

# National Science Foundation – Nuclear Physics

Allena K. Opper June 2022 Outline
Nuclear Physics Info
FY22 & FY23 Budget Info
Funding Announcements and Successes
Highlights

NOV/

# **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







2021

2022



#### **ENP Funding Trends** Requested funds 1st yr (M\$) New awards only Awarded Funds 1st yr (M\$) 20.0 18.0 16.0 80 14.0 ✓ 12.0✓ 10.08.0

2020

2019

2018

**Fiscal Year** 

6.0

4.0 2.0

0.0

2015

2016

2017

**Proposal Trends in Experimental Nuclear Physics** 





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#### American Institute of Physics | aip.org/fyi

FY 2023 BUDGET REQUEST TO CONGRESS

National Science Foundation

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

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



		FY 2021			FY 2023 Request change over:			:
	FY 2021	ARP	FY 2022	FY 2023	FY 2021 Actual		FY 2022 Enacted	
NSF by Account	Actual	Actual	Enacted <sup>1</sup>	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 <sup>2</sup>	369.01	19.87		879.87	510.86	138.4%	N/A	N/A
TIP Programs	136.73	2.00		596.81	460.08	336.5%	N/A	N/A
SBIR/STTR, including Operations	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 <sup>3</sup>	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 <sup>3,4</sup>	\$1,110.85	\$23.99	\$1,006.00	\$1,377.18	\$266.33	24.0%	\$371.18	36.9%
<b>Major Research Equipment &amp; Facilities</b>	\$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				Change over	
	FY 2021	ARP	FY 2022	FY 2023	FY 2021 Actual	
	Actual	Actual	(TBD)	Request	Amount	Percent
Astronomical Sciences (AST) <sup>1</sup>	\$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 Multidiscplinary 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%



# Faculty Career Development Program (CAREER)



- CAREER Awards in support of early-career faculty who have the potential to serve as academic role models in research and education, and to lead advances in the mission of their department or organization.
  - Integration of Research and Education CAREER proposals should describe an integrated path that will lead to a career as a researcher and educator
- PECASE Presidential Early Career Awards for Scientists and Engineers from among the most meritorious recent CAREER awardees
- Eligibility must be untenured assistant professor in position that is at least 50% tenure-track

II ab Users' Meeting

Five year award

New Solicitation!

June 2022



# Faculty Career Development Program (CAREER)

NSF.

NSF 22-586

- Deadline: Fourth Wednesday in July  $\Rightarrow$  July 27, 2022
- Required department chair may not be a letter of support; should
  - Affirm Pl's pre-tenure status
  - Indicate that the proposed research and education objectives of the proposal are supported by and advance department's goals
  - Describe how proposed goals are related to mission of department and how dept will provide appropriate mentoring
- PECASE text: additional requirement for the PI to reflect commitment to STEM DEI & accessibility
- Single copy document: states PI's eligibility for PECASE (optional)
- Submission through Research.gov or Grants.gov (not FastLane <sup>2</sup>)

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### PHY DCL: Growing a Strong, Diverse Workforce NSF 21-065

PHY-GR Supplements – emphasis on URMs in STEM fields

- Graduate Student Eligibility
  - Not currently supported by federal government (NSF, DOE, NIH, ...)
  - o US Citizen, US National, or US Permanent Resident
- Stipend, tuition, benefits, and IDC (~\$60k)
- Renewable up to two times, <u>no deadline for submission however, early</u> <u>submission suggested</u>

#### REU Supplements – emphasis on URMs in STEM fields

• US Citizen, US National, or US Permanent Resident



## MPS – ASCEND



ASCEND - Postdoctoral Research Fellowships NSF 22-501

- Goal: to support Postdoctoral Fellows who will broaden the participation of groups who are underrepresented in Mathematical and Physical Sciences (MPS) fields in the U.S.
- Prepare PD Fellows to transition from a postdoctoral position into the first few years of an academic faculty position
- Fellowships are awards to individuals, not institutions, and are administered by the Fellows
- \$100k/year for up to 3 years



### MPS – ASCEND

ASCEND - Postdoctoral Research Fellowships FY21: 33 MPS ASCEND Fellows (7 in PHY)

FY22: 31 MPS ASCEND Fellows (6 in PHY) Including Brandon Sumner:

Determine properties of excited cascade states, search for new states using data from GlueX at JLab, & develop in-person K – 12 outreach

Arizona State University with Michael Dugger





### MPS – LEAPS



LEAPS: Launching Early-Career Academic Pathways in MPS NSF 22-503

- Designed to launch research careers of pre-tenure faculty in MPS fields, emphasis on *minority-serving institutions (MSIs)*, predominantly undergraduate institutions (PUIs), and Carnegie Research 2 (R2) universities while promoting the participation of the entire MPS scientific community
- Awards = 24 months, up to \$250k



#### MPS – LEAPS

LEAPS: Launching Early-Career Academic Pathways in MPS NSF 22-503

FY21: 45 LEAPS-MPS Ascend Awardees (4 in PHY)

FY22: 54 LEAPS-MPS Awardees (5 in PHY)

Including Jason Fry Eastern KY Univ: Precise measurements of neutron beta decay parameters (Nab) and the free neutron lifetime (BL3) & mentoring 1<sup>st</sup> gen college students

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#### **Cosmic-ray Antinuclei as Messengers of New Physics**





**PI: von Doetinchem U** of Hawaii



- Search for cosmic antinuclei
- Improve (anti)nuclei formation models
- Use cosmic antinuclei as messengers for new physics

 $\frac{d^2n}{dydp_T}$  (c 10 - x 10<sup>-2</sup> y = 0.5 10-6 - x 10<sup>-3</sup> y = 0.7  $10^{-7}$  $- x 10^{-4} y = 0.9$  $10^{-8}$ — x 10⁻⁵ y = 1.1 10<sup>-9</sup> •  $- x 10^{-6} y = 1.3$  $10^{-10}$ — x 10<sup>-7</sup> y = 1.5 10<sup>-1</sup>  $10^{-12}$ y = 1.7  $-x 10^{-9}$  y = 1.9  $10^{-13}$ 0.5 1.5 2 p<sub>T</sub> (GeV/c)

High-precision antiproton spectrum

from 2010 p-liquid hydrogen target data

Published 🔶 High stat.

- x 10<sup>-1</sup>

 $-x 10^0$  y = 0.1

y = 0.3

2.5

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(GeV/c)<sup>-1</sup>

10

 $10^{-2}$ 

#### **Classical Novae and Nuclear Thermometers**



### Compact WD accretes matter from companion $\rightarrow$ nova $\rightarrow$ new nuclei ejected



 ${}^{30}P(p,\gamma){}^{31}S = bottleneck for A> 30$ dominated by p-capture on g.s. but many low-lying resonances  $\rightarrow$ significant uncertainty

To the rescue:  $^{31}\mbox{Cl}\ \beta\mbox{-delayed}\ p\mbox{-decay}\ thru\ ^{31}\mbox{S}\ resonance$ 



GADGET: designed to measure p-branching ratio of  ${}^{30}P(p,\gamma){}^{31}S$  260 keV res using  ${}^{31}Cl \beta$ -delayed p-decay



New <sup>30</sup>P(p, $\gamma$ )<sup>31</sup>S rate + 1D hydrodynamic nova model  $\rightarrow$ 

- factor of 2 4 improvement in accuracy of 4 nova thermometers
- <sup>30</sup>Si:<sup>28</sup>Si from WD novae greater than solar ratio.



T. Budner, et al., PRL 128, 182701 (2022)



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# **DEI Activities Within Research Awards**

- Ben Crider @ Mississippi State University
  - Determine properties of exotic, neutron-rich nuclear systems predicted to exhibit multiple shapes
  - o Training and mentoring a diverse group of undergrad and grad students → prepared for STEM careers
  - Physics summer school experience for students with Autism Spectrum Disorder in Mississippi → new generation of highly capable scholars





https://arxiv.org/abs/ 2204.13530

#### Comparison of b- & Inclusive-jet Suppression first observation of a difference between b- & inclusive-jet R<sub>AA</sub> values

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 $\begin{array}{l} R_{AA}: \mbox{ nuclear modification factor, quantifies jet} \\ \mbox{ quenching due to interactions with the QGP} \\ \mbox{ larger } R_{AA} \rightarrow \mbox{ less quenching} \end{array}$ 

~20% higher R<sub>AA</sub> for b-jets than inclusive jets



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# For the latest updates: https://www.nsf.gov/physics

#### Contact us at:

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FUNDING AWARDS DIS	COVERIES NEWS	PUBLICATIONS	STATISTICS	ABOUT NSF	FASTLANE				
National So Directorate for Ma	cience Foun thematical & Physica	dation al Sciences (MPS)	1	SEARCH					
MPS HOME MPS FU	NDING MPSAWA	RDS MPSDISC	OVERIES M	PSNEWS ABO	UT MPS				
Physics (PHY)	Physics (P	HY)		Email 🛃 Print 📕	Share 🛖				
Hy Home	PHY Replaces DCL	. with Solicitation N	SF 14-576						
wards wards warts	The Physics Division has issued a solicitation ( <u>NSF 14-576</u> ) 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.								
iscoveries ublications	PHY Int'l Activitie	s - Potential Co-Re	view						
areer Opportunities acilities and Centers HY Program Director Jobs ee Additional PHY Resources iew PHY Staff	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.								
earch PHY Staff	Special Announce	ments							
PS Organizations stronomical Sciences (AST) hemistry (CHE) aterials Research (DMR)	MPS Alliances fo Research Supple Dear Colleaque Le Instrumentation fo	r Graduate Educa ments (AGEP-GR tter - Announceme r FY2014 Awards ir	ation and the I (S) Dear Collect Int of Instrument Physics Division	Professoriate - G aque Letter (NSF tation Fund to Prov n (NSF 13-118)	iraduate 13-071) ide Mid-Scale				
	NOV				Jan Sala				

