National Science Foundation – Nuclear Physics

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MPS/PHY
July 2020

Nuclear Physics at NSF

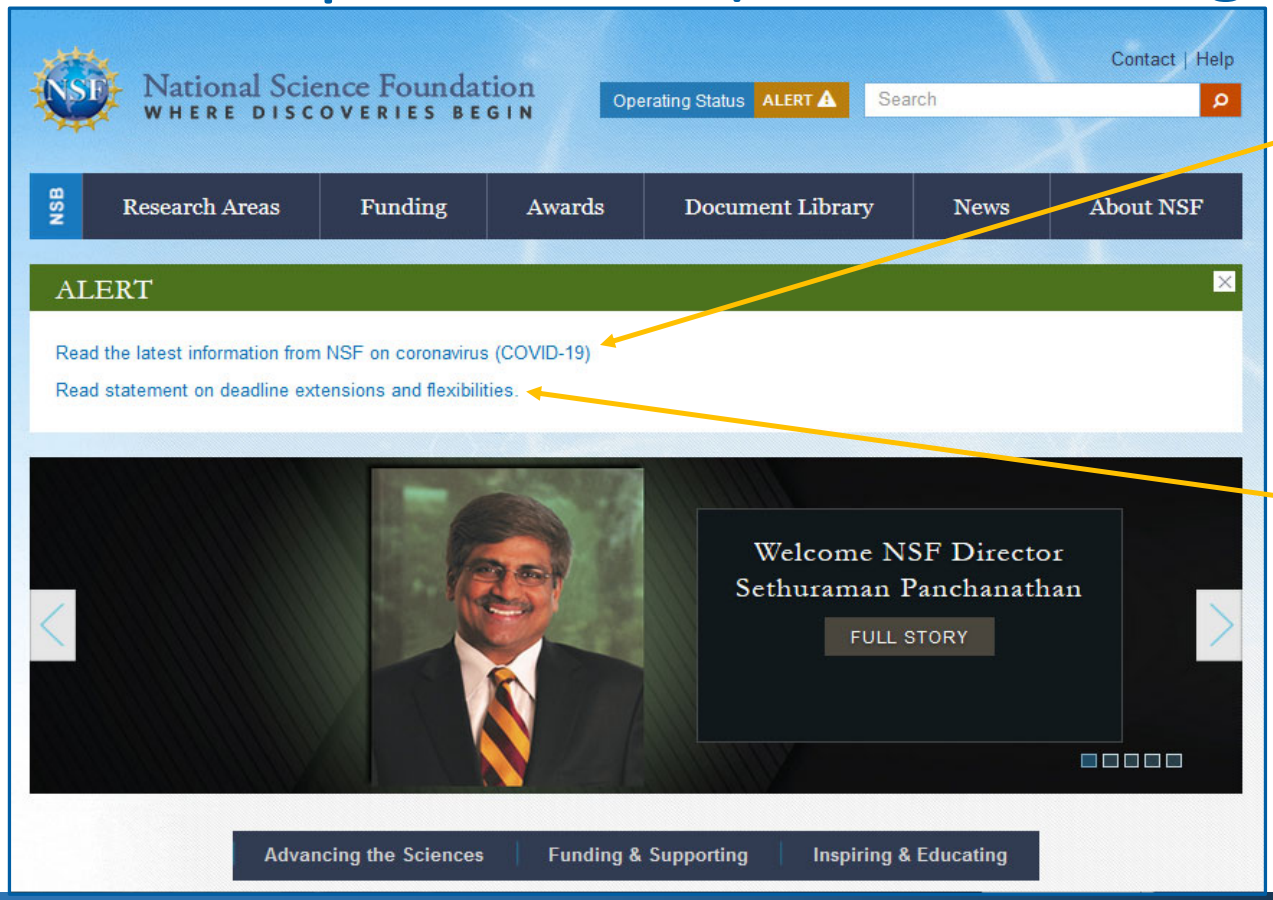
- Transitions at NSF
- COVID-19
- FY20 & FY21 Budgets
- Nuclear Physics Programs
- Funding Opportunities
- Research Infrastructure

NSF/MPS/PHY Personnel

- Sethuraman Panchanathan – Director (as of 23-jun-2020)
- Sean L. Jones – Acting Assistant Director for MPS
  - Denise Caldwell – Physics Division Director
  - Jean Cottam Alan – Deputy Division Director
  - Bogdan Mihaila – Nuclear Theory Program Director
- Jim Thomas – Expt'l Nuclear Physics Program Director
  - Allena Opper – Expt'l Nuclear Physics Program Director

www.nsf.gov/pubs/2019/phy19001/phy19001.jsp
www.nsf.gov/careers/rotator

COVID-19 Impacts https://www.nsf.gov



FAQs, OMB Guidance, NSF Guidance, Funding Opportunities & Impacts

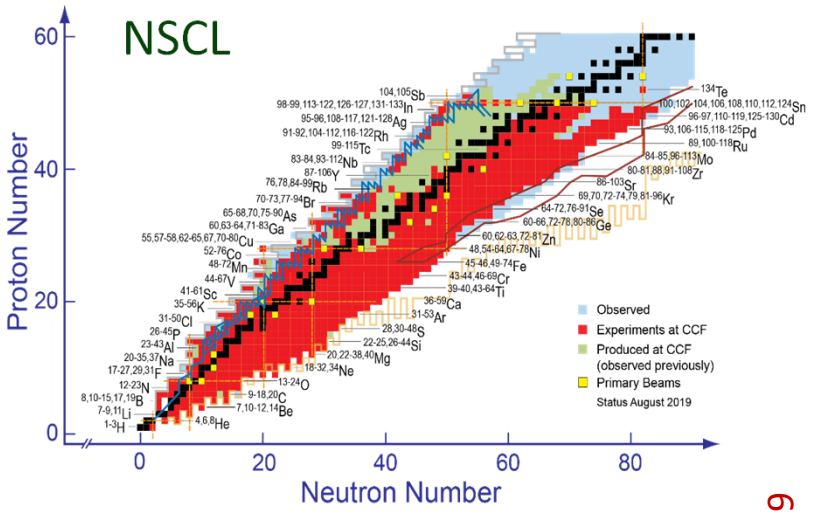
Deadline extensions

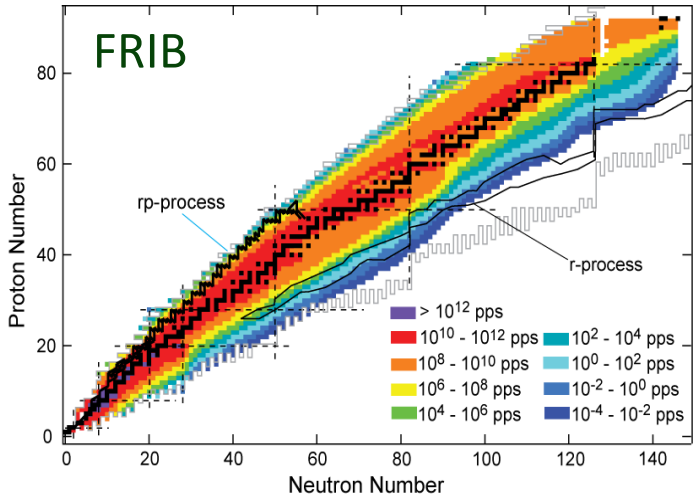
COVID-19 Impacts

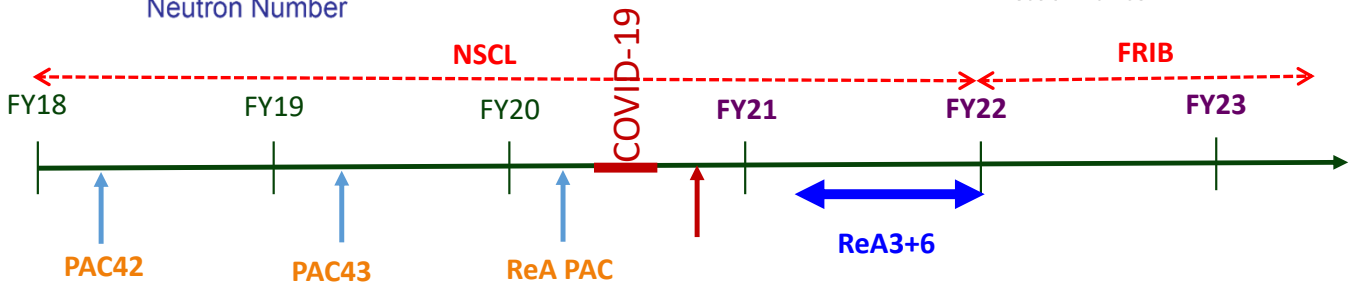
- Labs and universities resuming research operations
  - Phases, enhanced PPE, reduced occupancy, modified procedures
  - Lost beam time may not be fully recovered
- Immediate NSF actions
  - Flexibilities for current awards & facilities within Federal, State, local and institutional guidelines
  - Deadline extensions for solicitations & reports
  - COVID-19 “RAPID” funding opportunities – all $ allocated to 809 awards
- NSF operating via telework since mid-March
  - All panels (review, advisory, etc.) virtual
  - Business processes operational

NSCL / FRIB Transition

Smooth & close coordination → exciting opportunities

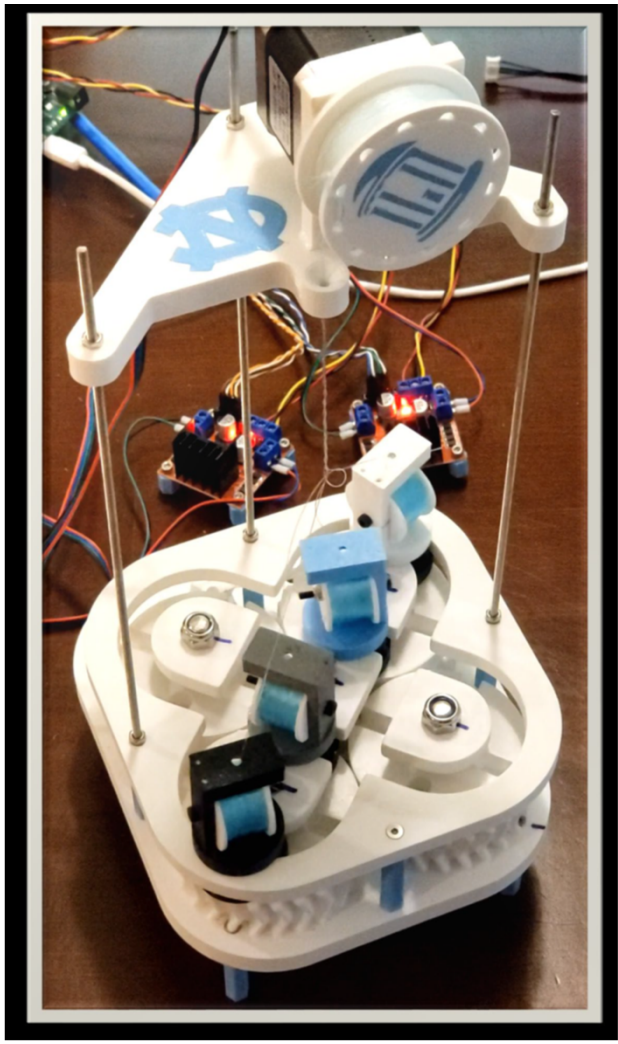




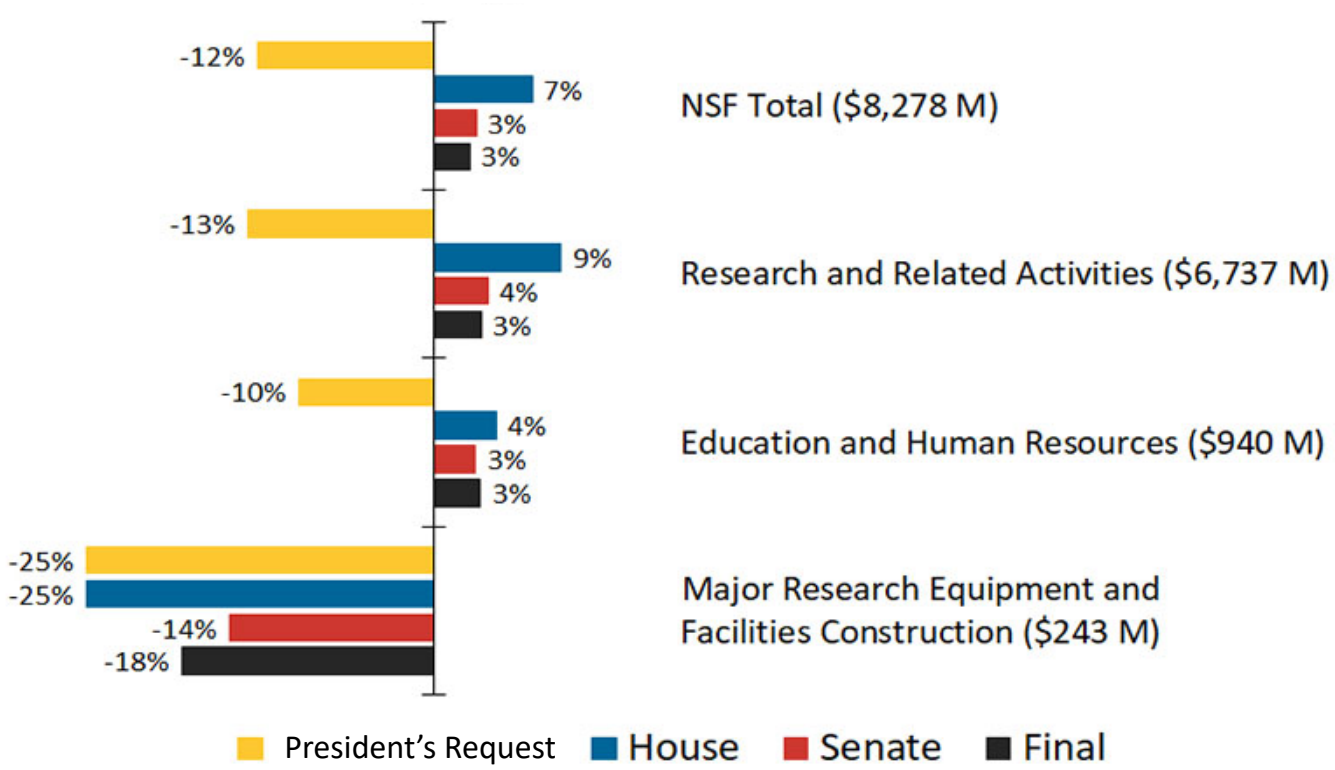


Productivity during COVID-19

- Phys Rev editors: paper submission is up
- Scientists and engineers continue to be productive
- L-200 needs 4-braided coax cables for each ^{76}Ge crystal in $0\nu\beta\beta$ detector array
  - Each strand ~ size of monofilament fishing line
  - Eric Martin (UNC postdoc) used 3D printer to design, fabricate, and assemble the braiding machine at home
  - Apparatus: clean, non lubrication → low-mass, low-noise cables
  - https://www.dropbox.com/s/d3k0p8s6a49d2nl/LEGENDCableBraiderVideo.mp4?dl=0



NSF FY20 Appropriation: $ in ( ) = FY20 appropriations



FY21 President's Budget Request – NSF ($M)

NSF by Account	FY 2019 Actual	FY 2020 Enacted[1]	FY 2021 Request	FY 2021 Request change over: FY 2019 Actual Amount	FY 2019 Actual Percent	FY 2020 Enacted Amount	FY 2020 Enacted 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
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%**
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.

FY21 President's Budget Request – MPS ($M)

	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%**

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July 7: House Mark = President's Request + $809.6M

Totals exclude reimbursable amounts.

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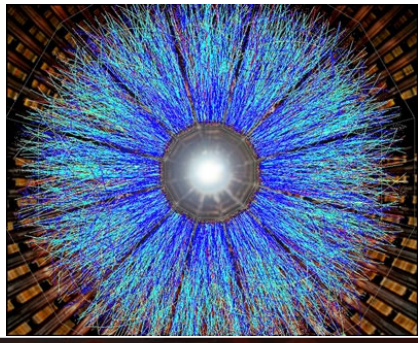
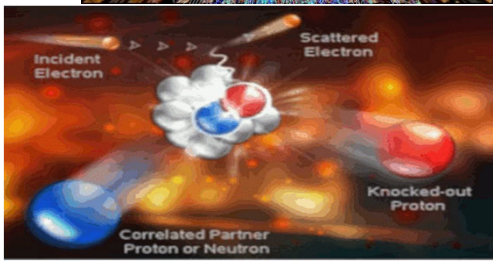
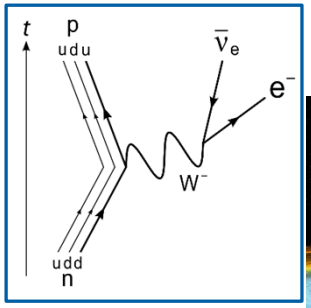
NSF Nuclear Physics

Supports the study of nuclear constituents to the reactions in stars burning throughout the universe, as understood through the strong and electroweak interactions.

- Nuclear and hadron QCD
- Nuclear astrophysics, reactions, and structure
- Nuclear precision measurements of fundamental symmetries and constants
- National Superconducting Cyclotron Laboratory
- University labs (FSU & UND)
- Nuclear Theory & Theory Hubs
- Co-review and co-funding with other NSF programs







Nuclear Physics Budget Trends ($k)

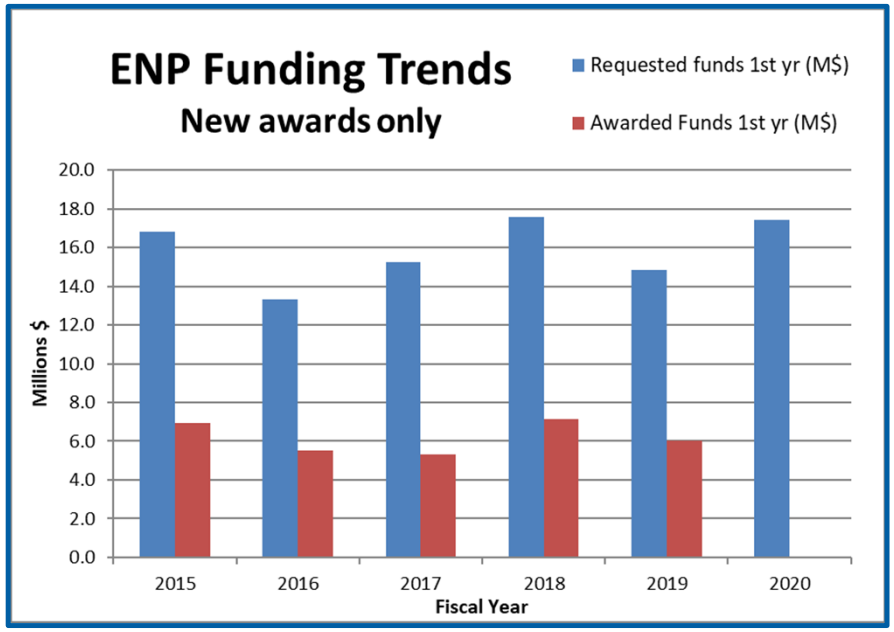
Includes co-funding and other leveraged funds

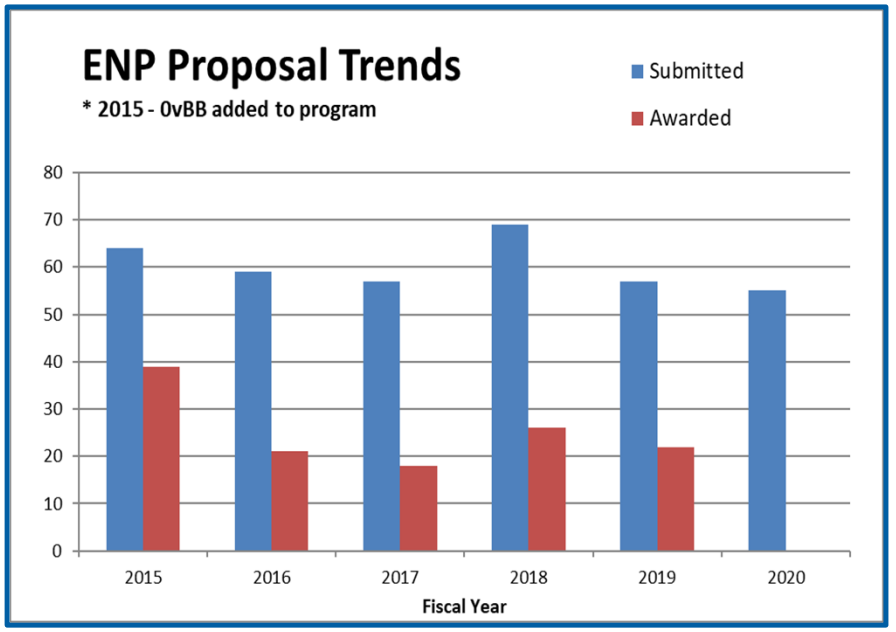
$18M = Operations
$ 6M = Research

FY	Nucleon & Hadron QCD	Nuclear Astroph, Reactions, Structure	Fund Symm	Total Exp't Nuclear Physics	Nuclear Theory	Nuclear Program Total	NSCL	JINA & JINA -CEE	MRI	Mid-Scale	Total Nuclear Physics
2016	7,141	5,046	7,391	19,579	4,223	23,802	24,000	2,280	1,869	3,238	55,189
2017	6,955	6,273	6,692	19,920	4,344	24,264	24,000	2,280	530	2,990	54,064
2018	7,160	5,048	7,589	19,787	4,384	24,171	24,000	2,280	3,970	5,249	59,791
2019	6,325	7,322	6,884	20,531	4,321	24,851	28,500	2,280	3,549	5,806	64,986
2020				+2,000			22,000				
2021				+2,000			15,500				
2022				+2,000			0				

* FY19 NSCL $28.5M = $24M + $4.5M to forward fund ¼ FY21 M&O
MRI: competes each year; one-time acquisition/development funds
Mid-scale: ad hoc competition; design and construction funds (L-200, nEDM)

Proposal pressure





Funding Opportunities

Faculty Early Career Development Program (CAREER) NSF 20-525

- Awards in support of early-career faculty who have the potential to serve as academic role models in research *and education*
- Eligibility: asst. professor (tenure-track), untenured as of 27-jul-2020
- Proposal deadline: **Aug 11, 2020**
- PECASE (Presidential Early Career Awards for Scientists and Engineers selected from the most meritorious CAREER awardees
- Contact program officer for information/advice ahead of time (budget, scope)

Funding Opportunities

PHY Investigator Initiated Research NSF 20-580

All proposals submitted to the Division of Physics programs must go through this solicitation.

- Deadlines: First Tuesday in December for *Experimental & Theoretical Nuclear Physics*
  → December 1, 2020
- Has text on Midscale Instrumentation & Long Duration Efforts
- Collaborators and Other Affiliations Template: list those people with whom you are conflicted – not everyone in the collaboration. Questions – contact cognizant program director. Do not use collaboration url.
- Follow instructions that are specific to this solicitation
- Must conform to the NSF Proposal & Award Policies & Procedures Guide (PAPPG) https://www.nsf.gov/pubs/policydocs/pappg20_1/index.jsp
  - Follow the Proposal Preparation checklist

Funding Opportunities

Research at Undergraduate Institutions (RUI) and Research Opportunity (ROA) Awards NSF 14-579

RUI and ROA funding opportunities support research by faculty members at predominantly undergraduate institutions (PUIs).

- RUI proposals support PUI faculty in research that engages them in their professional field(s), builds capacity for research at their home institution, and supports the integration of research and undergraduate education.
- ROA proposals support PUI faculty research, but these awards typically allow faculty to work as visiting scientists at research-intensive organizations where they collaborate with other NSF-supported investigators.
- Proposal deadlines are the same as ENP and NT (1-dec-2020).
- Contact ENP and NT program directors for information.

Alliances for Graduate Education and the Professoriate (AGEP) – increase the number of historically URM faculty in STEM disciplines by advancing knowledge about pathways to career success.

AGEP-GR Supplements to MPS awards NSF 20-083

- A mechanism by which current MPS PI supports one (additional) Ph.D. student in an ongoing MPS-funded research project.
- Available to PIs at AGEP or AGEP Legacy Institutions
  - https://www.nsf.gov/mps/broadening_participation/index.jsp
- Graduate Student Eligibility
  - Emphasis placed on under-represented groups in STEM fields
  - Not currently supported by federal government (NSF, DOE, NIH, …)
  - US Citizen, US National, or US Permanent Resident
- Stipend, tuition, benefits, and IDC (~$60k)
- Renewable up to two times, no deadline for submission

Major Research Instrumentation (MRI)

- Two tracks:
  - Track 1 $100 k < $ from NSF < $1 M; max of 2/university
  - Track 2 $1 M < $ from NSF < $4 M; max of 1/university
- Two types: development and acquisition
- Deadlines & details
  - January 1 – January 19, annually (a window of opportunity)
  - https://www.nsf.gov/od/oia/programs/mri/
  - https://www.nsf.gov/pubs/2018/nsf18513/nsf18513.htm
  - Contact your program directors well ahead of time to discuss & avoid pitfalls
  - 30% cost share req'd for PhD granting institutions
  - Awards above $1M compete across the entire Foundation

Mid-scale Research Infrastructure

- PHY Mid-scale NSF 20-580 (i.e. PHY solicitiation)
  - Total request: $4M - $15M
  - Non-renewable, one-time award for construction or acquisition
  - R&D not included
- Mid-scale Research Infrastructure-1 (MsRI-1)
  - Implementation = "shovel ready"; $6M < total request < $20M
  - Design/development = to prepare implementation proposal; $600,000 < total request < $20M
- Mid-scale Research Infrastructure-2 (MsRI-2)
  - Total request: $20M - $100M
  - "Shovel ready"

Solicitations: every other year

Look for new solicitations this fall!

NSF's 10 Big Ideas

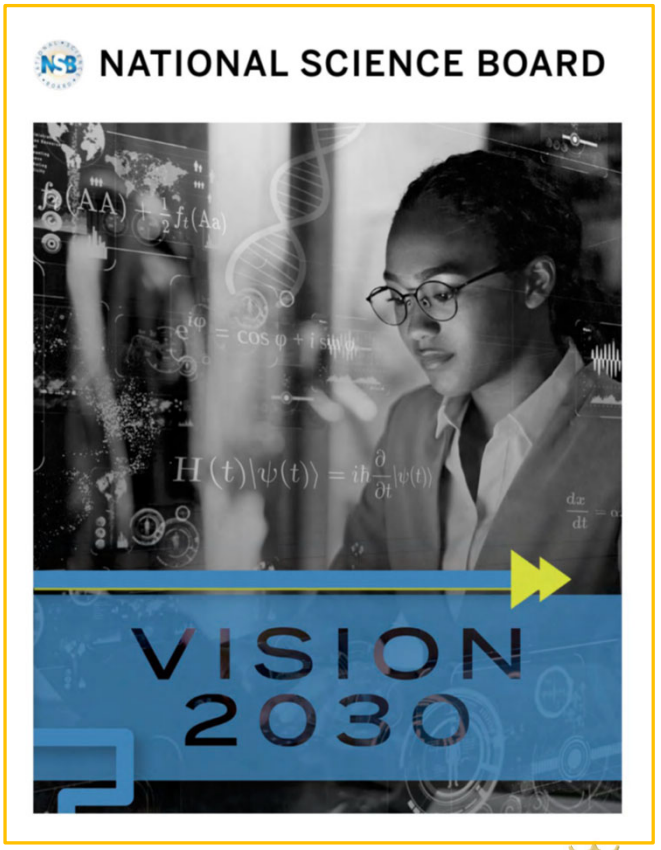
https://www.nsf.gov/news/special_reports/big_ideas/

- Future of Work
- Growing Convergence Research
- Harnessing the Data Revolution
- Mid-scale Research Infrastructure
- Navigating the Arctic
- NSF2026
- NSF Includes
- Quantum Leap
- Understanding the Rules of Life
- Windows on the Universe

National Science Board: Vision 2030 Report

https://www.nsf.gov/nsb/publications/2020/nsb202015.pdf

- "This report lays out what the National Science Board believes the U.S. must do to achieve this vision and remain the world innovation leader in 2030."
- Roadmap Elements:
  - Deliver benefits from research
  - Develop STEM talent for America
  - Expand the geography of innovation
  - Foster a global S&E community



NSF/PHY: Summary

- Recent fiscal years have been challenging
- And the physics has been compelling
- NSF continues to mitigate impacts of COVID-19
- NSF-wide priorities offer opportunities for nuclear physics
  - Mid-scale programs (NSF wide and within PHY)
  - Windows on the Universe
  - Quantum Leap
  - AI Institutes
- NSF Nuclear Physics continually works on programmatic balance
  - University labs, large groups, single PIs
  - Research scope
  - Risk

For the latest updates:

https://www.nsf.gov/physics

Contact us at:

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- jhthomas@nsf.gov
  or call (703)292-2911
- aopper@nsf.gov
  or call (703)292-8958

Back up slides

NSF Technology Directorate (?)

NSF will need a new building!

- Senate Minority Leader Chuck Schumer (D-NY) and Sen. Todd Young (R-IN) introduced legislation on May 21 "Endless Frontier Act": National Science Foundation → National Science and Technology Foundation with a new Directorate of Technology
  - artificial intelligence and machine learning
  - high performance computing, semiconductors, and advanced computer hardware
  - robotics, automation …
  - and exploration relevant to the other key technology focus areas

- The bill recommends Tech Dir budget = $2 billion in FY 2021 → $35 billion in fiscal FY24/25
  - "hold harmless" provision mandating Tech cannot receive funds in a given fiscal year if the budget for the rest of NSF declines. NSF's annual budget is currently about $8 billion.

FY21 President's Budget Request – PHY ($M)

	FY 2019 Actual	FY 2020 (TBD)	FY 2021 Request	Change over FY 2019 Actual Amount	Change over FY 2019 Actual Percent
Total	**$285.73**	**-**	**$257.83**	**-$27.90**	**-9.8%**
Research	**163.37**	**-**	**162.81**	**-0.56**	**-0.3%**
Centers Funding (total)	4.74	-	5.00	0.26	5.5%
STC: Center for Bright Beams	*4.74*	*-*	*5.00*	*0.26*	*5.5%*
Education	**5.52**	**-**	**4.56**	**-0.96**	**-17.5%**
Infrastructure	**116.83**	**-**	**90.46**	**-26.37**	**-22.6%**
IceCube	3.50	-	3.50	-	-
LHC	16.00	-	20.00	4.00	25.0%
LIGO[1]	55.47	-	45.00	-10.47	-18.9%
Midscale Research Infrastructure	13.34	-	6.46	-6.88	-51.6%
NSCL[2]	28.50	-	15.50	-13.00	-45.6%
Research Resources	0.02	-	-	-0.02	-100.0%