



Report from NSF

Allena K. Opper

- Budget
- Funding Opportunities
- Final Notes

RHIC & AGS

Annual Users' Meeting

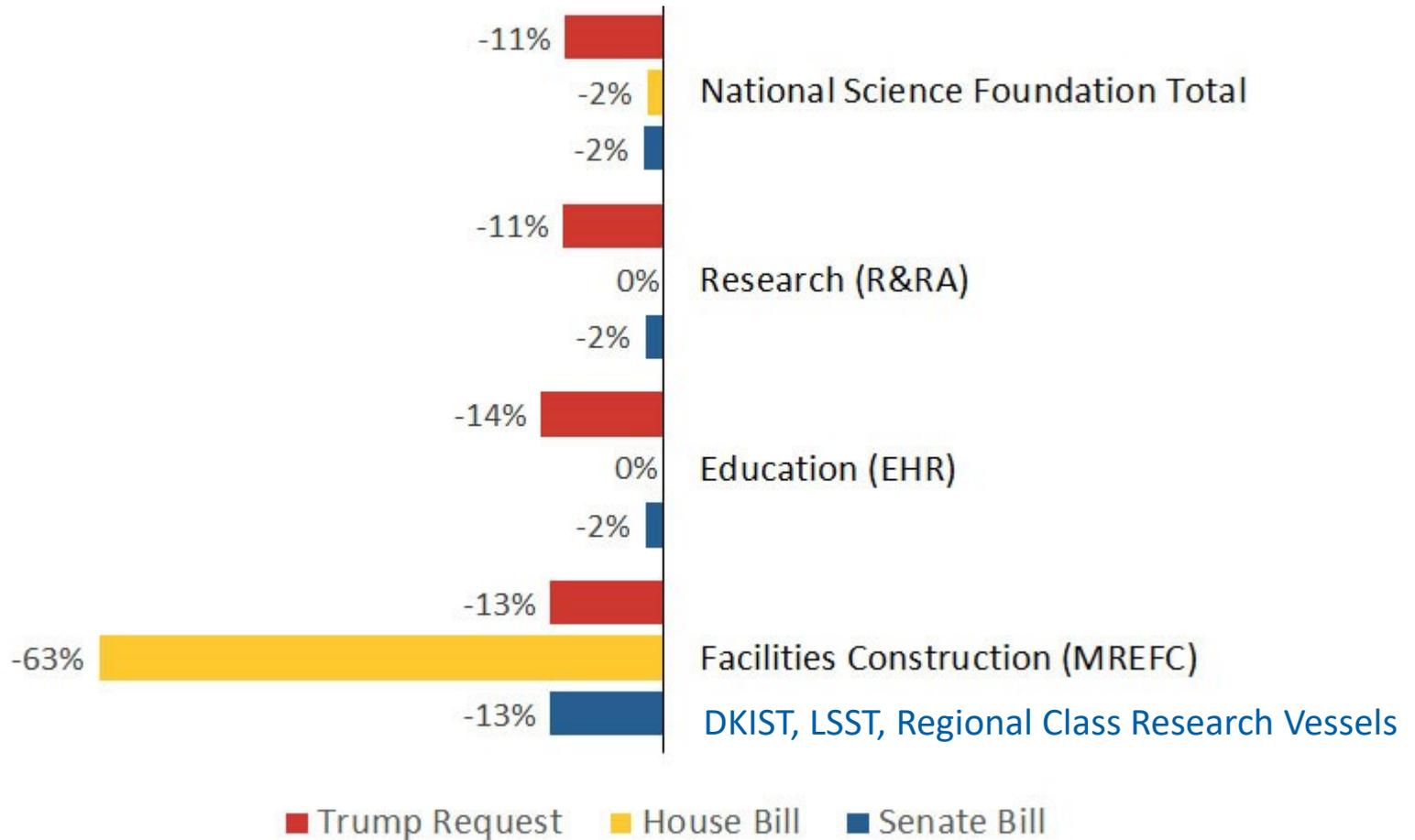
Hosted By Brookhaven National Laboratory



NSF FY18 Budget Proposals (% change from FY17 enacted)

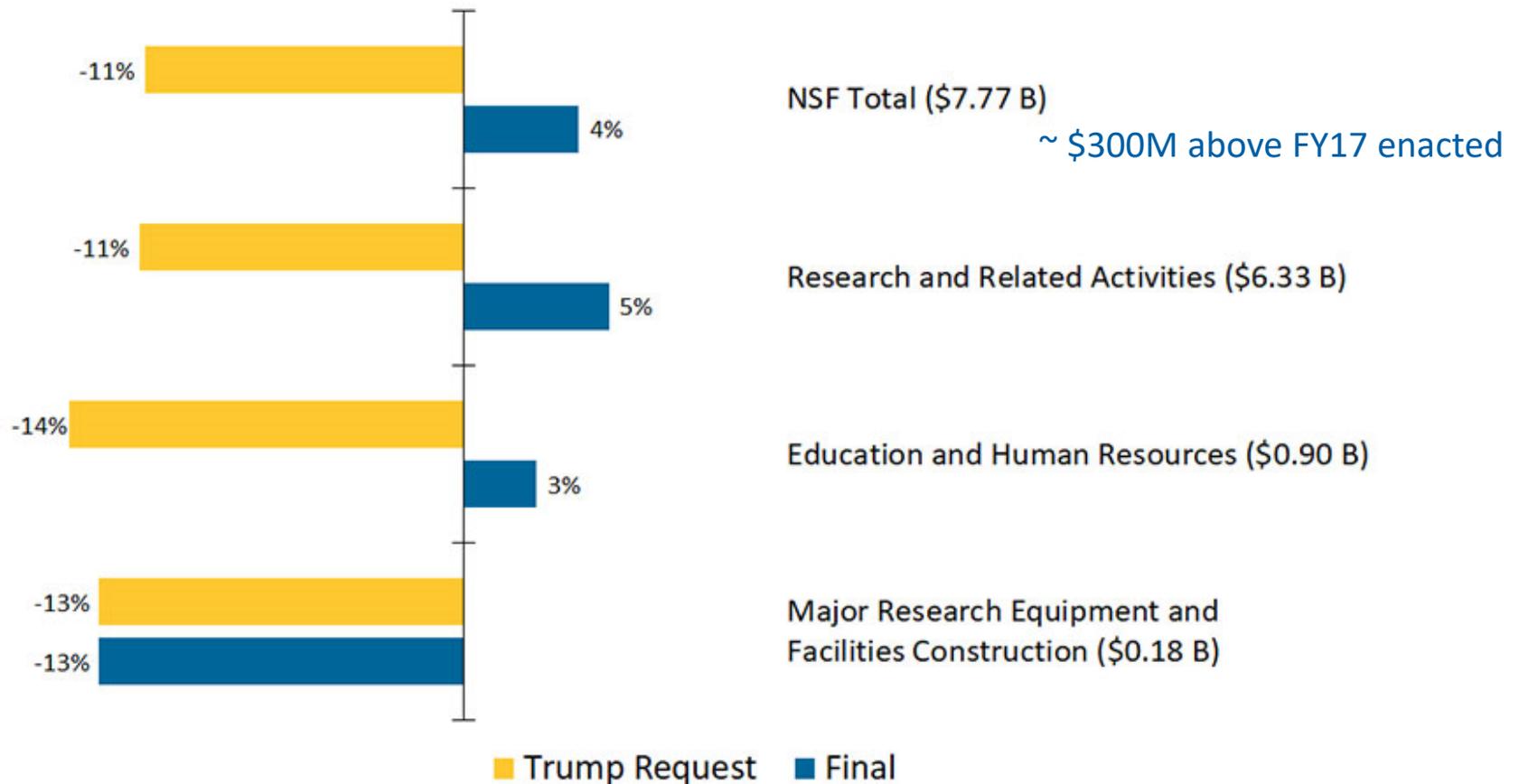


August 2017



Final FY18 Funding: National Science Foundation

% change from FY17 enacted
\$ in () are the FY18 amounts





FY19 NSF Request \$7,472 M

**NATIONAL SCIENCE FOUNDATION
SUMMARY TABLE
FY 2019 BUDGET REQUEST TO CONGRESS**
(Dollars in Millions)

NSF by Account	FY 2017 Actual	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request change over FY 2017 Actual	
				Amount	Percent
Research & Related Activities	\$6,006.51	\$5,992.67	\$6,150.68	\$144.17	2.4%
Education & Human Resources	\$873.37	\$874.02	\$873.37	-	-
Major Research Equipment & Facilities Construction	\$222.78	\$207.58	\$94.65	-\$128.13	-57.5%
Agency Operations & Award Management	\$382.06	\$327.76	\$333.63	-\$48.43	-12.7%
National Science Board	\$4.27	\$4.34	\$4.32	\$0.05	1.2%
Office of Inspector General	\$15.10	\$15.10	\$15.35	\$0.25	1.6%
Total, NSF	\$7,504.10	\$7,421.47	\$7,472.00	-\$32.10	-0.4%

FY19 Funding for NSF Big Ideas



(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

FY19 PHY \$266.73M



(Dollars in Millions)

	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request	Change Over EY 2017 Actual	
				Amount	Percent
Total	\$281.43	-	\$266.73	-\$14.70	-5.2%
Research	178.57	-	159.01	-19.56	-11.0%
CAREER	10.04	-	7.30	-2.74	-27.3%
Centers Funding (total)	4.60	-	5.00	0.40	8.7%
STC: Center for Bright Beams	4.60	-	5.00	0.40	8.7%
Education	5.87	-	4.92	-0.95	-16.2%
Infrastructure	96.99	-	102.80	5.81	6.0%
IceCube Neutrino Observatory (IceCube)	3.50	-	3.50	-	0.0%
Large Hadron Collider (LHC)	16.00	-	16.00	-	0.0%
Laser Interferometer Gravitational Wave Observatory (LIGO) ¹	41.93	-	45.00	3.07	7.3%
National Superconducting Cyclotron Laboratory (NSCL)	24.00	-	24.00	-	0.0%
Midscale Research Infrastructure	5.85	-	8.00	2.15	36.8%
Pre-construction Planning:					
High-Luminosity LHC Upgrade Planning	5.71	-	6.30	0.59	10.3%

¹FY 2017 includes one-time supplemental funding of \$2.50 million for a critical vacuum repair.



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 5, 2018** for Particle Astrophysics, Elementary Particle Physics *Experimental & Theoretical Nuclear Physics*
- Text on Midscale Instrumentation and 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

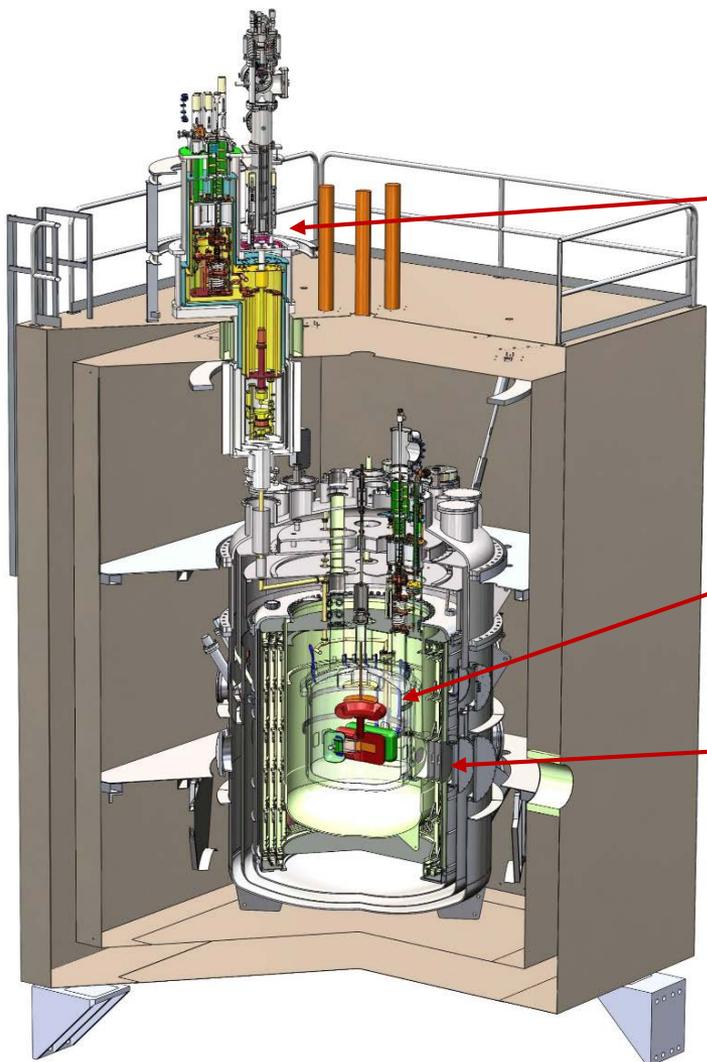


PHY Midscale Instrumentation

- 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 (SCDMS, ATLAS, CMS, LHCb, 2 Nuclear Physics)
- For more info, see PHY Solicitation

Midscale: nEDM

Critical Component Design ✓ → Large Subsystem Integration



- Prepare polarized ^3He
- Isotopically purify ^4He ; each meas't cycle
- Generate electric field
- Store ^3He & neutrons
- Monitor ^3He & neutron precession frequencies
- Generate uniform B-field

PIs: Brad Filippone (Caltech) and Doug Beck (UIUC)

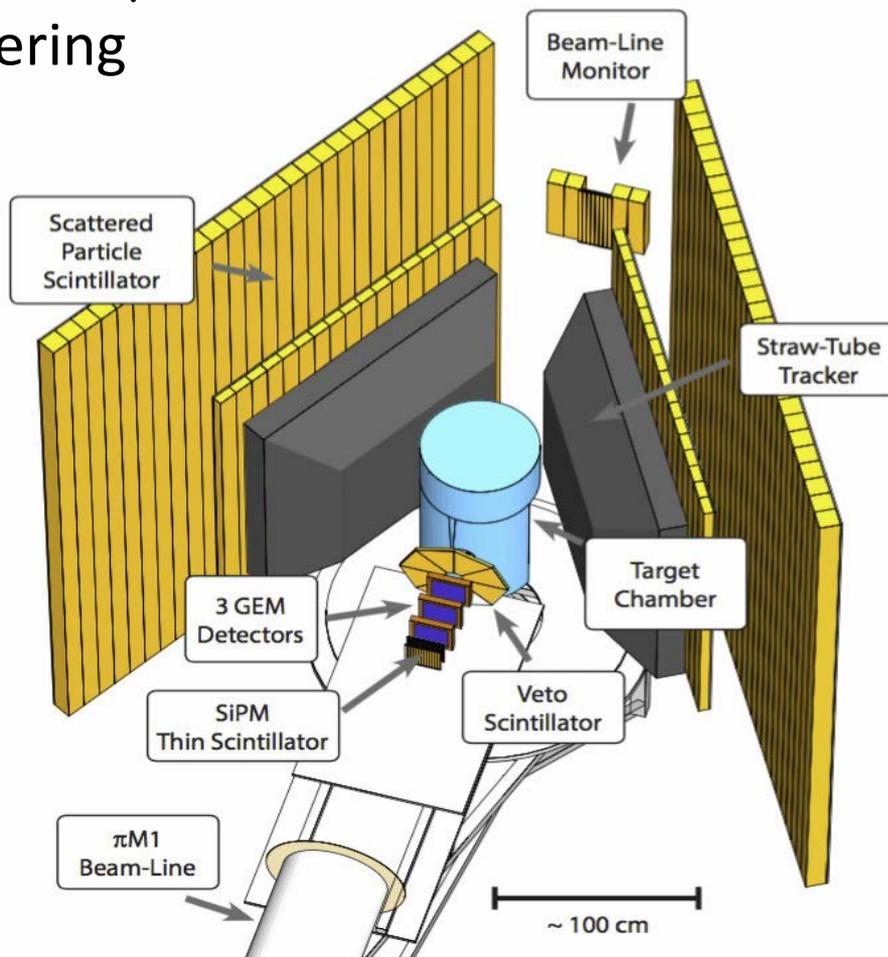
Midscale: MUSE

*Proton Radius Problem: Atomic meas't μ -H \rightarrow p radius
7 σ smaller than e-H and e-p scattering*

Precise comparison of e-p and μ -p scattering @ PSI

- Preparing for full commissioning run (late Fall 2018)
- Data taking: 20 weeks, May – Dec, 2019
- Goal: σ for elastic scattering of $\mu^{+/-}$ and $e^{+/-}$ with sub sub-1% relative precision over Q^2 from 0.002 to 0.07 GeV

PIs: R. Gilman (Rutgers), E. Downie (GWU), M. Kohl (Hampton), W. Lorenzon (U Mich), S. Strauch (USC)



Midscale: MUSE

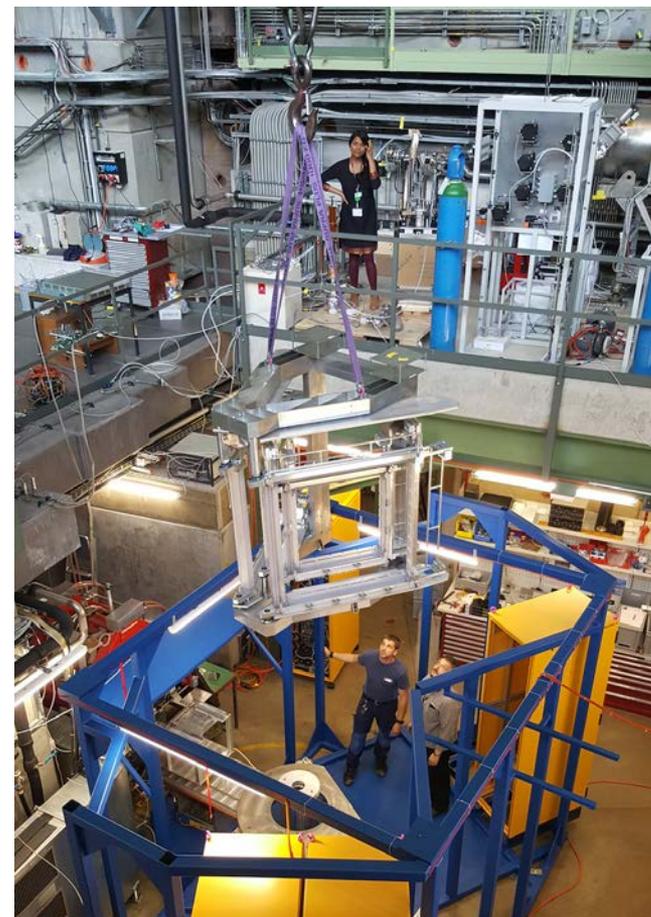
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Straw Tube Tracker Frame lowered into place



Midscale: MUSE

Proton Radius Problem: Atomic meas't μ -H \rightarrow p radius
7 σ smaller than e-H and e-p scattering

Precise comparison of e-p and μ -p
scattering @ PSI

- Preparing for full commissioning run (late Fall 2018)
- Data taking: 20 weeks, May – Dec, 2019
- Goal: σ for elastic scattering of μ +/- and e+/- with sub sub-1% relative precision over Q^2 from 0.002 to 0.07 GeV

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Cryotarget



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

FY18

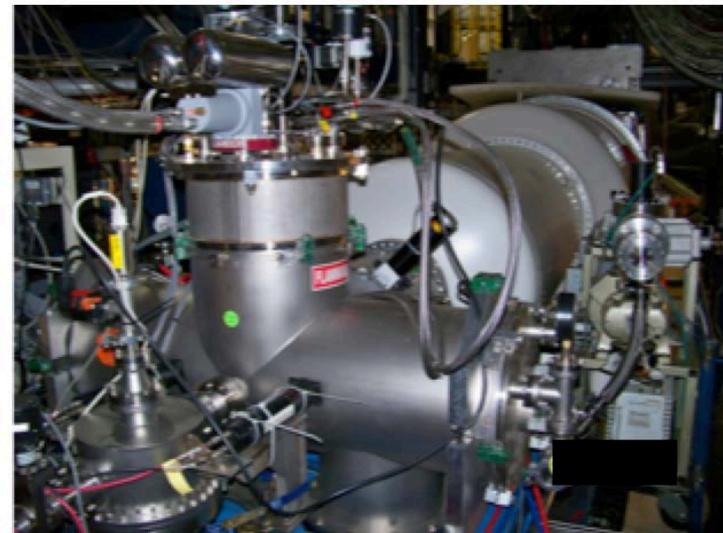
- *Physics: 34 proposals, 10 in ENP (7 for > \$1M)*
 - *Review process complete*
 - *Funding recommendations soon*



PRad

Proton Charge Radius Experiment @ JLab

- Instrumentation
 - Novel H₂ gas flow windowless target (*funded by NSF MRI*)
 - HyCal calorimeter refurbished and tested (*funded by DOE*)
 - Integrated high-speed DAQ
- Data taking May-June 2016
 - Lowest Q² data set in ep
 - Simultaneous meas't of Moller and Mott scattering → control systematic uncertainties



e-beam →

Target installed in Hall B beam line

$$\langle r_p^2 \rangle = 6 \left. \frac{dG_E^p(Q^2)}{dQ^2} \right|_{Q^2 = 0}$$

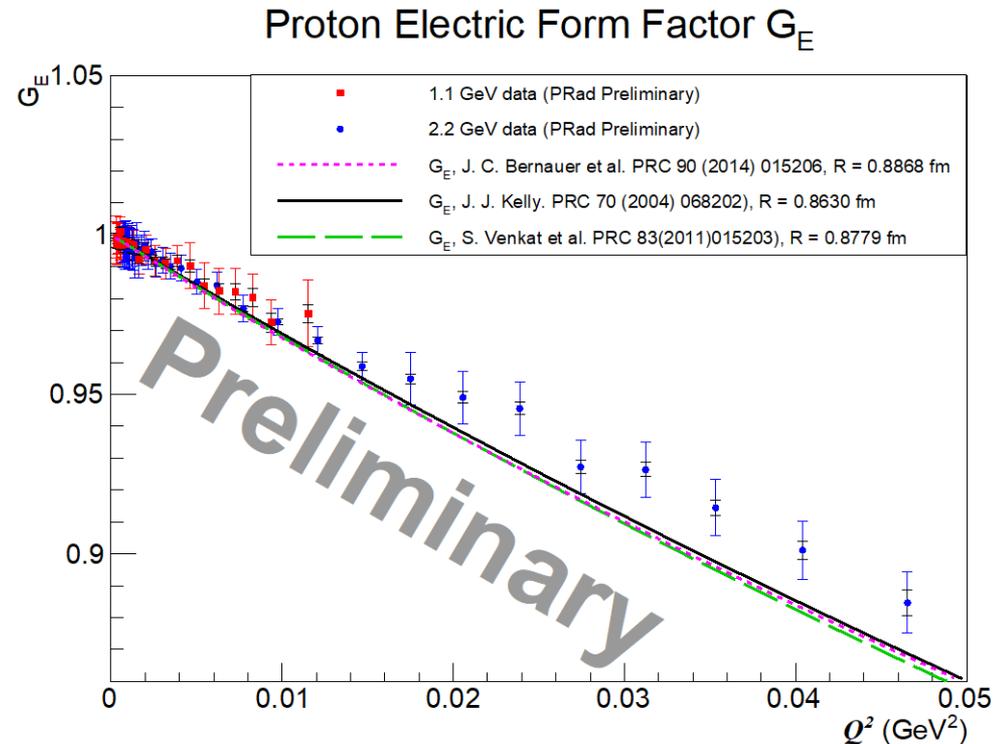


PRad

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Preliminary G_E slope seems to favor smaller radius

Career Program



- Solicitation: 17-537
- Must include excellent research proposal as well as excellent educational plan
- There are eligibility requirements: e.g., must be assistant professor, untenured
- 5 year awards, \$400,000 minimum
- Proposal deadline: **July 20, 2018**
- PECASE nominees are chosen from CAREER winners
- Contact program officer for information/advice ahead of time (budget, scope)

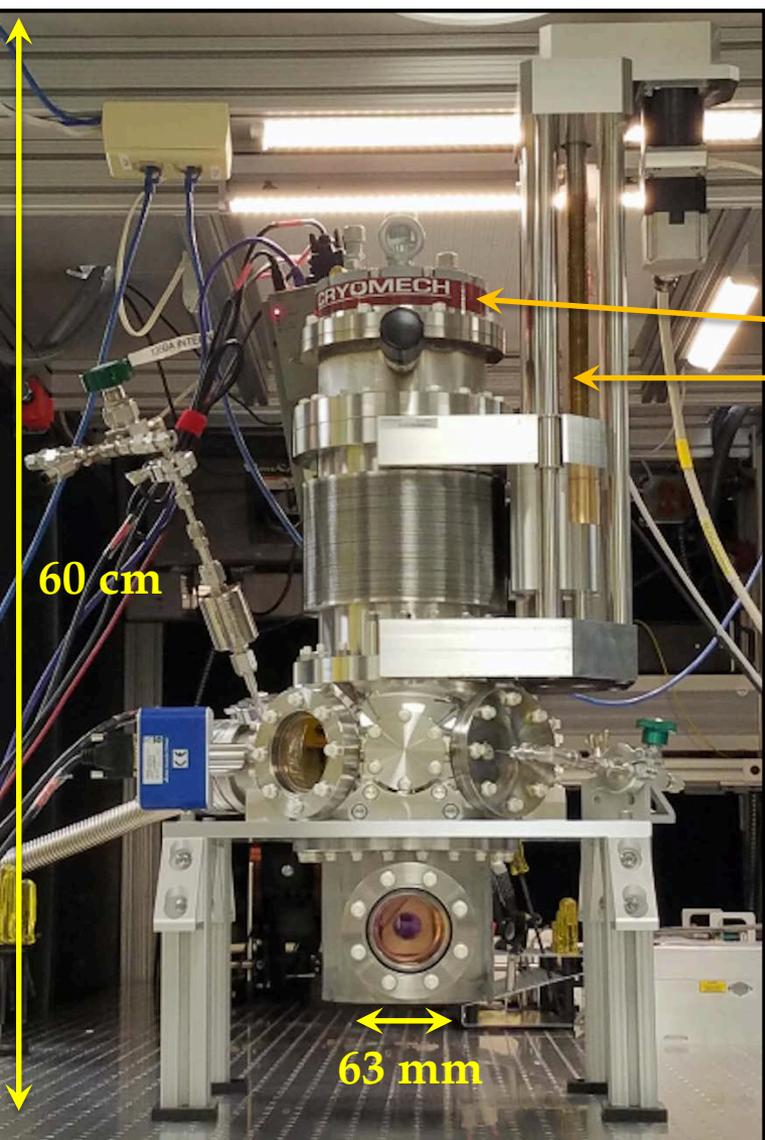
Optical Single Atom Microscope

– Rare Nuclear Reactions in Nuclear Astrophysics & $0\nu\beta\beta$

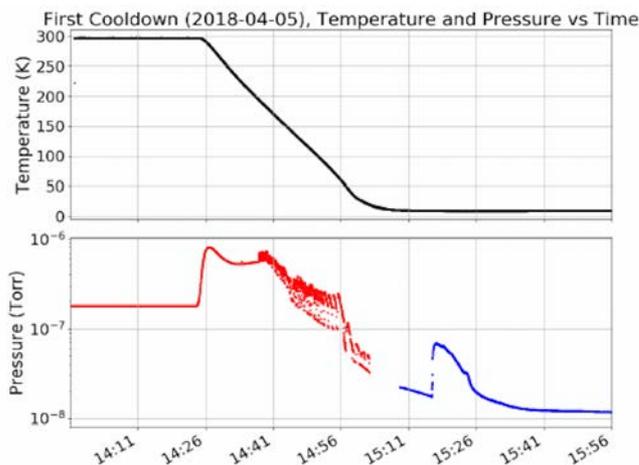
- Capture recoil products in noble gas solid
- Use resonant laser excitation to optically detect
- Goal: detect single atom of Yb in solid Ne
 - Detect ^{26}Mg in $^{22}\text{Ne}(\alpha, n)$ & $^{22}\text{Ne}(\alpha, \gamma)$ to understand slow n-capture in massive stars

Cryo-cooler

Linear Shift Mechanism



Successful neon film growth on 1st attempt!



Substrate temperature:
< 7 K

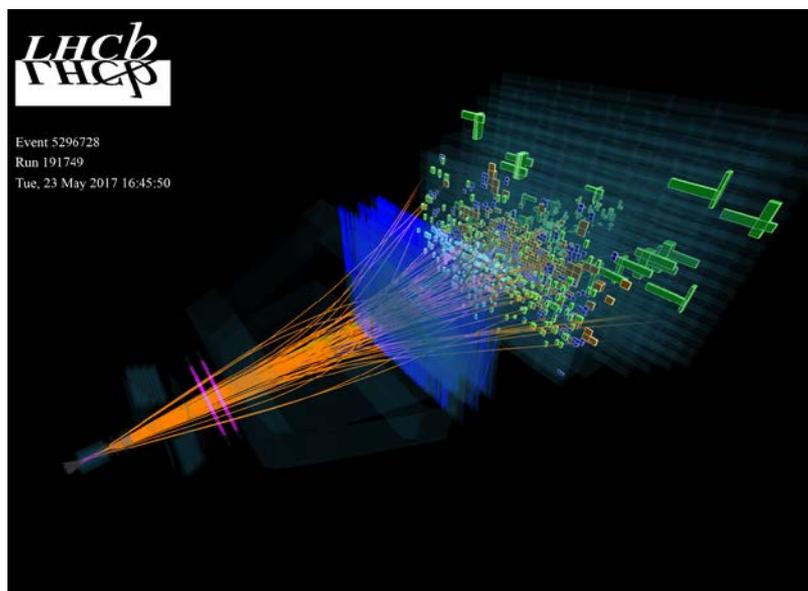
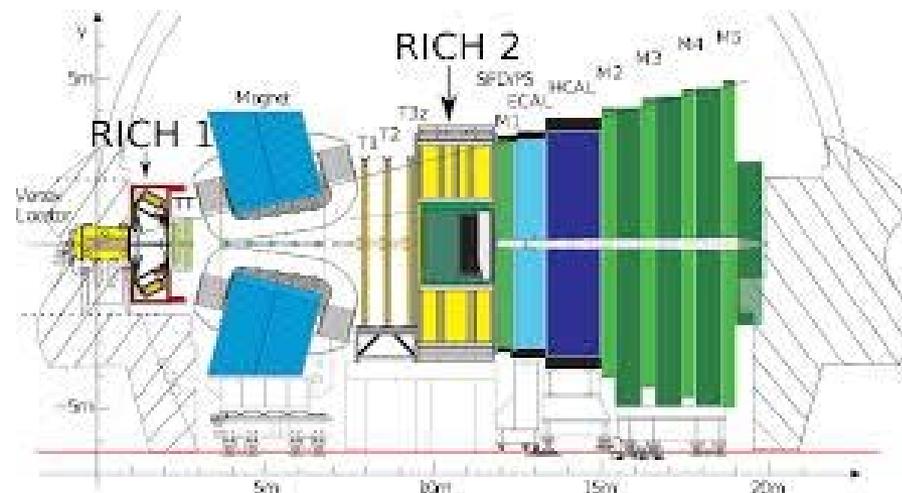
Base pressure:
< 10⁻⁸ Torr

PI: Jaideep Singh PhD Student: Ben Loseth

LHCb

– Study Proton Structure and QCD

- Far forward acceptance \rightarrow both high- x and low- x partons in p and Pb beams
- Extensive hadron PID + full jet reconstruction \rightarrow detailed hadronization studies



- D-Y p_T and ang dist \rightarrow constrain \perp mom dependent PDFs
- Identified hadron production within reconstructed jets
- Contribute to Upstream Tracker silicon upgrade

PI: Christine Aidala

PhD Students: William Dean, Kara Mattioli, Jordan Roth



AGEP GR *Supplements*

- 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
 - 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

See us and DCL 16-125 for more information

Writing proposals: Mentoring program



GOAL: make the proposal writing expertise of senior researchers available to junior investigators

How does it work?

- The Mentee requests a Mentor (email us at aopper@nsf.gov or ejgarcia@nsf.gov).
- We will send a list of Mentor Volunteers to Mentee, who contacts Mentors without identifying them to NSF.
- **The Mentor will read the Mentee's proposal and provide feedback once. Send the proposal early – Mentors are busy people!**
- NSF accepts no responsibility on the interaction/outcome of the program!

Needed: Mentors!

email us at aopper@nsf.gov or ejgarcia@nsf.gov



NSF/MPS/Physics Personnel

- **France Córdova** – Director
- **James Ulvestad** – Acting Assistant Director for MPS
- **Denise Caldwell** – Physics Division Director
- **Brad Keister** – Deputy Division Director; *after 21 years of service, will retire from NSF at the end of June.*
Acting D³ to be named soon.
- **Bogdan Mihaila** – Nuclear Theory Program Director
- ★ **Edmundo Garcia** – 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>



For the latest updates,
check out

<http://www.nsf.gov/div/index.jsp?div=PHY>

Contact us:

- bmihaila@nsf.gov
or call (703)292-8235
- ejgarcia@nsf.gov
or call (703)292-8095
- aopper@nsf.gov
or call (703)292-8958

The screenshot shows the NSF website interface. At the top, there is a navigation bar with links: HOME, FUNDING, AWARDS, DISCOVERIES, NEWS, PUBLICATIONS, STATISTICS, ABOUT NSF, and FASTLANE. Below this is the NSF logo and the text "National Science Foundation Directorate for Mathematical & Physical Sciences (MPS)". A search bar and "QUICK LINKS" button are also visible. A secondary navigation bar includes: MPS HOME, MPS FUNDING, MPS AWARDS, MPS DISCOVERIES, MPS NEWS, and ABOUT MPS. The main content area is titled "Physics (PHY)" and includes a sub-header "PHY Replaces DCL with Solicitation NSF 14-576". The text below this header states: "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." Below this is a section titled "PHY Int'l Activities - Potential Co-Review" with text: "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." A "Special Announcements" section follows, listing: "MPS Alliances for Graduate Education and the Professoriate - Graduate Research Supplements (AGEP-GRS) Dear Colleague Letter (NSF 13-071)" and "Dear Colleague Letter - Announcement of Instrumentation Fund to Provide Mid-Scale Instrumentation for FY2014 Awards in Physics Division (NSF 13-118)". On the left side of the page, there is a sidebar with a "Physics (PHY)" header, a photo of Albert Einstein, and a list of links: PHY Home, About PHY, Funding Opportunities, Awards, News, Events, Discoveries, Publications, Career Opportunities, Facilities and Centers, PHY Program Director Jobs, See Additional PHY Resources, and View PHY Staff. Below this is a search box for PHY Staff. At the bottom of the sidebar, there is a section for "MPS Organizations" with links for Astronomical Sciences (AST), Chemistry (CHE), and Materials Research (DMR).



Backup Slides

Budget Trends – NSF Nuclear Physics



~ 25% = Research
 ~ 75% = Operations

Includes co-funding and other leveraged funds

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\$)
2012	7,969	4,185	6,343	18,497	3,829	22,326	21,500	2,150	2,744		48,720
2013	6,183	4,693	5,653	16,509	3,474	20,008	21,500	2,150	2,996	490	47,144
2014	5,826	5,189	5,999	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	4,183	22,957	23,000	2,280	1,801	1,367	51,406
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 base = 17,800	4,344	24,264	24,000	2,280	530	2,990	54,064

FY15 Fundamental Symmetries: + \$1.32M for $0\nu\beta\beta$

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

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



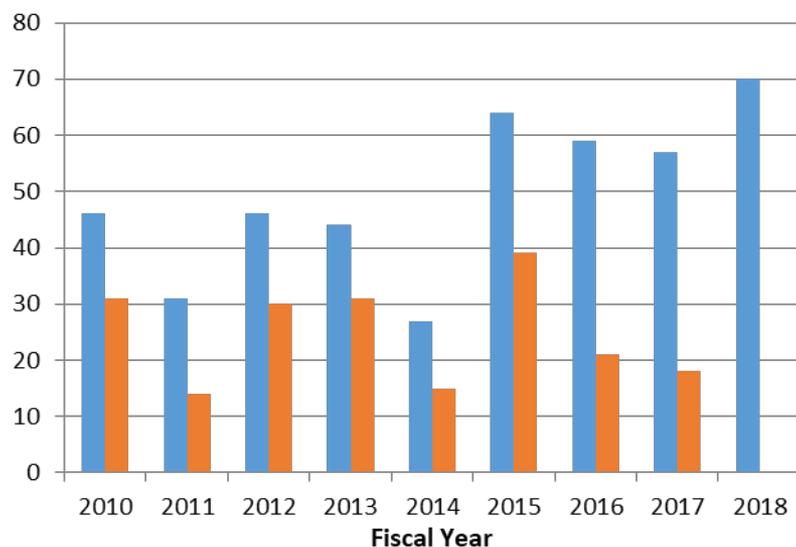
Experimental Nuclear Physics

ENP Proposal Trends

* 2015 - 0vBB added to program

Submitted

Awarded



ENP Funding Trends New awards only

Requested funds 1st yr (M\$)

Awarded Funds 1st yr (M\$)

