



National Science Foundation Nuclear Physics Overview

Allena K. Opper

- Personnel
- Announcements
- Budget – focus on PHY
- Highlights



NSF/MPS/Physics Personnel

- **France Córdova** – Director
- **Anne L Kinney** – Assistant Director for MPS
- **Denise Caldwell** – Physics Division Director
- ★ **Saúl González** – Acting 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

<http://www.nsf.gov/pubs/2015/phy15001/phy15001.jsp?org=PHY>

<http://www.nsf.gov/careers/rotator/index.jsp>



Solicitation for NSF Physics Division Investigator-Initiated Research Projects 18-564

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

- **Deadlines:**
 - **December 3, 2019** for Particle Astrophysics, Elementary Particle Physics, *Experimental & Theoretical Nuclear Physics*
- Has text on Midscale Instrumentation & Long Duration Efforts
- Follow Proposal & Award Policies & Procedures Guide (PAPPG)
https://www.nsf.gov/pubs/policydocs/pappg17_1/index.jsp
 - Follow the Proposal Preparation checklist
- Collaborators and Other Affiliations Template
- Follow instructions that are specific to this solicitation



Major Research Instrumentation (MRI) NSF 18-513

- Two tracks:
 - Track 1 \$100 k < \$ from NSF < \$1 M; max of 2/university
 - Track 2 \$1 M < \$ from NSF < \$4M; max of 1/university
- Two types: development and acquisition
- Contact program directors well ahead of submission to discuss (avoid pitfalls)
- Maximum award is \$4M; awards above \$1M compete across the entire Foundation
- Submission window **January 1 – 21, 2020**

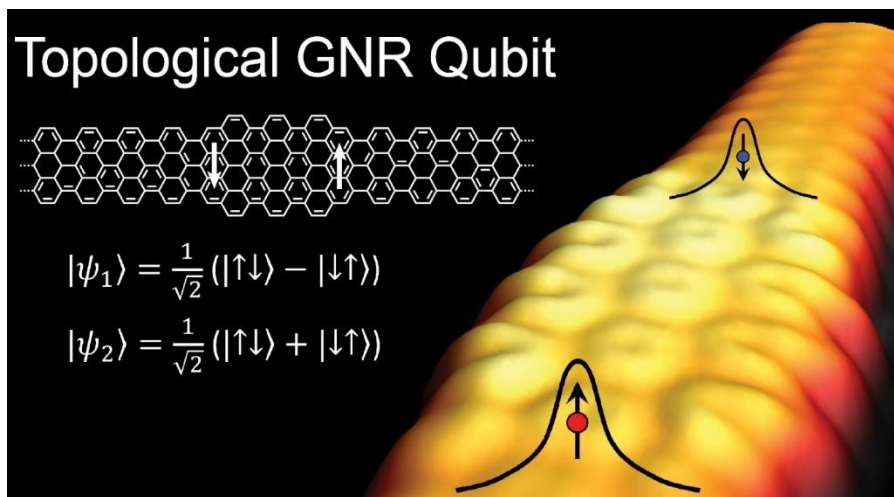
FY19

- *Physics: ~ 25% of the PHY proposals were in ENP*
 - *Grzywacz, U of TN: Development of a high resolution neutron detector for decay and reaction studies with exotic nuclei; ~ \$910k*
 - *Wissink, IU: Development of a forward calorimetry upgrade for STAR; ~ \$2,150k*
 - *Voytas, Wittenberg U: Development of a high sensitivity instrument to search for CP violation in positronium decay; ~ \$292k*
 - *Leshner, U of WI – LC: Acquisition of Si(Li) detectors and two BGO Compton suppression shields for the development of the La Crosse FIREBALL; ~ \$397k*

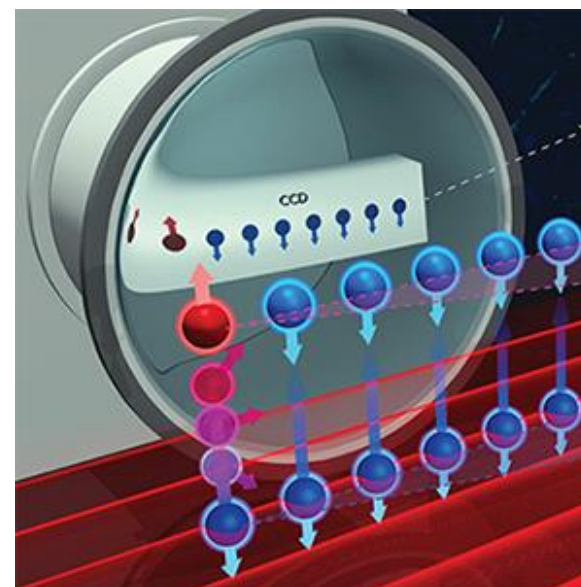
Permanent Position in PHY

Program Director with expertise in QIS

- <https://www.usajobs.gov/GetJob/ViewDetails/548130300>



Ref: University of California -- Berkeley



Ref: University of Maryland

Artificial Intelligence Research Institutes

Solicitation: NSF 20-503



The AI Research Institutes program will support the advancement of multidisciplinary, multi-stakeholder research on larger-scale, longer-time-horizon challenges in AI research than are supported in typical research grants

- Joint effort of the NSF, USDA, NIFA, DHS-S&T, DOT, FHWA, & VA to enable AI research
- Two tracks:
 - Institutes in 6 themes (including **AI for Discovery in Physics**); due date **28-jan-2020**
 - Planning; due date 30-jan-2020



Mid-scale Research Infrastructure (Mid-scale RI)

- Track 1 (Mid-scale RI-1): **\$6-\$20 million implementation or design**, funded from **R&RA** account.

- Solicitation NSF 19-537
- \$60M in FY 2019 projected
- \$30M in FY 2020 Request
- FY19 awards total \$121M



- Track 2 (Mid-scale RI-2): **\$20-\$70 million implementation only**, funded from **MREFC** account.
 - Solicitation NSF 19-542.
 - \$60M in FY 2020 Request; \$75M in Senate mark

PHY Midscale Instrumentation

Proposals should be submitted to the PHY
Solicitation 18-564

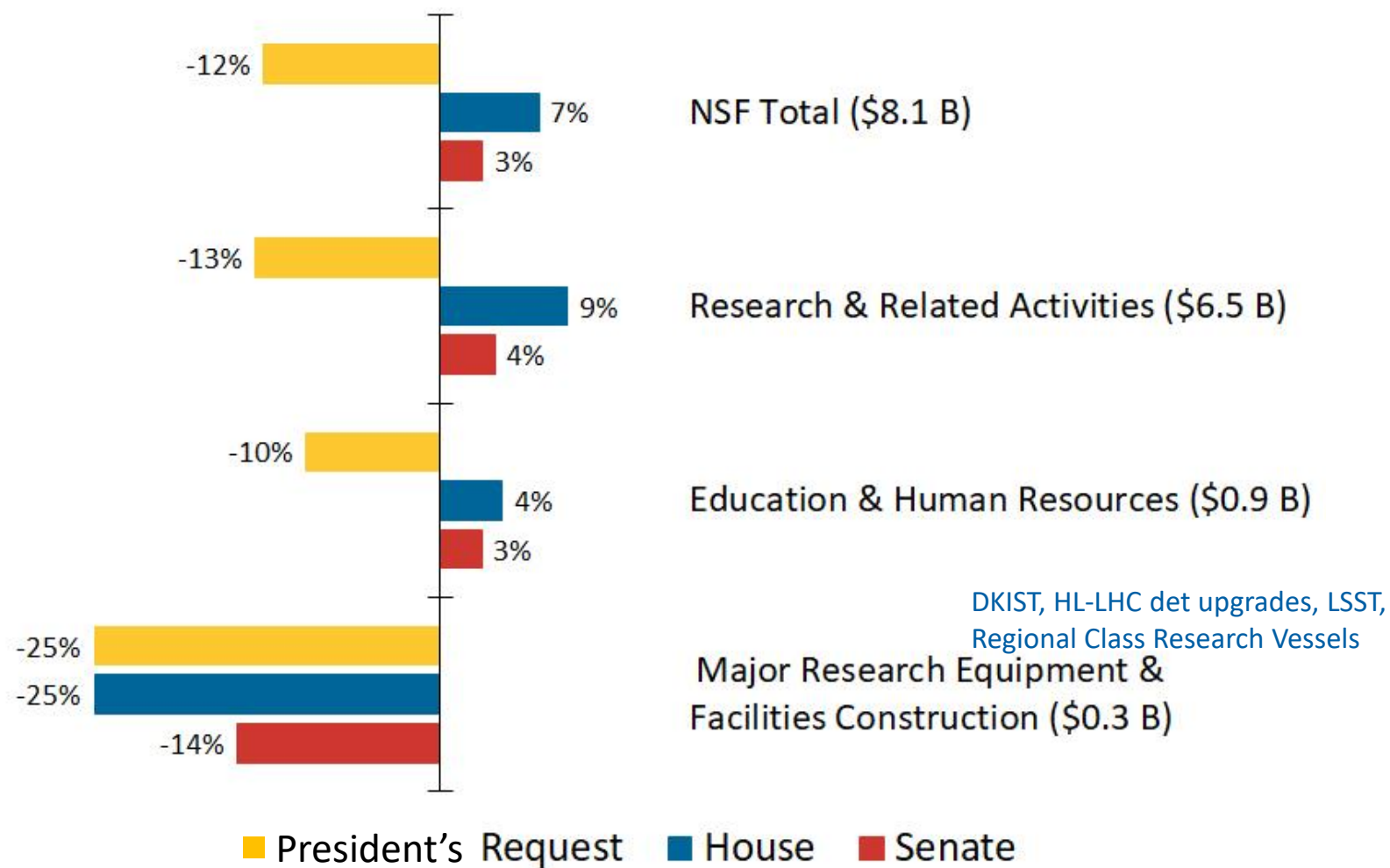


- Design and Construction *or* Acquisition of Instrumentation
 - R & early D, operations *funded by research programs*
- ~ \$4M < TPC < ~ \$15M; over multiple years
- Selection based on
 - merit review
 - exceptional opportunity
 - research community priorities.
- Currently 6 Midscale projects
(3 Nuclear Physics: MUSE, nEDM, LEGEND-200)
- For more info, see PHY Solicitation



NSF FY20 Budget Proposals

\$ in () = FY19 enacted



FY20 PHY \$247.50M

President's Request



(Dollars in Millions)

	FY 2018 Actual	FY 2019 (TBD)	FY 2020 Request	Change over FY 2018 Actual	
				Amount	Percent
Total	\$310.75	-	\$247.50	-\$63.25	-20.4%
Research	182.35	-	145.63	-36.72	-20.1%
CAREER	10.14	-	6.78	-3.36	-33.1%
Centers Funding (total)	4.81	-	5.00	0.19	4.0%
STC: Center for Bright Beams	4.81	-	5.00	0.19	4.0%
Education	4.50	-	4.70	0.20	4.4%
Infrastructure	123.90	-	97.17	-26.73	-21.6%
IceCube	3.50	-	3.50	-	-
LHC	15.86	-	20.00	4.14	26.1%
LIGO	39.43	-	44.60	5.17	13.1%
Midscale Research Infrastructure	14.42	-	6.67	-7.75	-53.7%
NSCL	24.00	-	22.00	-2.00	-8.3%
Research Resources	0.09	-	-	-0.09	-100.0%
Facilities Design Stage Activities (total)	26.60	-	0.40	-26.20	-98.5%
High Luminosity-LHC ¹	16.60	-	-	-16.60	-100.0%
Advanced LIGO Plus (LIGO A+)	10.00	-	0.40	-9.60	-96.0%

¹ FY 2018 Actual reflects \$7.50 million of funding for FY 2019 and FY 2020 development and design. No additional funds are expected in these years.

Budget Trends – NSF Nuclear Physics



Includes co-funding and other leveraged funds

~ 25% = Research

~ 75% = Operations



FY	Nucleon & Hadron QCD (k\$)	Nuclear Astroph, Reactions, Structure (k\$)	Prec Meas'ts & Fund. Symm. (k\$)	Total Exp't Nuclear Physics (k\$)	Nuclear Theory (k\$)	Nuclear Program Total (k\$)	NSCL (k\$)	JINA & JINA -CEE (k\$)	MRI (k\$)	Mid-Scale (k\$)	Total Nuclear Physics (k\$)
2013	6,183	4,693	5,653	16,509 base = 16,277	3,474	20,008	21,500	2,150	2,996	490	47,144
2014	5,826	5,189	5,999	17,014 17,014	3,514	20,528	22,500	2,280	1,038	1,188	47,533
2015	6,769	4,702	7,304	18,774 18,267	4,183	22,957	23,000	2,280	1,801	1,367	51,406
2016	7,141	5,046	7,391	19,579 17,761	4,223	23,802	24,000	2,280	1,869	3,238	55,189
2017	6,955	6,273	6,692	19,920 17,801	4,344	24,264	24,000	2,280	530	2,990	54,064
2018	7,160	5,048	7,589	19,787 17,761	4,384	24,291	24,000	2,280	3,970	5,249	59,791
2019	6,325	7,322	6,884	20,531	3,921	24,452	24,000	2,280	3,549	5,806	60,086

MRI: competes each year; one-time acquisition/development funds

Mid-scale: ad hoc competition; design and construction funds (L-200, MUSE, nEDM)



PD 18-5115 July 31, 2018

Program Description: Windows on the Universe: The Era of Multi-Messenger Astrophysics



- Proposals submitted to participating programs in MPS/AST, MPS/PHY and GEO/OPP.
- Proposals funded through “Big Idea” allocation as well as existing programs.
- Criteria: any area of research supported through the participating divisions that address at least one of the following:
 - *Coordination:* Hardware, software, or other infrastructure to coordinate observations involving more than one messenger.
 - *Observations:* Observations of astrophysical objects or phenomena that are potentially sources of more than one messenger, including the use of existing observatories, experiments, and data archives, as well as the development and construction of new capabilities for advancing multi-messenger astrophysics.
 - *Interpretation:* Theory, simulations and other activities to understand or interpret observations of astrophysical objects that are sources of more than one messenger.

https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505593

MRI: Helium-Jet Ion-Guide System (HJ-IGS) for multi-user operation at NSCL

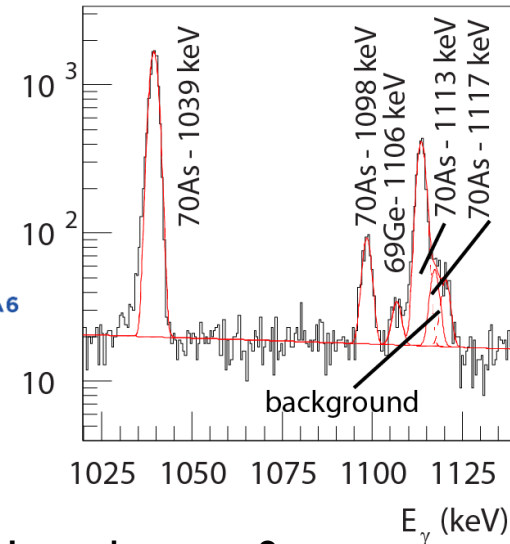
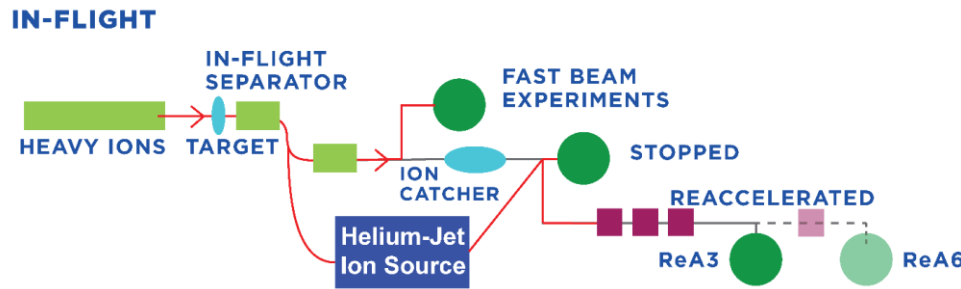
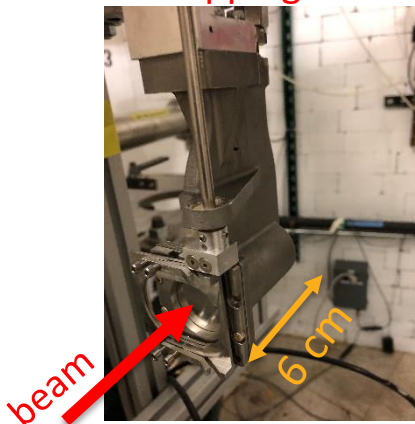
Rare isotopes caught in stopping cell

- 7 atm He-aerosol mixture
- Off-axis and along A1900
- Some selection of isotopes

Isotopes transported to HJ-IGS

- Decay experiments
- Ionization & transport to other experimental stations

Stopping cell



2019: Demonstrated by delivery of ^{70}As from A1900 \rightarrow HJ enclosure & measurement of its decay; transmission efficiency = $4 \pm 1\%$

Goal: select & collect short-lived isotopes for simultaneous experiments
Complementary to isotope harvesting from beam dump

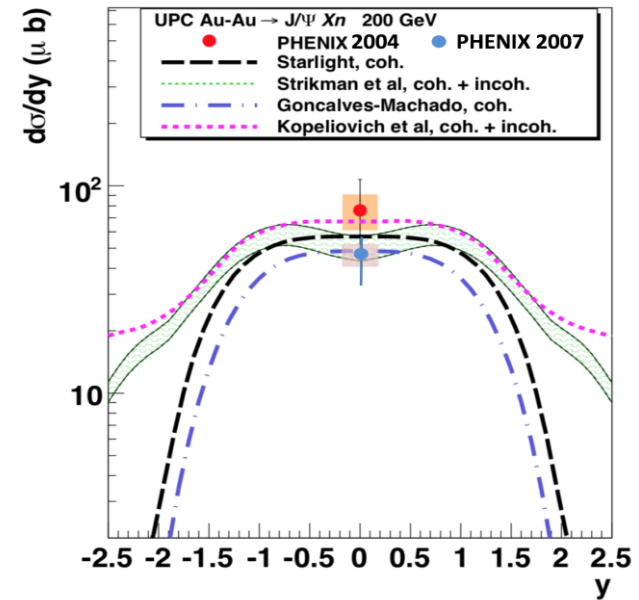
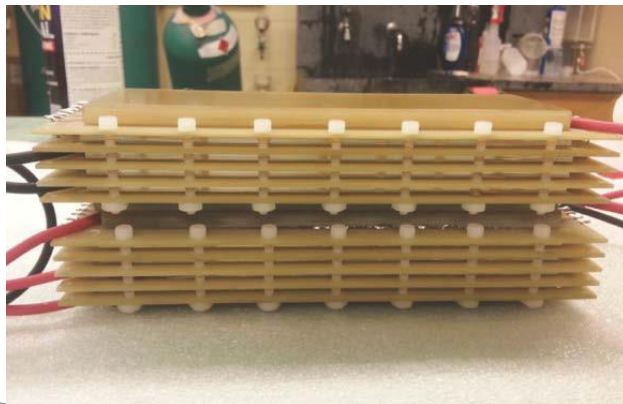


HBCU Collision Collaboration



With Mickey Chiu at BNL

- Analysis of UPC data on photo-production of J/Ψ from PHENIX
→ x 3 reduction in stat errors

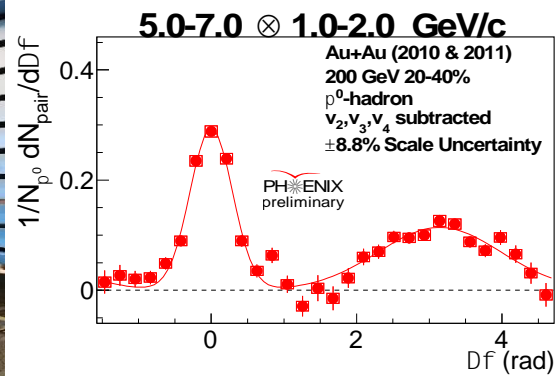
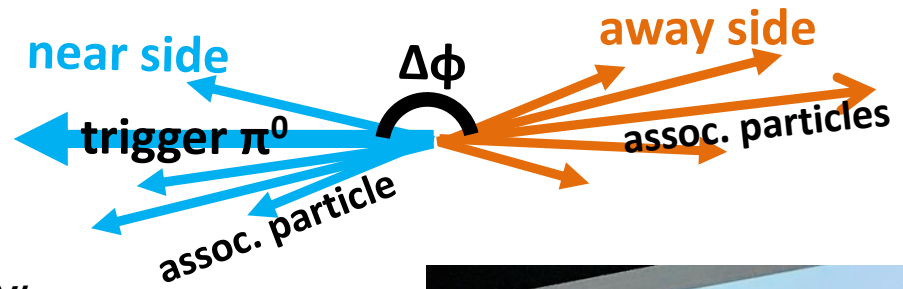


- Develop cosmic test stand
→ R&D for future colliders (test RPCs & fast TOF systems)

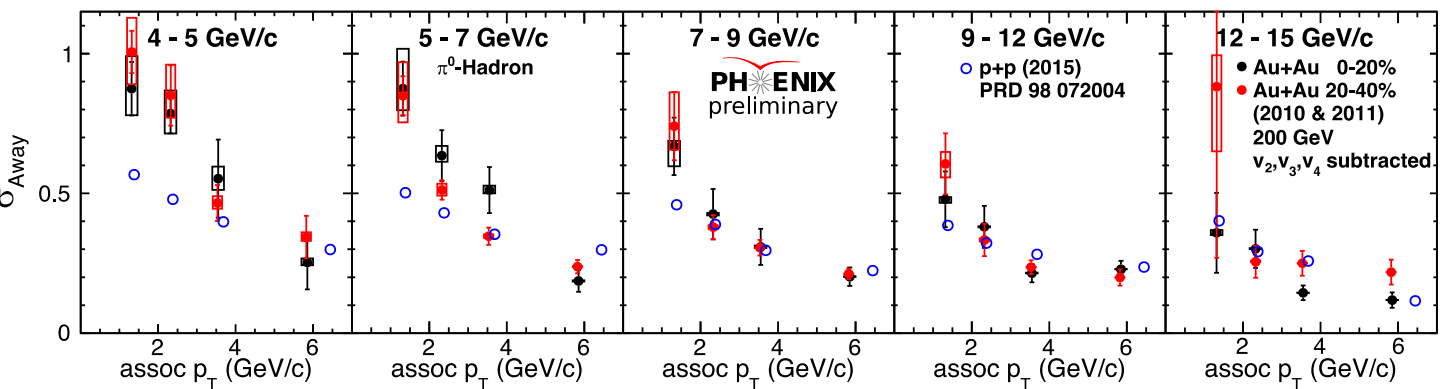
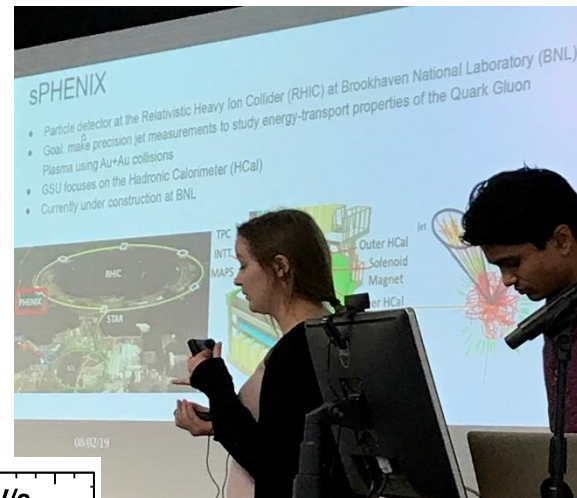
CAREER: Jet Measurements and a Novel Hadronic Calorimeter at RHIC

Megan Connors

Quantifying jet modification in the QGP via π^0 -h correlations with PHENIX data



Jet broadening in Au+Au collisions

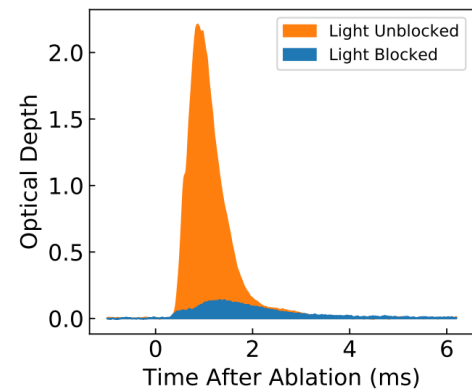
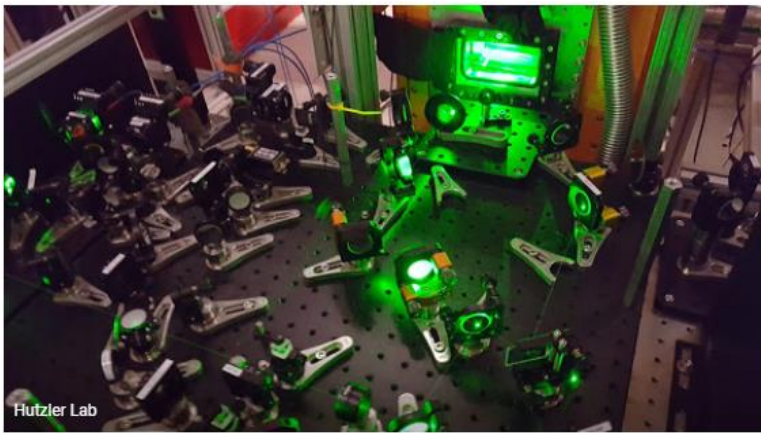
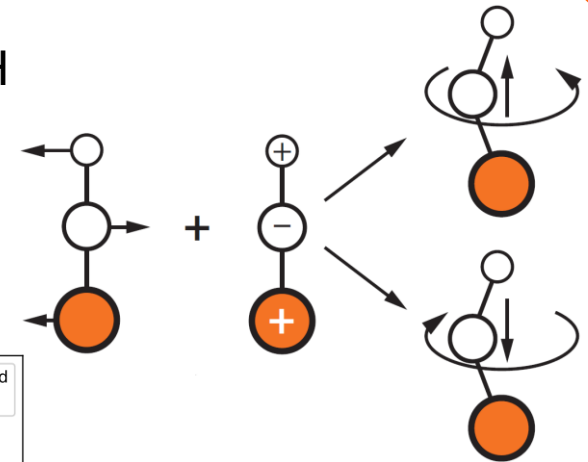


Undergraduates presenting summer experience with sPHENIX HCal tile testing

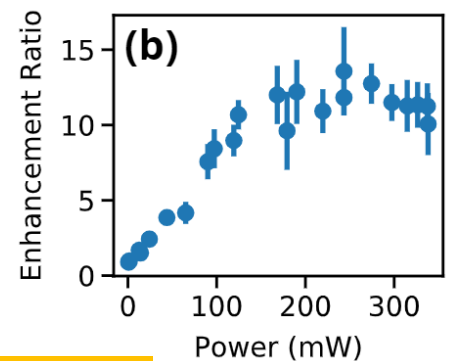
CAREER: Search for CP-Violating Hadronic Physics BSM with Polyatomic Molecules

Nick Hutzler

- Goal: search for Nuclear MQM in cryo beam of $^{173}\text{YbOH}$
 - Nuclear MQMs probe hadronic CP-violation
 - Effects amplified by large E fields in polar molecules
 - Yb has quadrupole deformation \rightarrow enhanced MQM



- Order of mag increase in molecule production via cold chemistry
 - Optically excite Yb to metastable 3P_1 state
 - Reactive state to overcome chem barriers



Co-funded by NSF AMO and ENP Programs



For the latest updates, check out
<https://www.nsf.gov/div/index.jsp?div=PHY>

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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 (NSF 13-118)

NSAC: NSF NP Overview OCT 2019

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Backup Slides

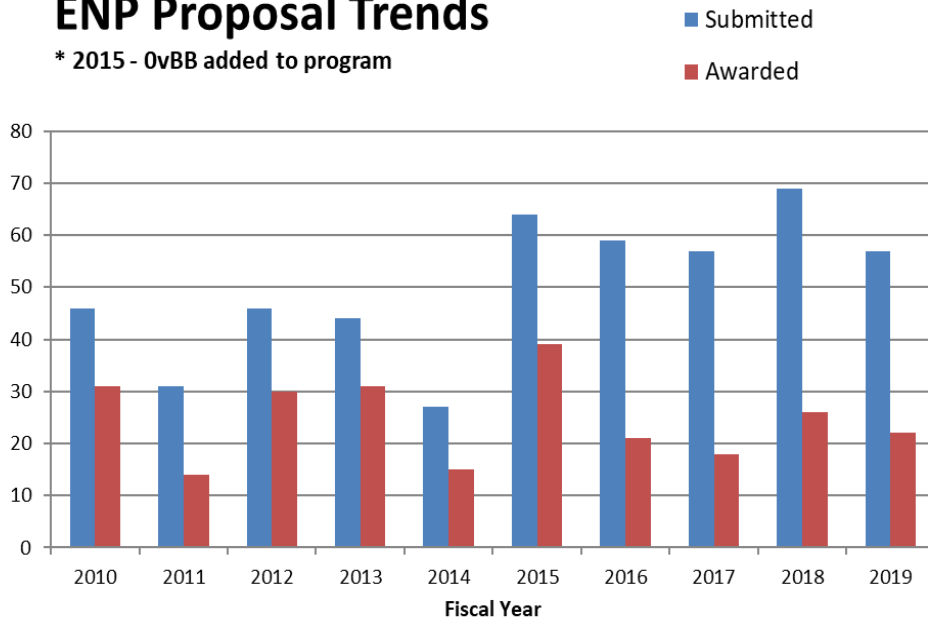


Experimental Nuclear Physics



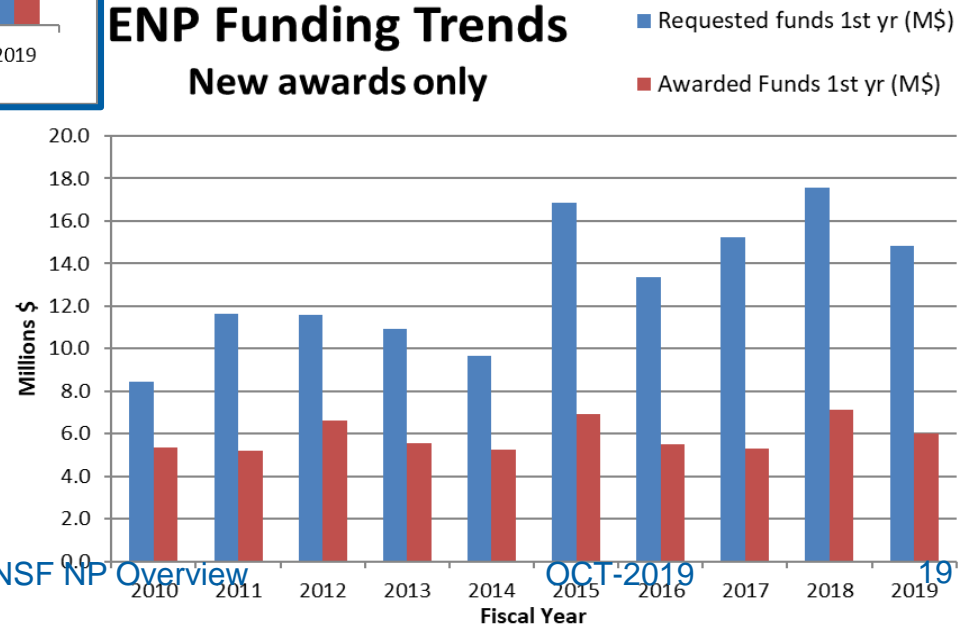
ENP Proposal Trends

* 2015 - 0vBB added to program



ENP Funding Trends

New awards only





FY20 Funding for NSF Big Ideas

President's Request

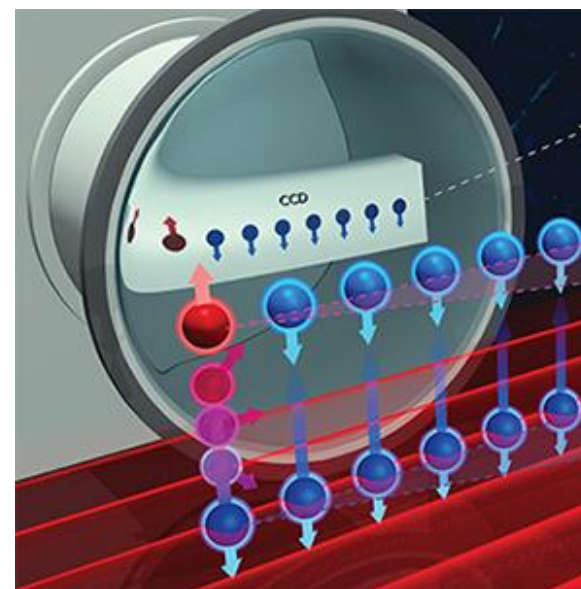
(Dollars in Millions)

	FY 2019 Request
Big Ideas	
Research Ideas	\$180.00
Harnessing the Data Revolution for 21st- Century Science and Engineering - HDR (CISE/ITR) ¹	30.00
Navigating the New Arctic - NNA (GEO/ICER)	30.00
The Future of Work at the Human-Technology Frontier - FW-HTF (ENG/EFMA) ¹	30.00
The Quantum Leap - QL (MPS/OMA)	30.00
Understanding the Rules of Life - URoL (BIO/EF)	30.00
Windows on the Universe - WoU (MPS/OMA)	30.00
Process Ideas	\$102.50
Growing Convergence Research - GCR (IA)	16.00
Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science - NSF INCLUDES (EHR)	20.00
Mid-Scale Research Infrastructure (IA)	60.00
NSF 2026 Fund (IA)	6.50
Total, NSF Big Ideas	\$282.50

Quantum Leap

Exploiting quantum mechanics to observe, manipulate, and control the behavior of particles and energy at atomic and subatomic scales, resulting in next-generation technologies for sensing, computing, modeling, and communicating.

- NSF 18-578 QAMASEI: Foundries for Q. Materials Science, Engineering, and Info. \$20M - \$25M
- NSF 19-507 QCIS Faculty Fellows; FY'19 and FY'20; \$6.7M
- NSF 19-532 QII-TAQS Transformational Advances in Quantum Systems; \$26M in FY'19
- NSF 19-559 QLCI Quantum Leap Challenge Institutes; \$5M/year for each of several centers



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