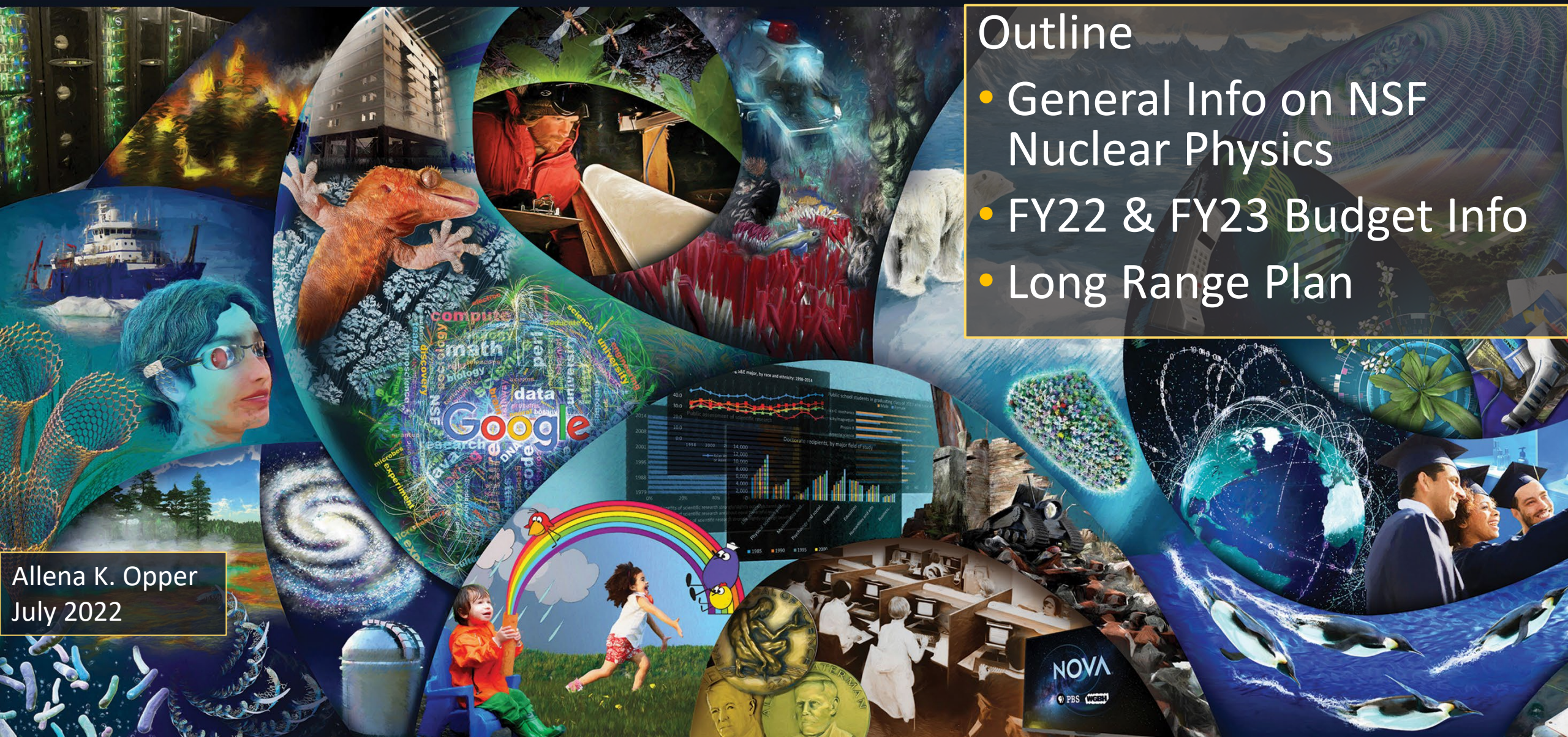




National Science Foundation – Nuclear Physics

Outline

- General Info on NSF Nuclear Physics
- FY22 & FY23 Budget Info
- Long Range Plan

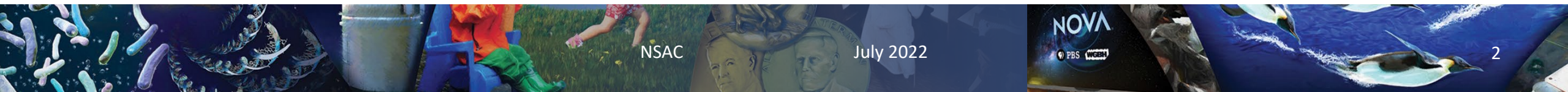


Allena K. Opper
July 2022



The National Science Foundation

- The NSF responds to proposals from a wide community
 - Extraordinary science from University groups
 - Extraordinary science from small Colleges
 - With compelling *Broader Impacts*
- Two merit review criteria
 - Intellectual Merit (The heart of every proposal)
 - Broader Impacts (Reach out and touch society!)
 - Education & Outreach
 - Building the economy & workforce of the future through STEM
 - Broadening participation
 - Impact on other fields of science & engineering
 - National Security ... more

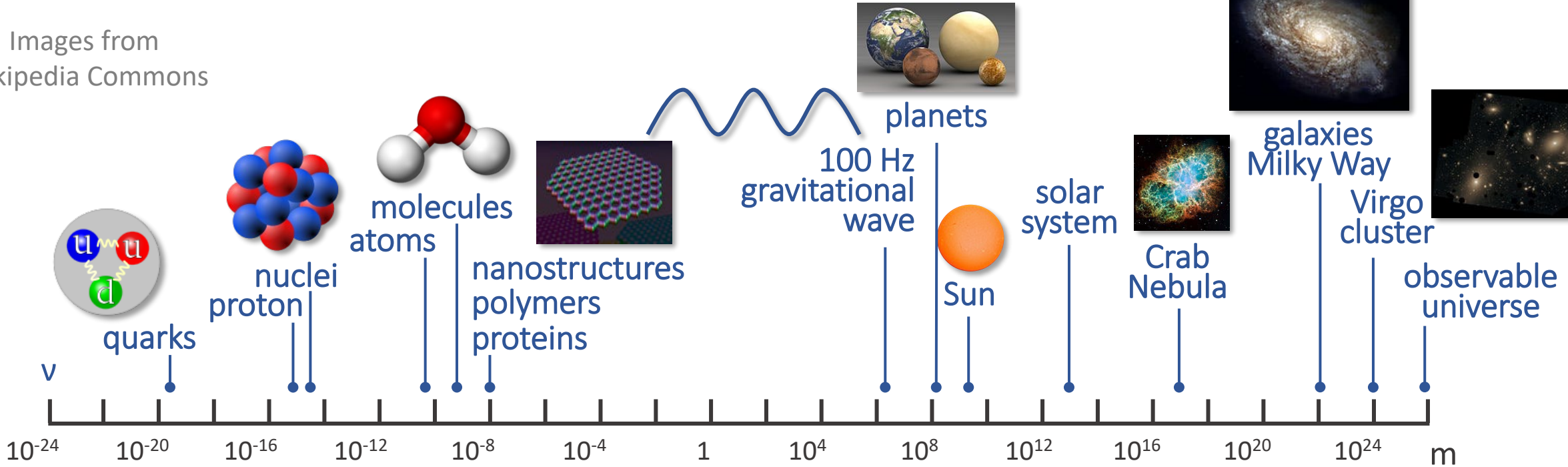




Mathematical and Physical Sciences (MPS)

Science at the Scales of the Universe

Images from
Wikipedia Commons



CHE, DMR



PHY



AST



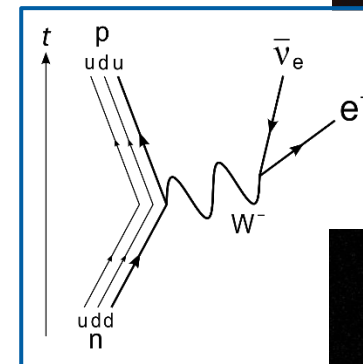
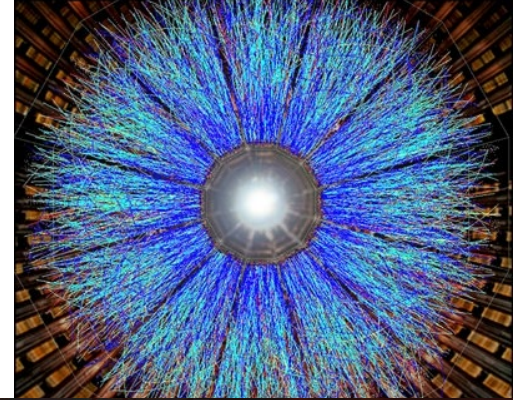
DMS



NSF Nuclear Physics

Supports the study of nuclear constituents, reactions, and structure within nuclei and nucleons – and in stars, *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
- University labs (FSU & UND)
- Nuclear Theory & Theory Hubs
- Co-review and co-funding with other NSF programs

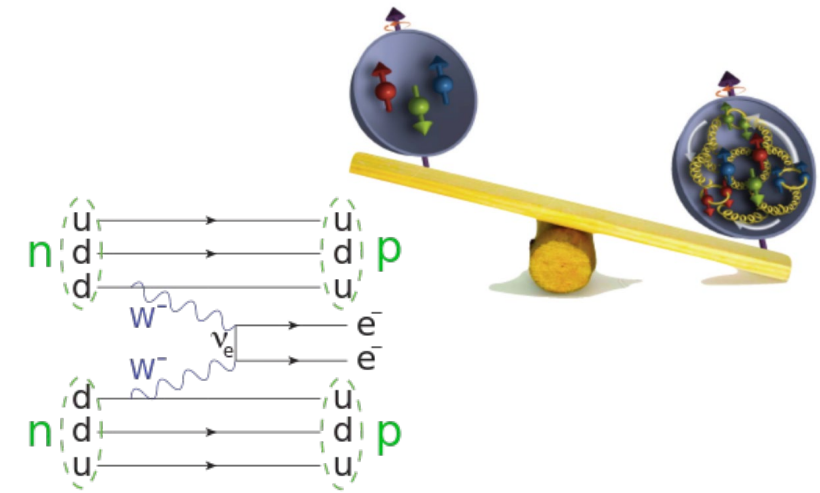
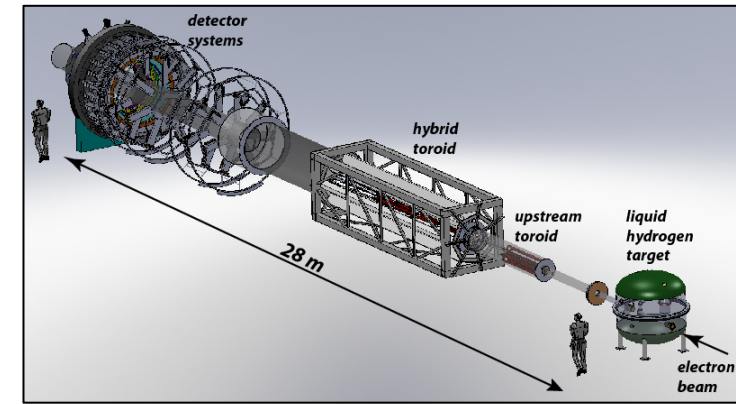




NSF and DOE Coordination in Nuclear Physics



- MOLLER – parity violating Moller (elastic $\vec{e} e$) scattering
 - DOE CD-1 Dec 2020
 - NSF PHY Mid-scale award for specific scope
- EIC – the Electron Ion Collider
 - DOE CD-1 in Jul 2021; BNL selected for site
 - Project includes EIC + 1 detector
- Next Generation $0\nu\beta\beta$
 - Demonstrators: CUOREcino, CUORE, MJD, 200, KamLAND-Zen, NEMO, ...
 - DOE $0\nu\beta\beta$ portfolio review \rightarrow 3 technologies



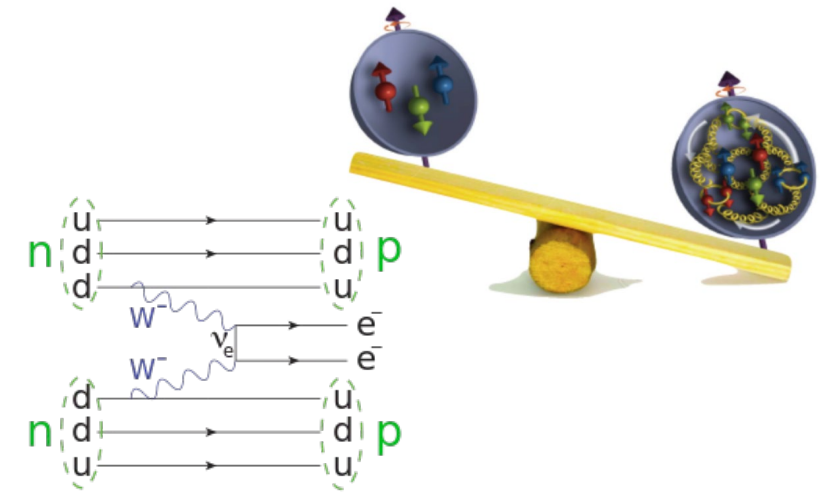
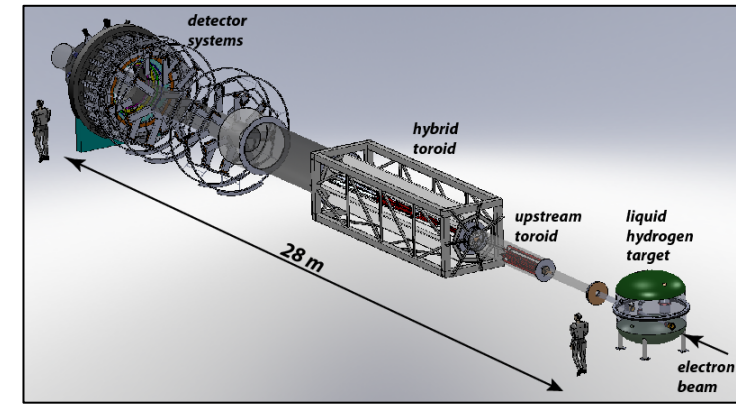


NSF and DOE Coordination in Nuclear Physics

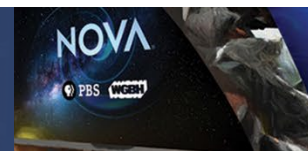
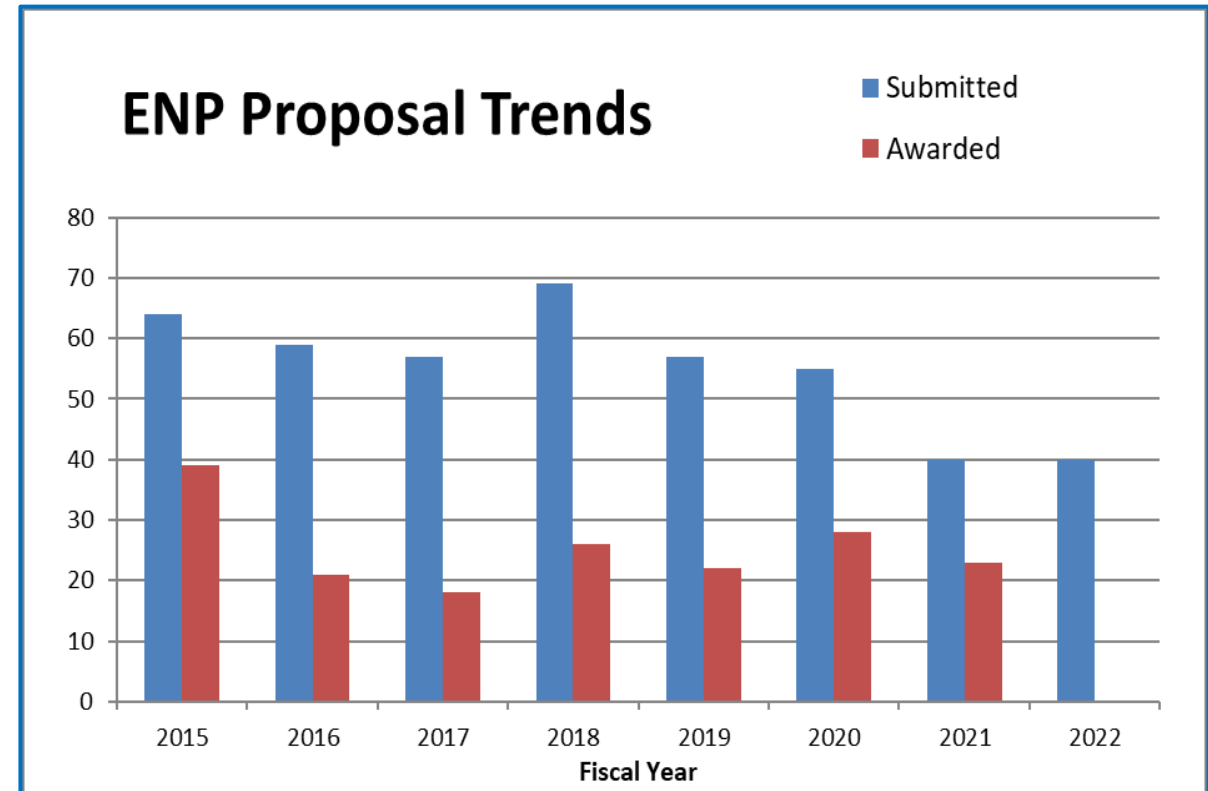
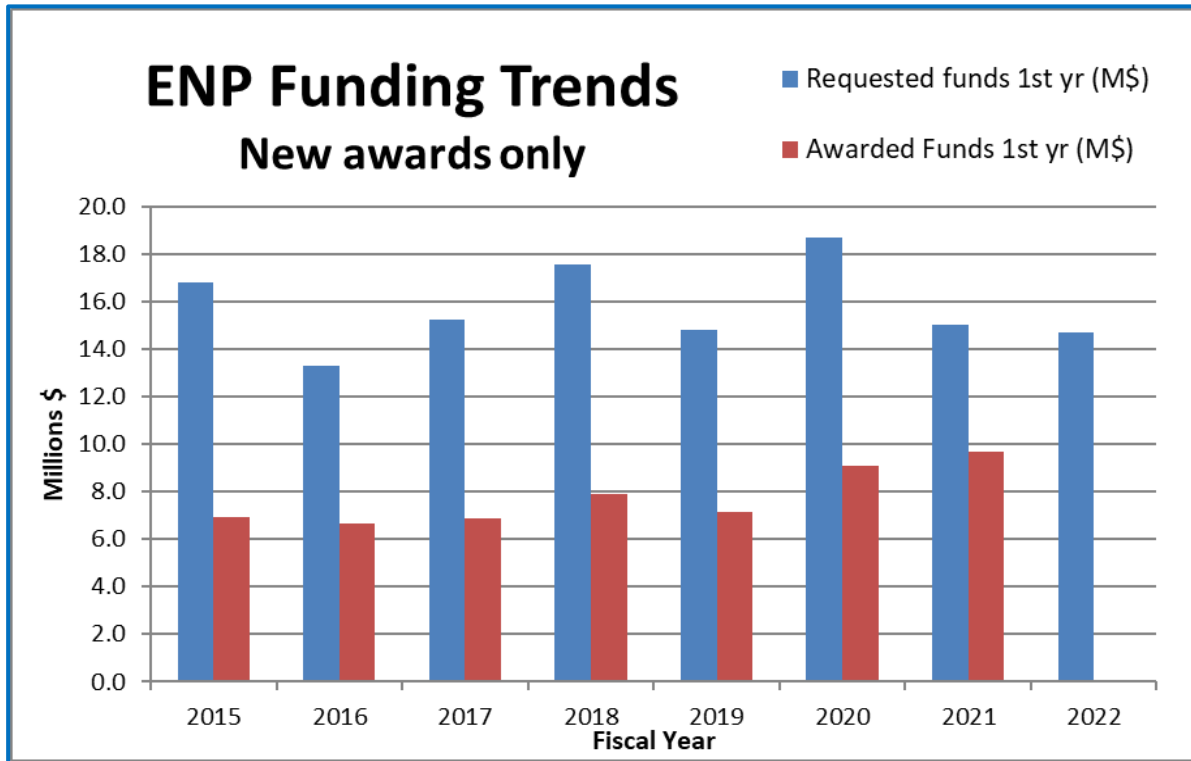


NSF responds to proposals

- No guarantee of NSF participation in a future mission-driven project
- Will not get out ahead of DOE
- Successful proposals will have clearly defined scope with high impact
- All NSF proposals have at least two merit review criteria:
 - Intellectual Merit
 - Broader Impacts

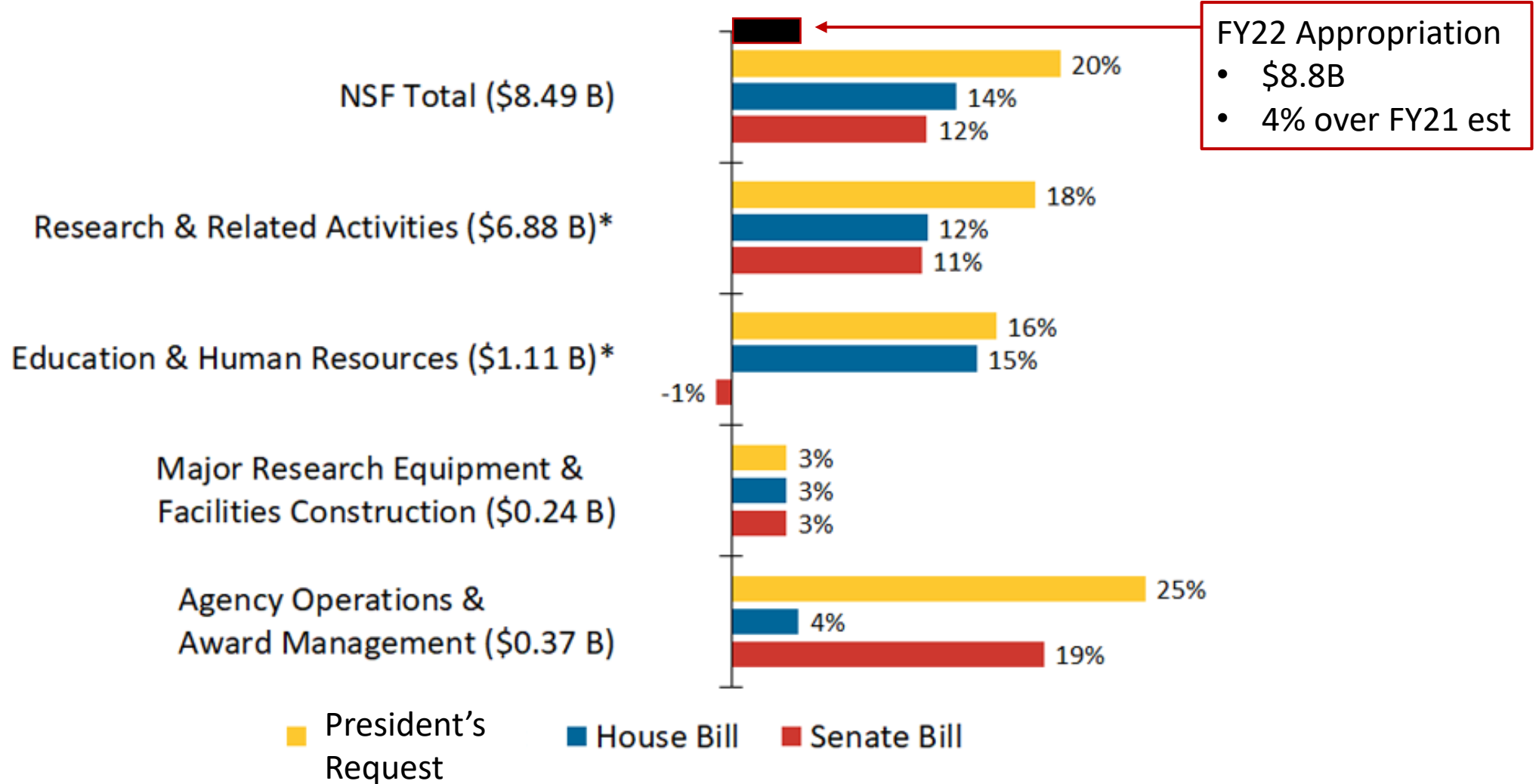


Proposal Trends in Experimental Nuclear Physics



FY22 Budget Proposals – NSF

\$ in () = FY21 estimates



* Figures account for consolidation of the Graduate Research Fellowship Program budget in the EHR directorate.

Director's vision points to opportunities we must seize:

- Strengthening Established NSF
 - NSF's central focus = accelerate discovery and enhance state of the art research capabilities
- Bringing the "Missing Millions" into the STEM Workforce
 - There is tremendous untapped STEM potential throughout the nation
- Accelerating Partnerships
 - NSF will foster partnerships with other agencies, private industry, philanthropy, like-minded countries – and thriving partnership environments

FY 2023
BUDGET REQUEST
TO CONGRESS





FY23 President's Budget Request – NSF (\$M)

What Congress appropriates

NSF by Account	FY 2021				FY 2023 Request change over:			
	FY 2021	ARP	FY 2022	FY 2023	FY 2021 Actual		FY 2022 Enacted	
	Actual	Actual	Enacted ¹	Request	Amount	Percent	Amount	Percent
BIO	\$817.74	\$9.18		\$970.23	\$152.49	18.6%	N/A	N/A
CISE	1,007.13	35.72		1,150.78	143.65	14.3%	N/A	N/A
ENG	764.43	3.00		940.28	175.85	23.0%	N/A	N/A
GEO	1,004.27	71.04		1,239.05	234.78	23.4%	N/A	N/A
MPS	1,593.31	20.33		1,746.847	153.54	9.6%	N/A	N/A
SBE	282.11	18.16		330.21	48.10	17.0%	N/A	N/A
TIP ²	369.01	19.87		879.87	510.86	138.4%	N/A	N/A
<i>TIP Programs</i>	136.73	2.00		596.81	460.08	336.5%	N/A	N/A
<i>SBIR/STTR, including Operations</i>	232.28	17.87		283.06	50.78	21.9%	N/A	N/A
OISE	51.29	1.45		74.04	22.75	44.4%	N/A	N/A
OPP	484.04	14.52		547.10	63.06	13.0%	N/A	N/A
IA ³	386.42	2.28		545.86	159.44	41.3%	N/A	N/A
U.S. Arctic Research Commission	1.60	-		1.72	0.12	7.5%	N/A	N/A
Research & Related Activities	\$6,761.35	\$195.54	\$7,159.40	\$8,425.987	\$1,664.63	24.6%	\$1,266.59	17.7%
STEM Education^{3,4}	\$1,110.85	\$23.99	\$1,006.00	\$1,377.18	\$266.33	24.0%	\$371.18	36.9%
Major Research Equipment & Facilities	\$161.27	\$8.95	\$249.00	\$187.23	\$25.96	16.1%	-\$61.77	-24.8%
Agency Operations & Award Management	\$384.52	\$12.00	\$400.00	\$473.20	\$88.68	23.1%	\$73.20	18.3%
Office of Inspector General	\$17.61	-	\$19.00	\$23.393	\$5.78	32.8%	\$4.39	23.1%
Office of the National Science Board	\$4.43	-	\$4.60	\$5.09	\$0.66	14.9%	\$0.49	10.7%
Total, NSF Discretionary Funding	\$8,440.03	\$240.48	\$8,838.00	\$10,492.08	\$2,052.05	24.3%	1654.08	18.7%
STEM Education - H-1B Visa	146.51	-	162.47	158.86	12.35	8.4%	-3.61	-2.2%
Donations	25.94	-	10.00	10.00	-15.94	-61.4%	-	-
Total, NSF Mandatory Funding	\$172.45	-	\$172.47	\$168.86	-\$3.59	-2.1%	-\$3.61	-2.1%
Total, NSF Budgetary Resources	\$8,612.48	\$240.48	\$9,010.47	\$10,660.94	\$2,048.46	23.8%	\$1,650.47	18.3%



FY23 President's Budget Request – MPS (\$M)

	FY 2021	FY 2021	FY 2022	FY 2023	Change over	
	Actual	ARP Actual	(TBD)	Request	FY 2021 Actual Amount	Percent
Astronomical Sciences (AST) ¹	\$289.27	-	-	\$294.05	\$4.78	1.7%
Chemistry (CHE)	259.60	-	-	284.14	24.54	9.5%
Materials Research (DMR)	330.07	-	-	349.92	19.85	6.0%
Mathematical Sciences (DMS)	243.66	-	-	259.47	15.81	6.5%
Physics (PHY)	304.42	-	-	316.59	12.17	4.0%
Office of Multidisciplinary Activities (OMA)	166.29	20.33	-	242.677	76.39	45.9%
Total	\$1,593.31	\$20.33	-	\$1,746.847	\$153.54	9.6%

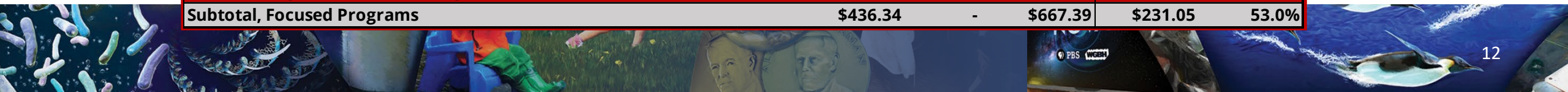


FY23 President's Budget Request = \$10,492M

Focused Programs to Broaden Participation = \$667M



	FY 2021	FY 2022	FY 2023	Delta (FY 2021 Actual)	
	(Dollars in Millions) Actual	(TBD)	Request	Amount	Percent
ADVANCE	\$18.13	-	\$20.50	\$2.37	13.1%
Alliances for Graduate Education & the Professoriate (AGEP)	8.00	-	14.00	6.00	75.0%
AGEP Graduate Research Supplements (AGEP-GRS)	8.20	-	4.64	-3.56	-43.4%
Broadening Participation in Biology Fellowships	4.70	-	10.50	5.80	123.4%
Broadening Participation in Engineering (BPE)	6.55	-	9.00	2.45	37.4%
Career-Life Balance (CLB) ¹	2.03	-	0.28	-1.75	-86.2%
Centers of Research Excellence in Science & Tech. (CREST)	24.00	-	41.00	17.00	70.8%
CISE Education and Workforce	13.65	-	12.75	-0.90	-6.6%
CISE-MSI Research Expansion Program	-	-	7.00	7.00	N/A
Coastlines and People (CoPe)	32.59	-	28.00	-4.59	-14.1%
Disability and Rehabilitation Engineering (DARE)	-	-	6.00	6.00	N/A
Excellence Awards in Science & Engineering (EASE) ²	3.63	-	7.64	4.01	110.7%
Growing Resrch Access for Nationally Transformative Equity & Diversity	-	-	50.00	50.00	N/A
Historically Black Colleges & Univ. Undergrad Program (HBCU-UP)	36.50	-	48.50	12.00	32.9%
HBCU Excellence in Research (HBCU-EiR)	21.25	-	37.93	16.68	78.5%
IUSE: Hispanic Serving Institutions (HSI) Program	46.50	-	60.50	14.00	30.1%
NSF INCLUDES	20.75	-	50.50	29.75	143.3%
Louis Stokes Alliances for Minority Participation (LSAMP)	49.51	-	70.50	20.99	42.4%
MPS Ascending Postdoctoral Research Fellowships (MPS-Acend)	9.26	-	20.00	10.74	115.9%
NSF Scholarships in STEM (S-STEM) ³	94.70	-	119.15	24.45	25.8%
Partnerships for Research & Ed. in Materials (PREM)	8.95	-	9.00	0.05	0.6%
Partnerships in Astronomy & Astrophysics Res. Ed. (PAARE)	-	-	1.50	1.50	N/A
SBE Build and Broaden	6.30	-	8.00	1.70	27.0%
SBE Postdoctoral Res. Fellowships-Broadening Participation (SPRF-BP)	3.13	-	6.00	2.87	91.5%
Science of Broadening Participation	1.50	-	1.50	-	-
Tribal Colleges & Universities Program (TCUP)	16.50	-	23.00	6.50	39.4%
Subtotal, Focused Programs	\$436.34	-	\$667.39	\$231.05	53.0%



FY23 President's Budget Request = \$10,492M

Focused BP Programs: **NSF-wide & MPS Specific** = \$528M

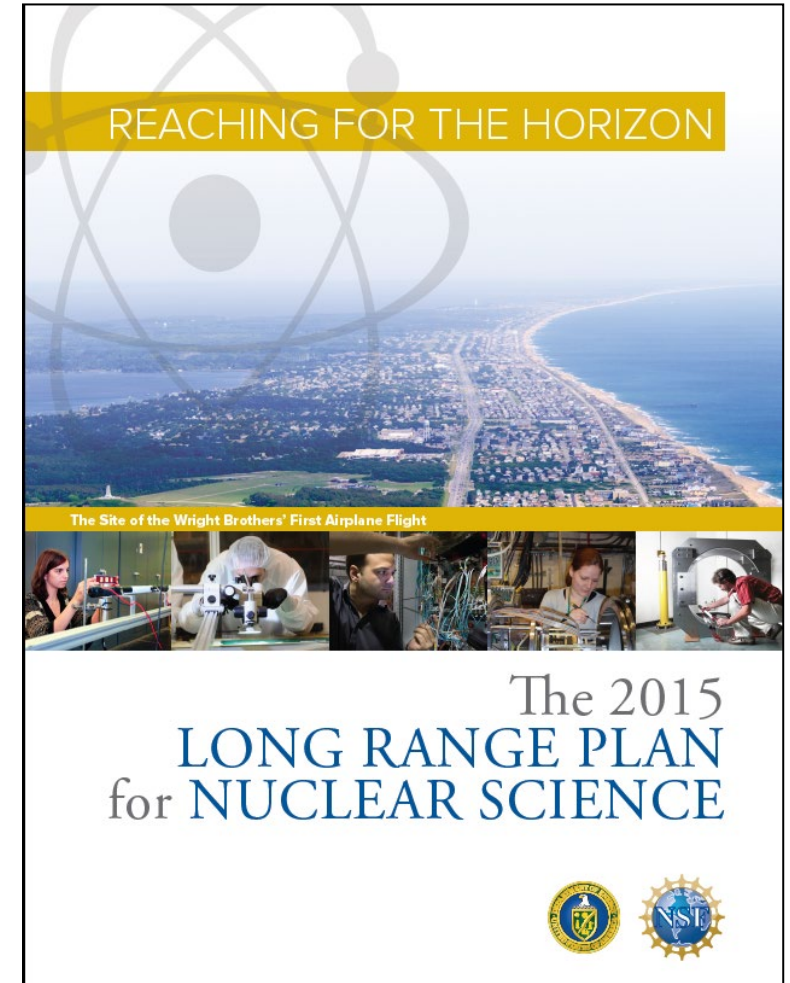


	FY 2021	2022	FY 2023	Delta (FY 2021 Actual)	
	(Dollars in Millions) Actual	(TBD)	Request	Amount	Percent
ADVANCE	\$18.13	-	\$20.50	\$2.37	13.1%
Alliances for Graduate Education & the Professoriate (AGEP)	8.00	-	14.00	6.00	75.0%
AGEP Graduate Research Supplements (AGEP-GRS)	8.20	-	4.64	-3.56	-43.4%
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★ NSF INCLUDES	20.75	-	50.50	29.75	143.3%
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Partnerships in Astronomy & Astrophysics Res. Ed. (PAARE)	-	-	1.50	1.50	N/A
★ Tribal Colleges & Universities Program (TCUP)	16.50	-	23.00	6.50	39.4%
Subtotal, Focused Programs: NSF-wide & MPS Specific	\$365.89	-	\$528.36	\$162.47	



NSF and the Long Range Plan for Nuclear Science

- NSF is proposal driven
- NSF budget for NP and other programs is not a line item in federal budget
- Areas of agency overlap, NSF considers
 - Distinctiveness
 - Leadership
- *Observation of process informs us*
- Most valuable input: science challenges, priorities, and arguments for them
- Provides critical advice for review process
- Does not necessarily lead directly to investments



Key Parallel with DOE

Major Facilities: project with TPC to NSF > \$100M

- Funded through the MREFC budget line
- Antarctic Infrastructure, DKIST, HL- LHC Upgrade, RCRV, Vera C. Rubin Observatory, NSCL
- Must be approved by the NSB
- Cooperative Agreement every 5 years
- NSB typically sees major awards that are unique and/or world leading (e.g. polar research stations, ships, ...)
- FACA advisory is important input (see also decadal surveys)





Mid-scale Research Infrastructure

- Mid-scale Research Infrastructure-1 (MsRI-1) [NSF 21-505](#)
 - Implementation = “shovel ready”; \$6M < total request < \$20M
 - Design/development = to prepare MsRI implementation proposal; \$600,000 < total request < \$20M
- Mid-scale Research Infrastructure-2 (MsRI-2) [NSF 21-537](#)
 - Total request: \$20M - \$100M
 - “Shovel ready”
- Solicitations published in alternate years; next publication in FY23
- Solicitation scope: NSF-wide



PHY Mid-scale Instrumentation

- Design and Construction *or* Acquisition of Instrumentation
 - “shovel ready”
 - R & early D, operations *funded by research programs*
- $\sim \$4\text{M} < \text{TPC} < \sim \20M ; over multiple years
- Selection based on
 - merit review
 - exceptional opportunity
 - research community priorities.
- Currently 4 ENP Midscale projects (BL3, nEDM, LEGEND-200, MOLLER)
- For more info, see PHY Solicitation & talk with PHY program directors





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; “shovel ready”
- 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**



What does NSF want/need from the LRP?

- What works:
 - Identify compelling opportunities
 - Identify major national facilities that enable high priority science
- What does not work:
 - “NSF should do X ...”
 - Prescriptive language





NSF/MPS/PHY Personnel

- Sethuraman Panchanathan – Director
- Sean L. Jones – Assistant Director for MPS
- Denise Caldwell – Physics Division Director
- Jean Cottam Alan – Deputy Division Director
- Bogdan Mihaila – Nuclear Theory Program Director
- Alfredo Galindo-Uribarri – Expt'l Nuclear Physics Program Director
- Allena Opper – Expt'l Nuclear Physics Program Director



For the latest updates:

<https://www.nsf.gov/physics>

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- Alfredo Galindo-Uribarri
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NSF National Science Foundation
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Physics (PHY)

PHY Replaces DCL with Solicitation NSF 14-576

The Physics Division has issued a solicitation (NSF 14-576) for FY2015 that replaces its prior annual Dear Colleague Letter. The solicitation follows most of the requirements in the Grant Proposal Guide, but has additional requirements that relate primarily to proposers who anticipate having multiple sources of support, and proposals involving significant instrumentation development. The solicitation also has deadlines instead of target dates. All proposals submitted to the Physics Division that are not governed by another solicitation (such as CAREER) should be submitted to this solicitation; otherwise they will be returned without review.

PHY Int'l Activities - Potential Co-Review

The Physics Division has issued a Dear Colleague Letter (NSF 14-009) to announce the guidelines for "International Activities within the Physics Division - Potential International Co-Review". The DCL outlines a possible coordinated review of projects involving international colleagues and counterpart funding organizations where a mutual review and funding process is beneficial to the advancement of Physics research. Contact with the appropriate NSF Program Officer is a necessary first step and additional time for this coordination must be allowed. Proposals requesting co-review will be competing with all other proposals in that area and must succeed on the strengths of their intellectual merit and broader impact.

Special Announcements

MPS Alliances for Graduate Education and the Professoriate - Graduate Research Supplements (AGEP-GRS) Dear Colleague Letter (NSF 13-071)

Dear Colleague Letter - Announcement of Instrumentation Fund to Provide Mid-Scale Instrumentation for FY2014 Awards in Physics Division (NSF 13-118)

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MPS Organizations

- Astronomical Sciences (AST)
- Chemistry (CHE)
- Materials Research (DMR)

NSAC July 2022

NOVA PBS WGBH

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