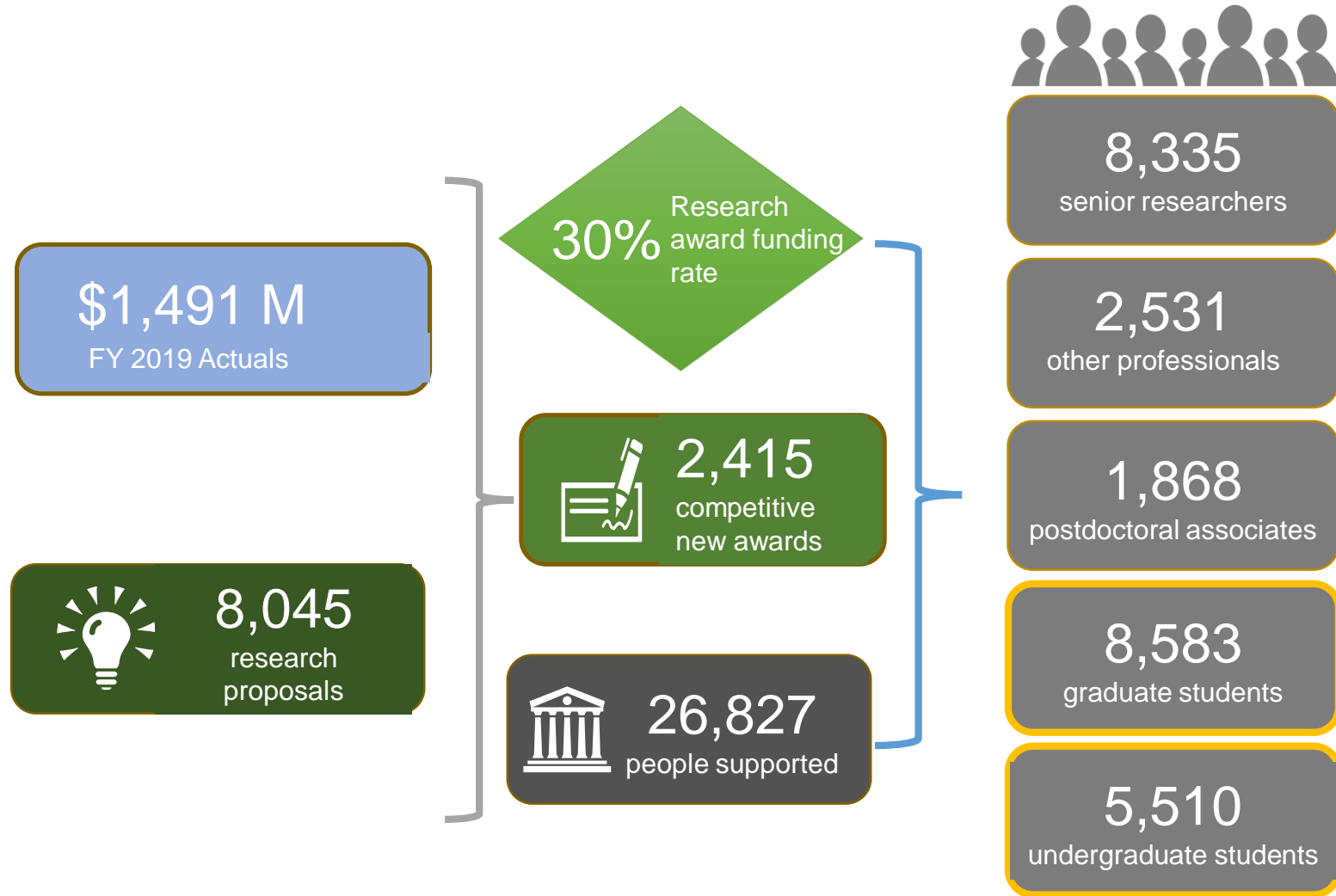


NSF by the Numbers

\$8.1 billion	FY 2019 Appropriations (does not include mandatory accounts)
1,800	Colleges, universities, and other institutions receiving NSF funding in FY 2019
41,000	Proposals evaluated in FY 2019 through a competitive merit review process
11,300	Competitive awards funded in FY 2019
192,000	Proposal reviews conducted in FY 2019
306,000	Estimated number of people NSF supported directly in FY 2019 (researchers, postdoctoral fellows, trainees, teachers, and students)
60,000	Students supported by NSF Graduate Research Fellowships since 1952

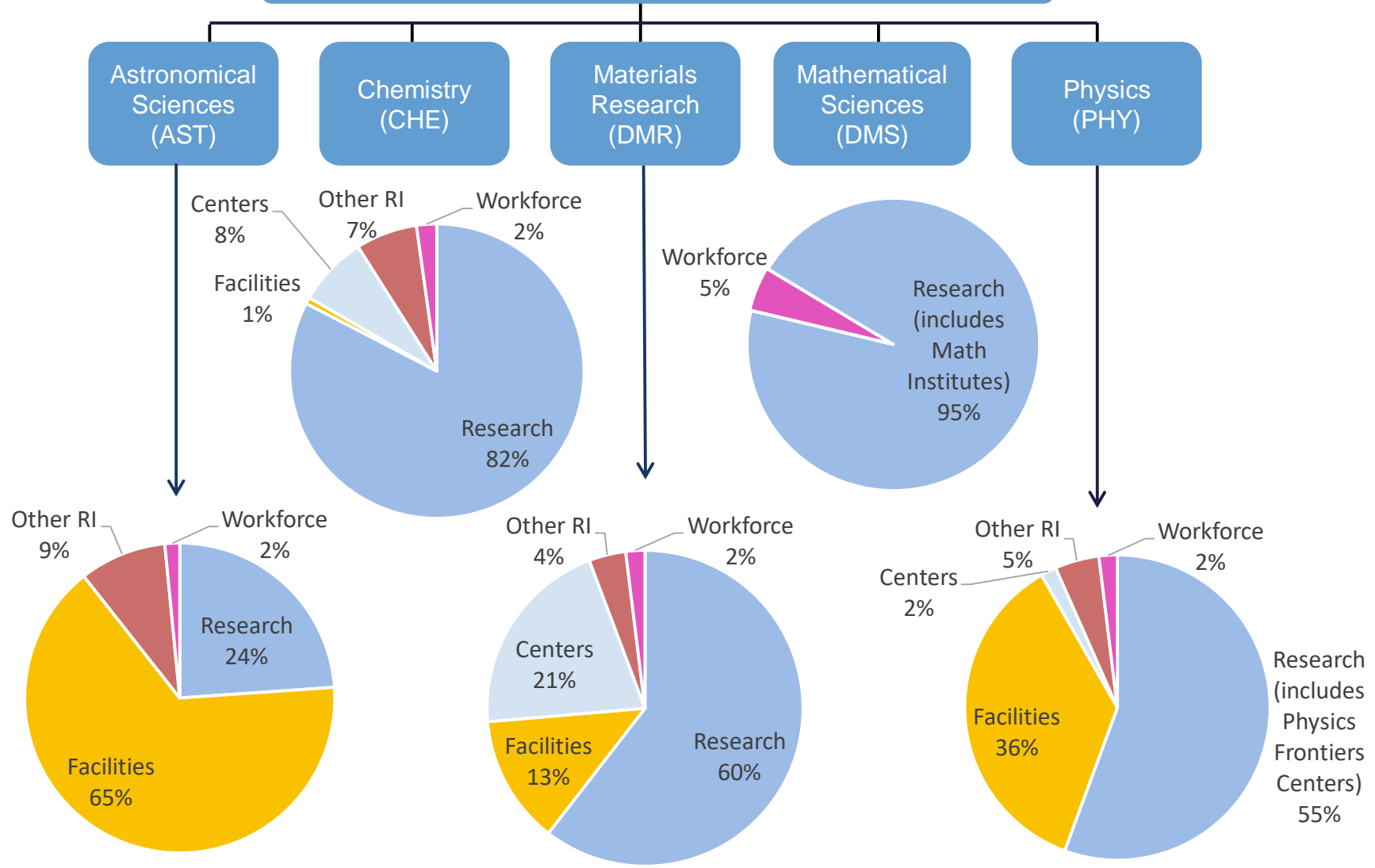


MPS by the Numbers: FY 2019

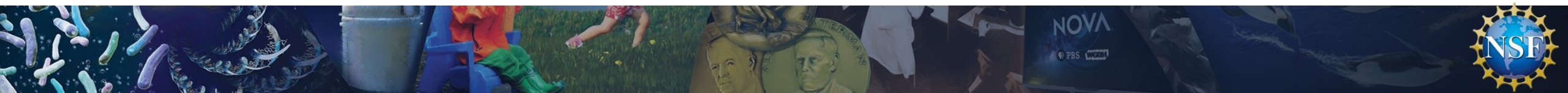


FY 2019

Mathematical and Physical Sciences (MPS)

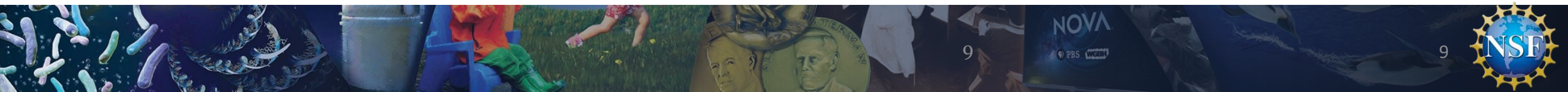


Source: FY 2019 Actuals Data



NSF Budget Status (\$M)

<u>NSF Actual FY 2019</u>	<u>\$8,338.27</u>
R&RA Actual FY 2019	\$6,578.14
MPS Actual FY 2019	\$1,490.61
<u>NSF Enacted FY 2020</u>	<u>\$8,578.33</u>
R&RA Enacted FY 2020	\$6,737.20
<u>NSF Request FY 2021</u>	<u>\$7,947.66</u>
R&RA Request FY 2021	\$6,213.02
MPS Request FY 2021	\$1,448.32



**NATIONAL SCIENCE FOUNDATION
SUMMARY TABLE
FY 2021 BUDGET REQUEST TO CONGRESS**
(Dollars in Millions)

NSF by Account	FY 2019 Actual	FY 2020 Enacted ¹	FY 2021 Request	FY 2021 Request change over:			
				FY 2019 Actual		FY 2020 Enacted	
				Amount	Percent	Amount	Percent
BIO	\$783.75	-	\$704.95	-\$78.80	-10.1%	N/A	N/A
CISE	985.12	-	1,062.40	77.28	7.8%	N/A	N/A
ENG	991.15	-	909.78	-81.37	-8.2%	N/A	N/A
<i>Eng Programs</i>	779.50	-	700.53	-78.97	-10.1%	N/A	N/A
<i>SBIR/STTR, including Operations</i>	211.65	-	209.25	-2.40	-1.1%	N/A	N/A
GEO	969.88	-	836.61	-133.27	-13.7%	N/A	N/A
MPS	1,490.61	-	1,448.32	-42.29	-2.8%	N/A	N/A
SBE	271.17	-	246.84	-24.33	-9.0%	N/A	N/A
OISE	49.00	-	44.01	-4.99	-10.2%	N/A	N/A
OPP	488.68	-	419.78	-68.90	-14.1%	N/A	N/A
IA	547.31	-	538.73	-8.58	-1.6%	N/A	N/A
U.S. Arctic Research Commission	1.48	-	1.60	0.13	8.5%	N/A	N/A
Research & Related Activities	\$6,578.14	\$6,737.20	\$6,213.02	-\$365.12	-5.6%	-\$524.18	-7.8%
Education & Human Resources	\$934.53	\$940.00	\$930.93	-\$3.60	-0.4%	-\$9.07	-1.0%
Major Research Equipment & Facilities Construction	\$285.27	\$243.23	\$229.75	-\$55.52	-19.5%	-\$13.48	-5.5%
Agency Operations & Award Management	\$332.69	\$336.90	\$345.64	\$12.95	3.9%	\$8.74	2.6%
Office of Inspector General	\$15.28	\$16.50	\$17.85	\$2.57	16.8%	\$1.35	8.2%
Office of the National Science Board	\$4.32	\$4.50	\$4.21	-\$0.11	-2.6%	-\$0.29	-6.4%
Total, NSF Discretionary Funding	\$8,150.23	\$8,278.33	\$7,741.40	-\$408.83	-5.0%	-\$536.93	-6.5%
Education and Human Resources - H-1B Visa	149.00	234.92	166.26	17.26	11.6%	-68.66	-29.2%
Donations	39.04	65.12	40.00	0.96	2.5%	-25.12	-38.6%
Total, NSF Mandatory Funding	\$188.04	\$300.03	\$206.26	\$18.22	9.7%	-\$93.77	-31.3%
Total, NSF Budgetary Resources	\$8,338.27	\$8,578.36	\$7,947.66	-\$390.61	-4.7%	-\$630.70	-7.4%

Totals exclude reimbursable amounts.

¹ Funding amounts below the account level for the FY 2020 Enacted were not available at the time of printing.



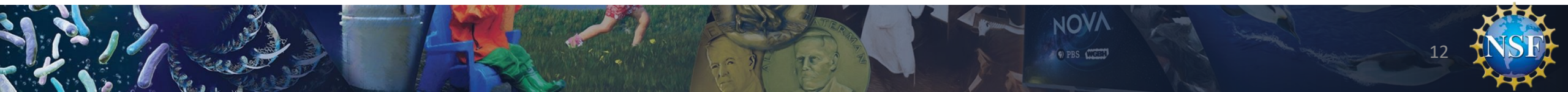
President's FY 2021 MPS Request:

MPS Funding
(Dollars in Millions)

	FY 2019 Actual	FY 2020 (TBD)	FY 2021 Request	Change over FY 2019 Actual	
				Amount	Percent
Astronomical Sciences (AST)	\$287.01	-	\$242.10	-\$44.91	-15.6%
Chemistry (CHE)	247.27	-	218.71	-28.56	-11.6%
Materials Research (DMR)	302.99	-	280.22	-22.77	-7.5%
Mathematical Sciences (DMS)	237.03	-	214.79	-22.24	-9.4%
Physics (PHY)	285.23	-	257.83	-27.40	-9.6%
Office of Multidisciplinary Activities (OMA)	131.08	-	234.67	103.59	79.0%
Total	\$1,490.61	-	\$1,448.32	-\$42.29	-2.8%

Includes plus-ups from FY 19 levels:

- \$17 M for Spectrum Innovation Initiative
- \$19.98 M for Quantum Leap
- \$103.59 M for high priority initiatives including Industries of the Future



Industries of the Future

FY 2021 Administration R&D Budget Priority Memo:

“These industries promise to fuel American prosperity, improve quality of life and national security, and create high-paying jobs for American workers.”

Quantum Information
Science



Artificial Intelligence



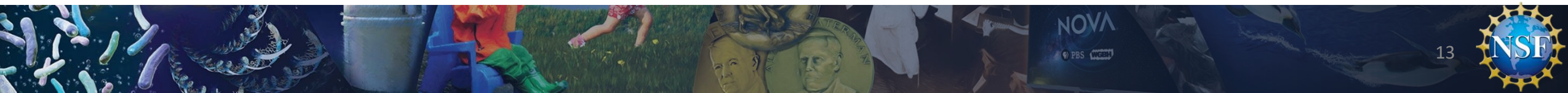
Advanced Wireless/5G



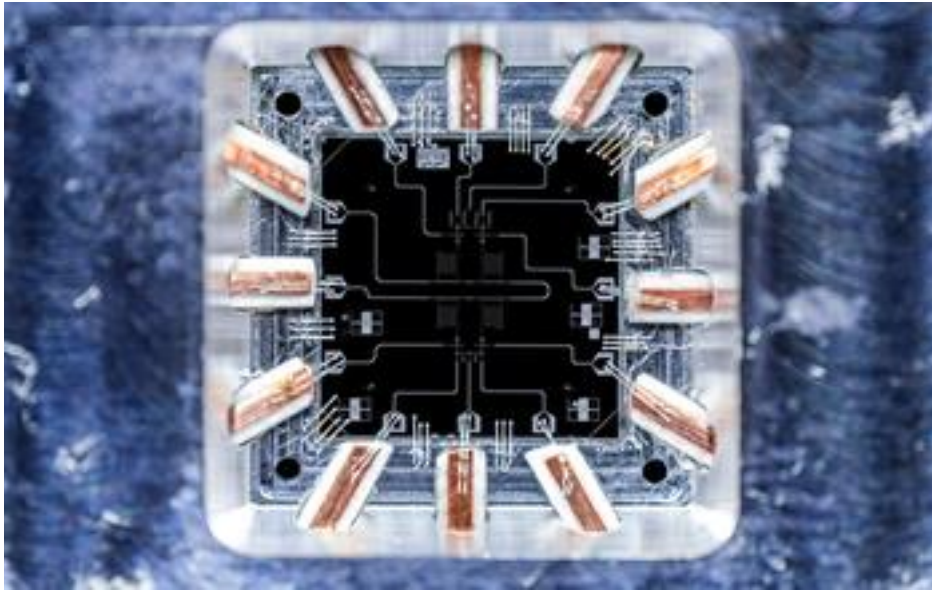
Biotechnology



Advanced Manufacturing



Quantum Information Sciences

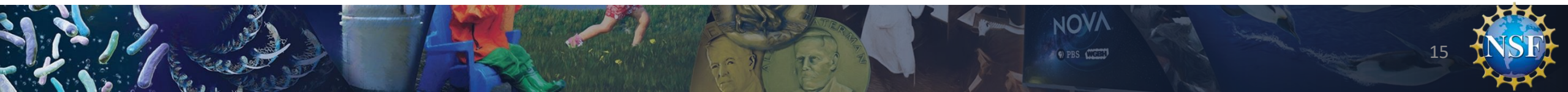


- MPS is the Agency Steward for QIS
- National Quantum Initiative (NQI) aligned investments will focus on:
 - Quantum sensors and simulators
 - Quantum interconnects
 - Quantum computing
- Diverse quantum-literate workforce



Artificial Intelligence

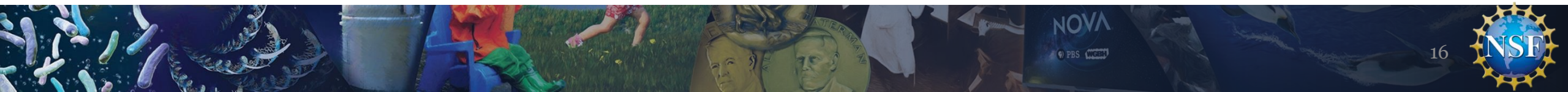
- CISE is the Agency Steward
- AI Institutes
- Focus areas: Machine Learning, Deep Learning, Molecular Synthesis and Manufacturing





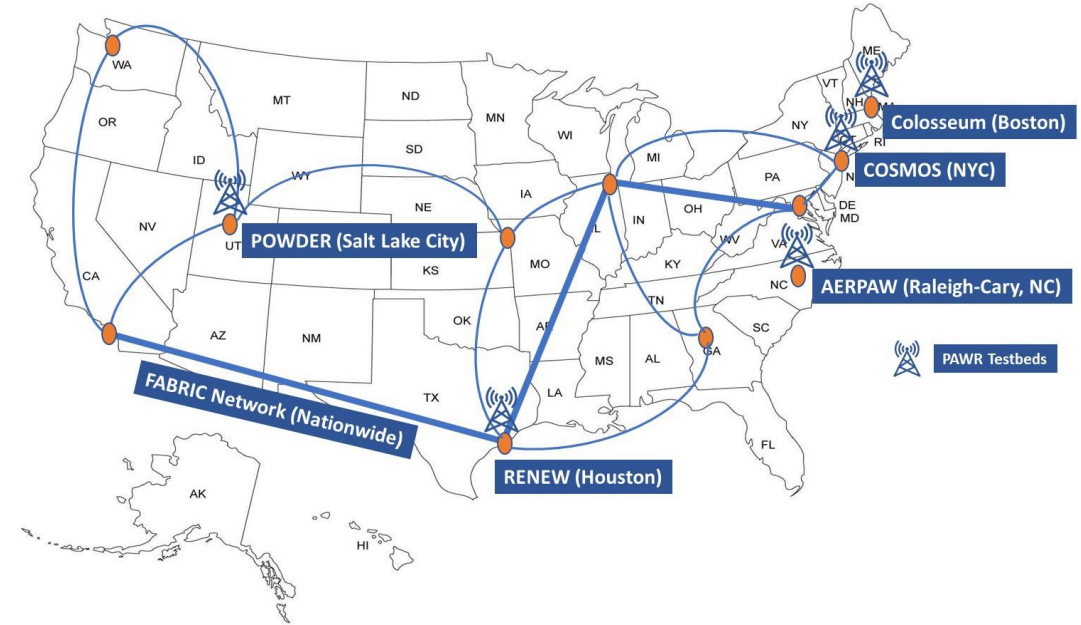
National Artificial Intelligence (AI) Research Institutes Program

- Joint effort of NSF, USDA, NIFA, DHS, DOT, FHWA, and VA
- Institutes will comprise scientists, engineers, and educators united by a common focus on advancing the research frontiers in AI
- Proposals were accepted to **Planning** and **Institute** tracks in January 2020
- 9 to 14 awards expected, ~8 Planning Grants and 1-6 Institutes
- FAQ about the AI Research Institutes program is available on the NSF website:
<https://www.nsf.gov/pubs/2020/nsf20021/nsf20021.jsp>

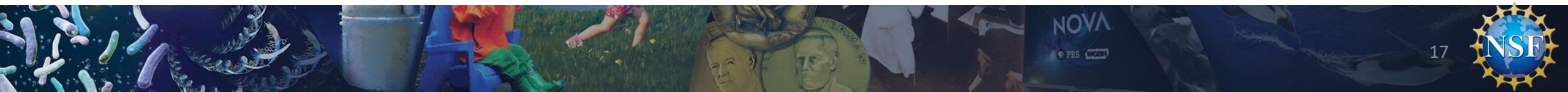


Advanced Wireless/5G

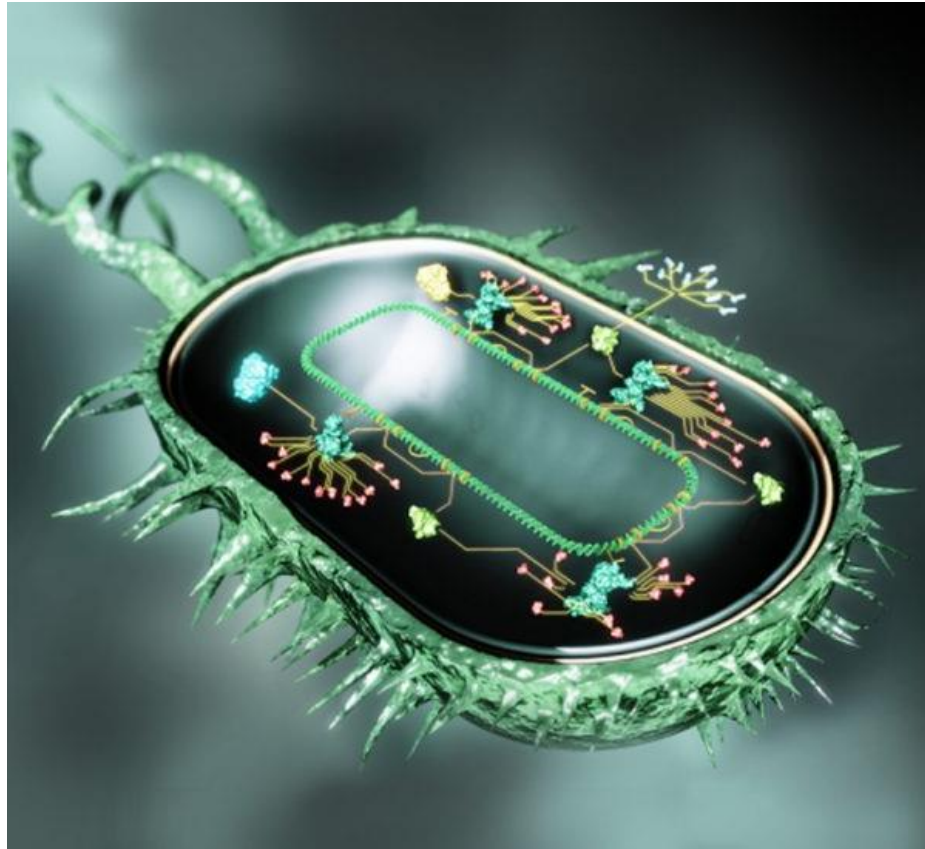
- MPS is the Agency Steward for the Spectrum Innovation Initiative
- National Radio Dynamic Zones
- Collaborative Institutes
- Workforce Development



Platforms for Advanced Wireless Research (PAWR)



Biotechnology



- BIO is the Agency Steward
- MPS will make contributions to URoL programs in synthetic biology, epigenetics, and microbiome research

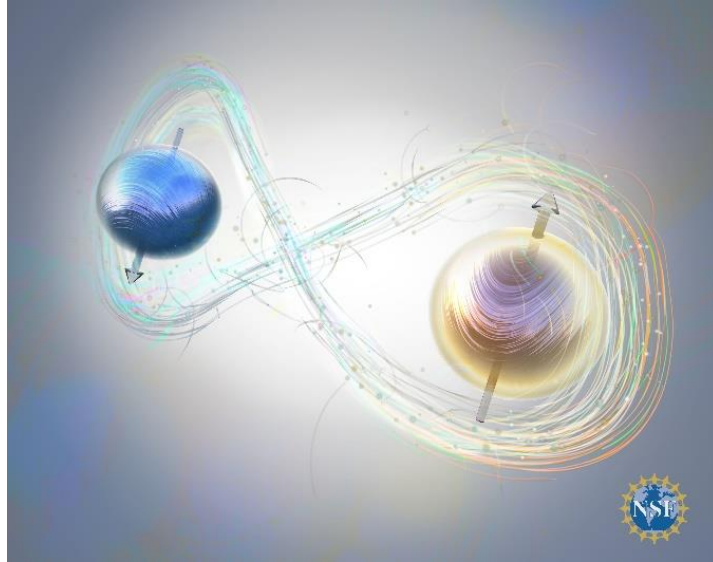


Advanced Manufacturing

- ENG is the Agency Steward
- Transforming capabilities, methods, and practices
- Future Manufacturing
- New methods, processes, analyses, tools and equipment for manufacturing products, supply chain components and materials



MPS FY 2021 Big Idea Investments (MPS Stewardship)



Quantum Leap (\$78.51 million)

- A wide variety of mechanisms may be employed, with a focus on team science and workforce development
- Continued team science efforts will target quantum computing, communications, and sensing
- Focus on center-scale investments in quantum materials foundries and Quantum Leap Challenge Institutes

*QL and WoU totals include Stewardship funds held by MPS + Foundational research activities

FY 2020 Update

Quantum Leap Challenge Institutes (QLCI)

Two award types:

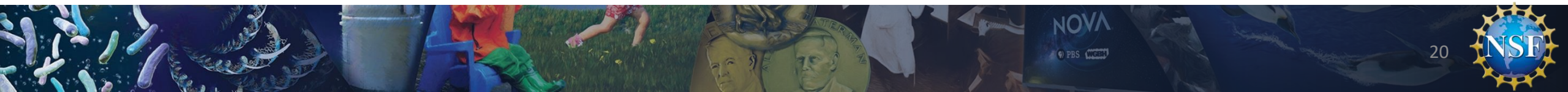
- 12-month **Conceptualization Grants** (CG) to support teams envisioning Institute proposals
- 5-year **Challenge Institute** (CI) awards to establish and develop large-scale interdisciplinary research projects that aim to advance the frontiers of quantum information science and engineering

ROUND I (2019-2020): **CG or CI proposals** *but not both*

- 18 CG grants awarded in FY 2019
- CI full proposals by invitation only **under review**

ROUND II (2020-2021): **CI proposals only**

- Letters of Intent for preliminary proposals due August 3, 2020
- Preliminary proposals due September 1, 2020
- Full proposals (by invitation only) due February 1, 2021

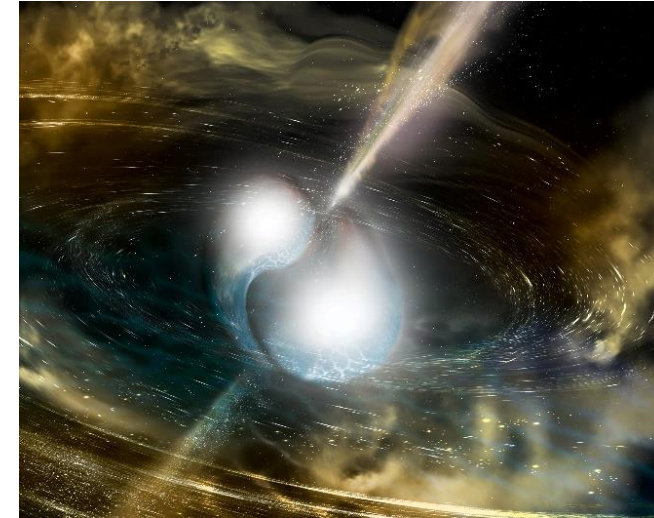


MPS FY 2021 Big Idea Investments (MPS Stewardship)

Windows on the Universe (\$51.00 million)

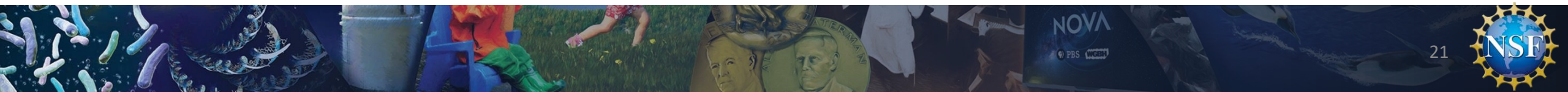
- Awards will support the research community directly, as well as developing instrumentation and facilities
- Scientific foci will include astronomy, particle astrophysics, and gravitational physics
- Investments will build capacity for multi-messenger observations, coordination, and interpretation

*QL and WoU totals include Stewardship funds held by MPS + Foundational research activities



FY 2020 Update

- \$30 M awarded in FY 19 across 66 awards
- Participating programs in the NSF divisions of Astronomy and Physics and the Office of Polar Programs are currently accepting proposals to the WoU-MMA metaprogram for FY 2020 funding
- Proposals must address one of the following for multi-messenger astrophysical explorations of the Universe:
 - Coordination, Observations, or Interpretation
- The list of participating programs and due dates can be found at:
https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505593



MPS FY 2021 Big Idea Investments

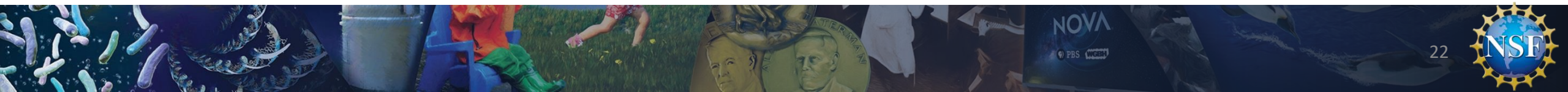


Harnessing the Data Revolution (\$19.10 million)

- Key scientific foci will include theoretical foundations of data science, machine learning, artificial intelligence, and data mining
- Mechanisms for involvement will include the HDR Frameworks, Ideas Lab, and TRIPODS activities, as well as the Physics at the Information Frontier program

Understanding the Rules of Life (\$37.06 million)

- Key scientific foci will include the chemistry of life processes, mathematical modeling of biological systems, and physics of living systems
- Mechanisms for involvement will include URoL's microbiome programs and synthetic cell research network, as well as the NSF-Simons Research Centers

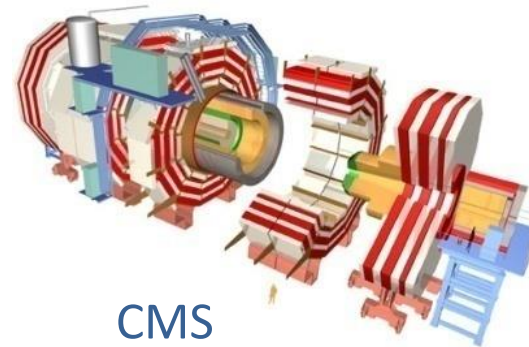


HL-LHC Upgrades

Final Design Reviews (FDRS) validated construction-readiness of upgrade plans for the ATLAS and CMS detectors

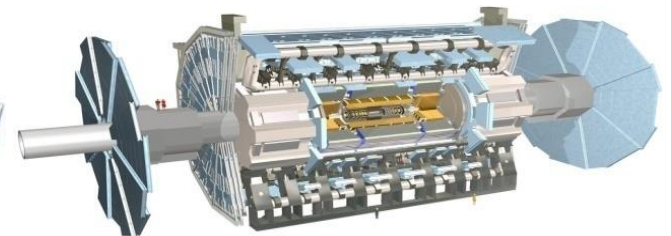
The National Science Board authorized the NSF Director to make MREFC awards for the upgrades, with construction scheduled to begin in FY 2020

September 2019



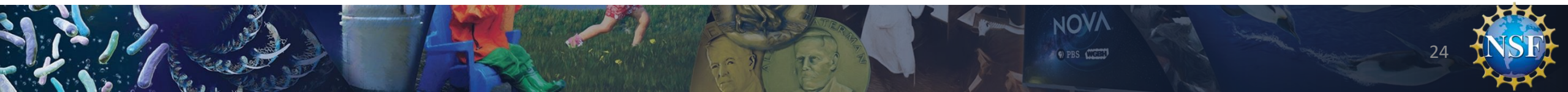
CMS

February 2020



ATLAS

Additional Science Slides

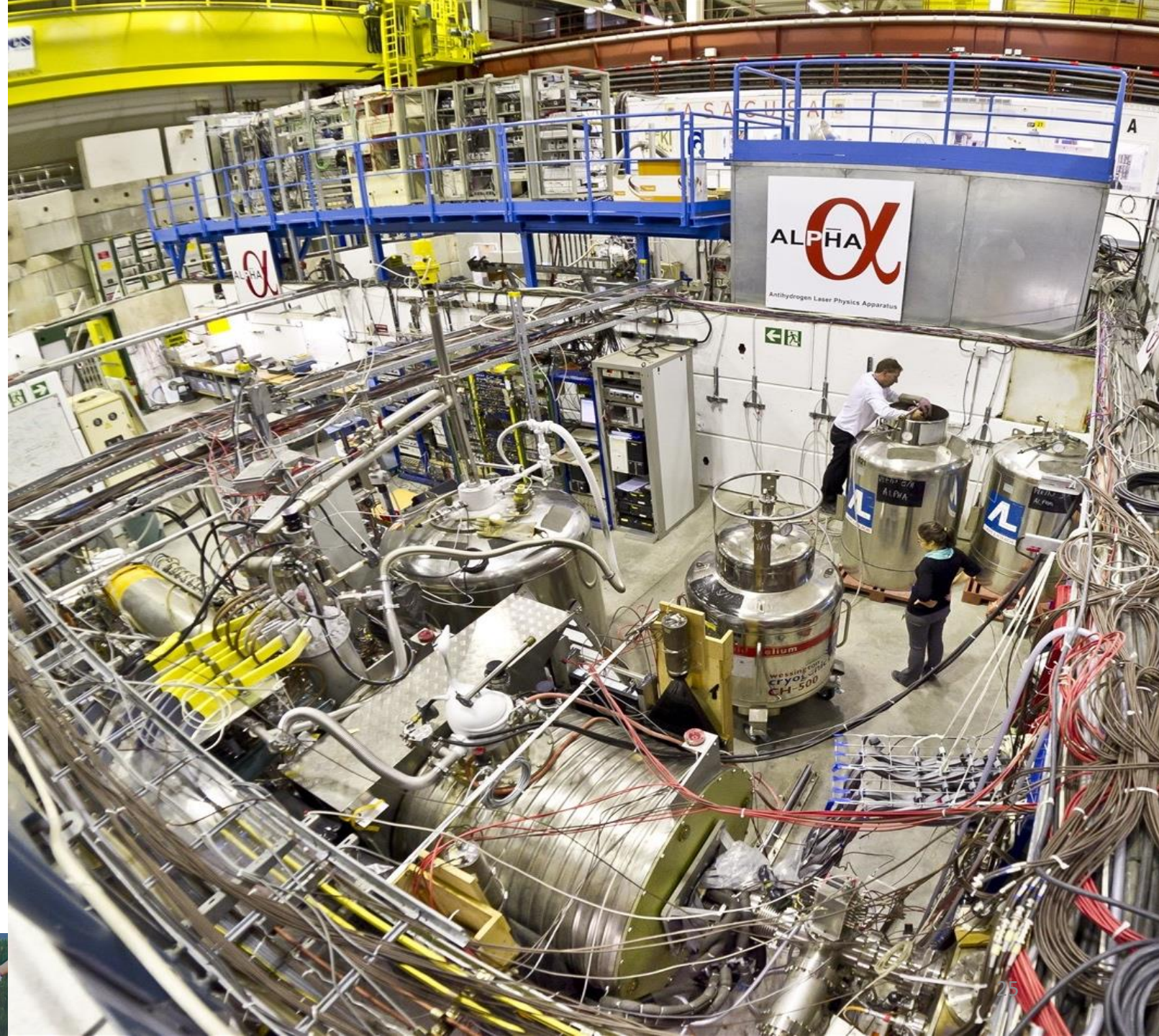


NSF & DOE Supported Breakthrough at CERN

Feb 2020:

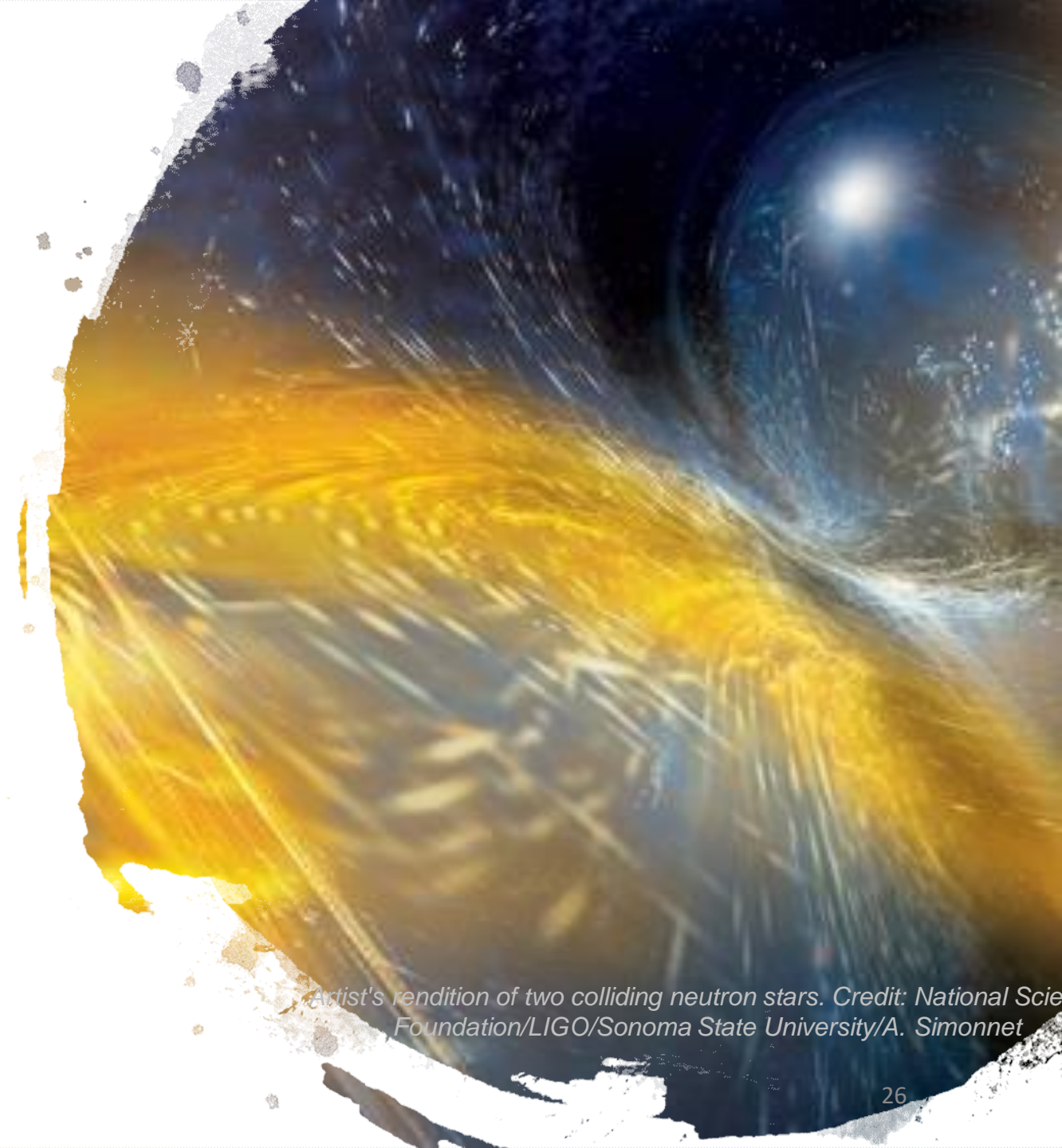
- ALPHA collaboration reported the first measurements of certain quantum effects in the energy structure of [antihydrogen](#)
- Measured the energy difference between the 1S and 2P states and observed results consistent with the Lamb shift
- Coverage: [Nature](#), [CERN](#), [ScienceNews](#), [ABC Science](#), [Wired](#)

The ALPHA experiment in the Antiproton Decelerator hall at CERN (Image: CERN)



LIGO-Virgo Network Catches Another Neutron Star Collision

- New study confirms that an April 25, 2019 gravitational wave observation was likely the result of a neutron star collision
- Only the second time such an event has been observed



Artist's rendition of two colliding neutron stars. Credit: National Science Foundation/LIGO/Sonoma State University/A. Simonnet