



Report from NSF

Ken Hicks

- ▶ Experimental Nuclear Physics Program Scope
- ▶ Announcements
 - New Solicitation
- ▶ Budget
- ▶ Physics Division Personnel



Nuclear Physics @ NSF

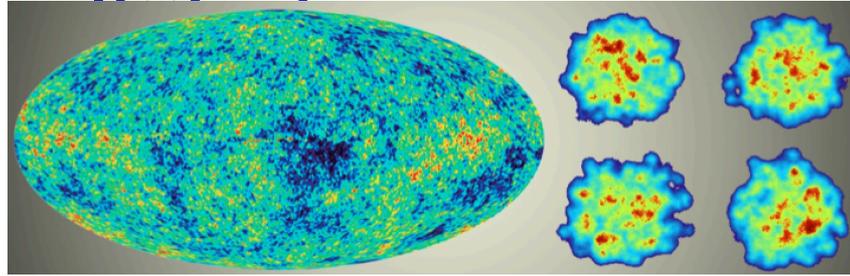
- **Nucleon and Hadron QCD** – properties and behavior of nucleons and nuclear matter under extreme conditions, confinement, hadron spectra, nuclear equation of state
- **Nuclear Reactions and Structure** – structure of many-body nuclei and reactions of relevance to structure
- **Nuclear Astrophysics** – origin of the elements, properties of dense matter in a compact object, nuclear reactions that drive stars and stellar explosions
- **Nuclear Precision Measurements and Fundamental Symmetries** – tests of QCD and chiral perturbation theory, tests of the Standard Model in a strongly interacting environment
- **Nuclear Theory** – structure and reactions of nuclei and of hadrons in few-nucleon and nuclear environments, the quark/gluon substructure expressed by QCD



Highlights

- A few selected results shown here:
 - RHIC results from some NSF PI's
 - Some results outside of RHIC physics
 - NSF experimental nuclear physics funds a broad range of experiments, and I apologize if your NSF-funded results are not shown here.

Image the e-by-e harmonic flow of

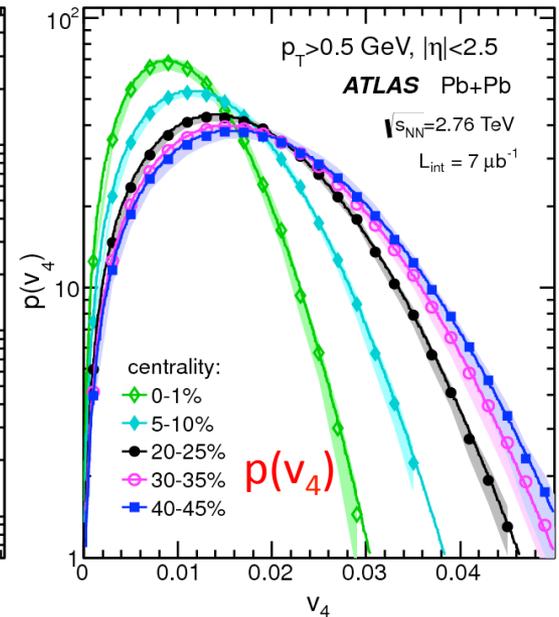
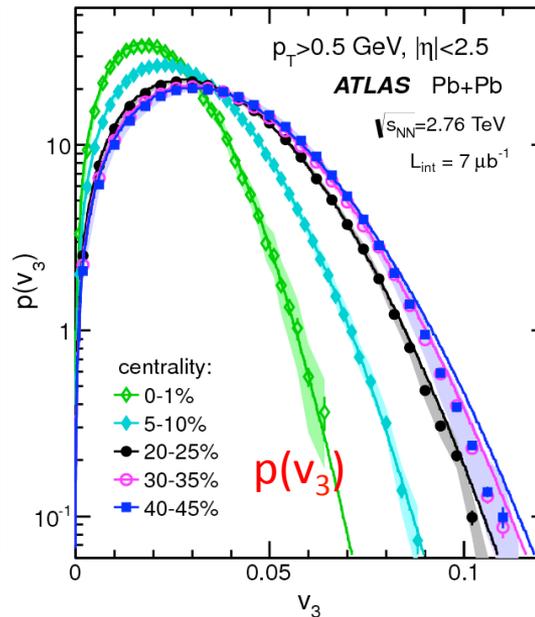
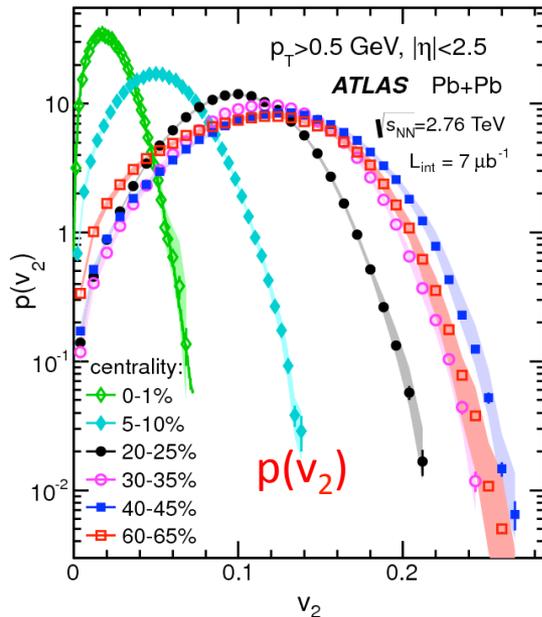


$$\frac{dN}{d\phi} \propto 1 + 2v_2 \cos 2(\phi - \Psi_2) + 2v_3 \cos 3(\phi - \Psi_3) + 2v_4 \cos 4(\phi - \Psi_4) + \dots$$

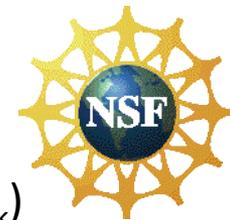
First measurements of $p(v_n)$, $p(v_n, v_m)$, $p(\Psi_n, \Psi_m)$, $p(\Psi_n, \Psi_m, \Psi_k)$

J. Jia: three papers published over 2012-2015:

JHEP11(2013)183, PRC90,024905 (2014), PRC92,034903(2015)

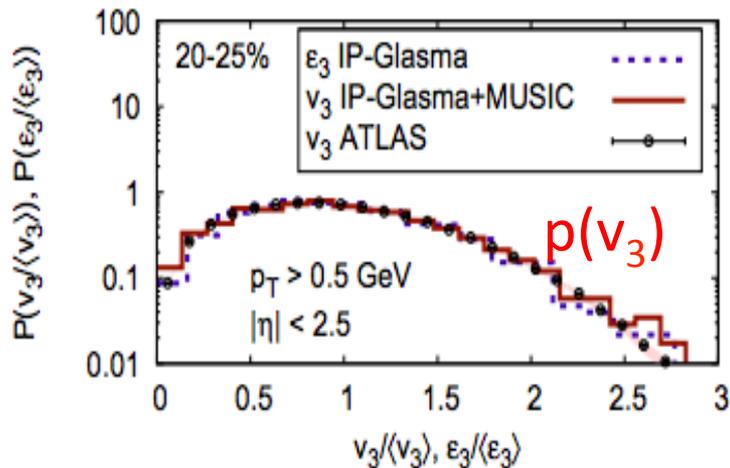
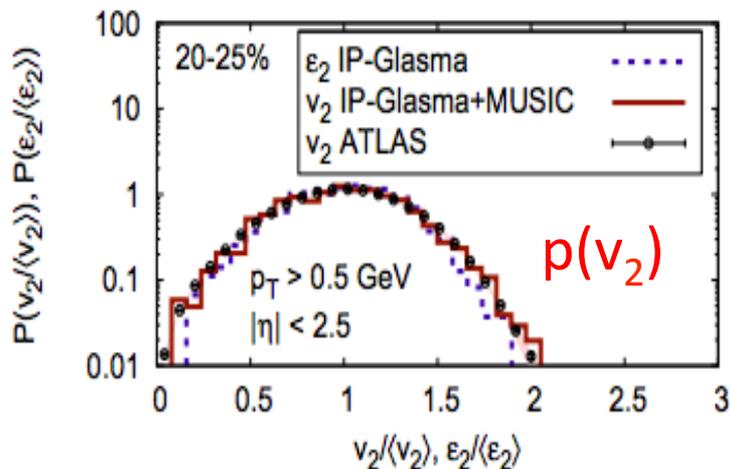


Constrain initial condition & medium

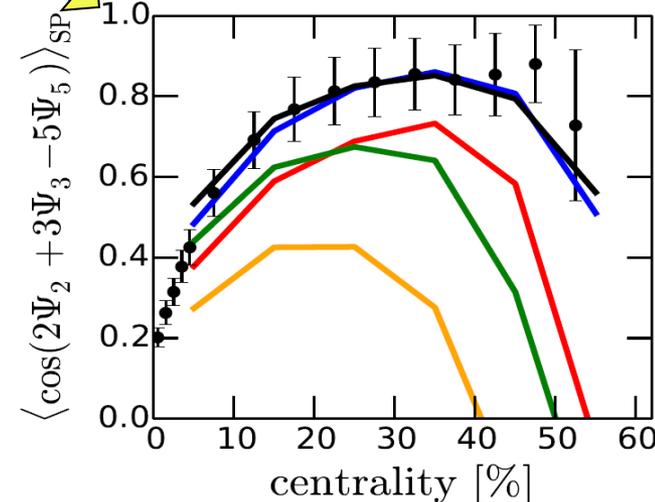
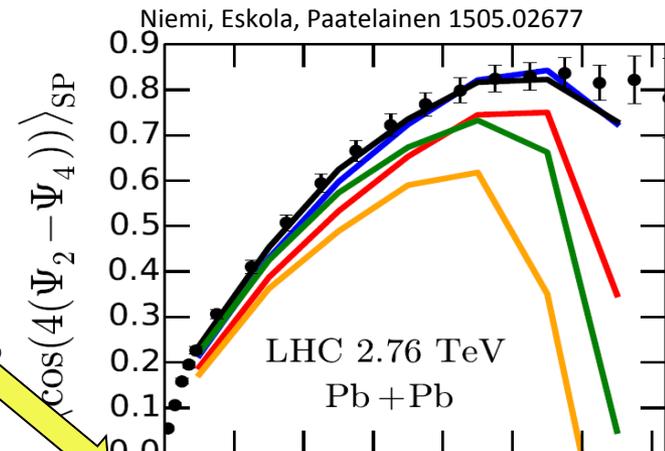
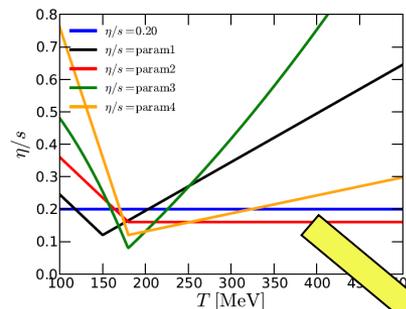


$p(v_n)$: constrain initial condition

Gale, Jeon, Schenke, Tribedy, Venugopalan 1209.6330



$p(\Psi_n, \Psi_m)$ and $p(\Psi_n, \Psi_m, \Psi_k)$
constrain medium property

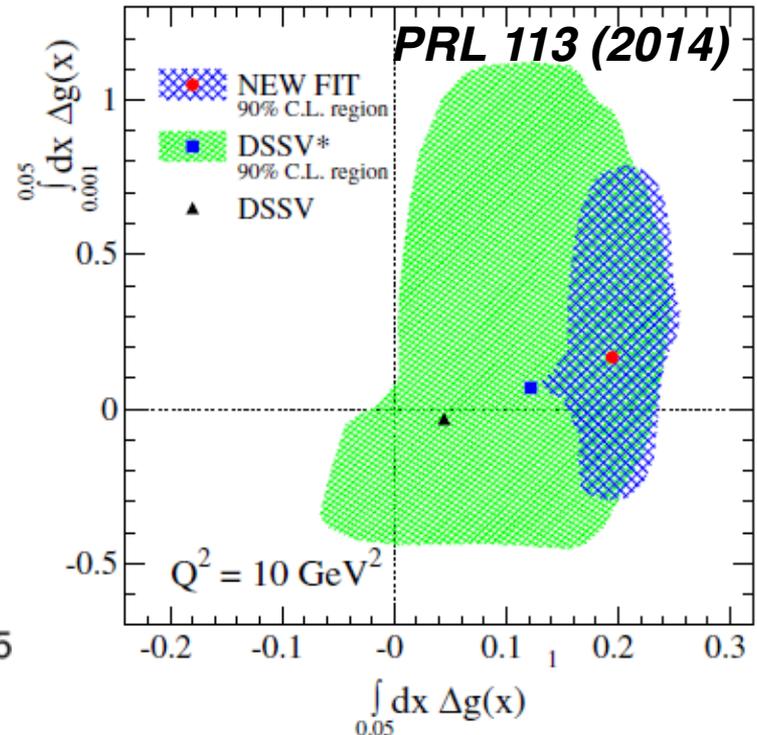
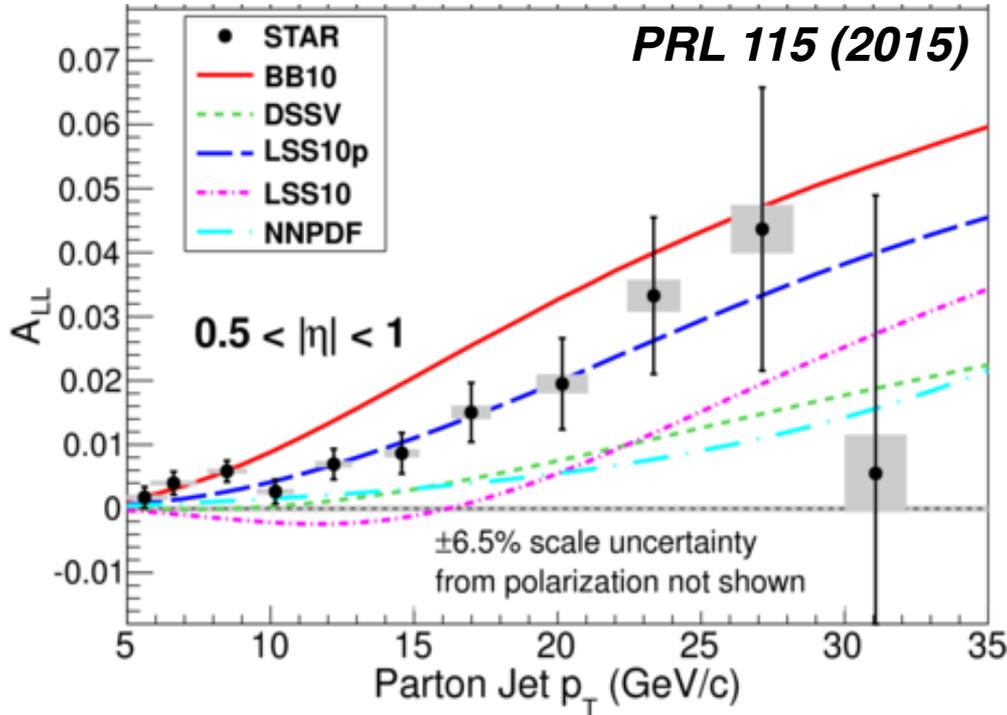


Distinguish models with different $\eta/s(T)$ but the same $\langle \eta/s \rangle$.

STAR results: IU site visit (S. Wissink)



Inclusive jets: Asymmetry results from 2009 data

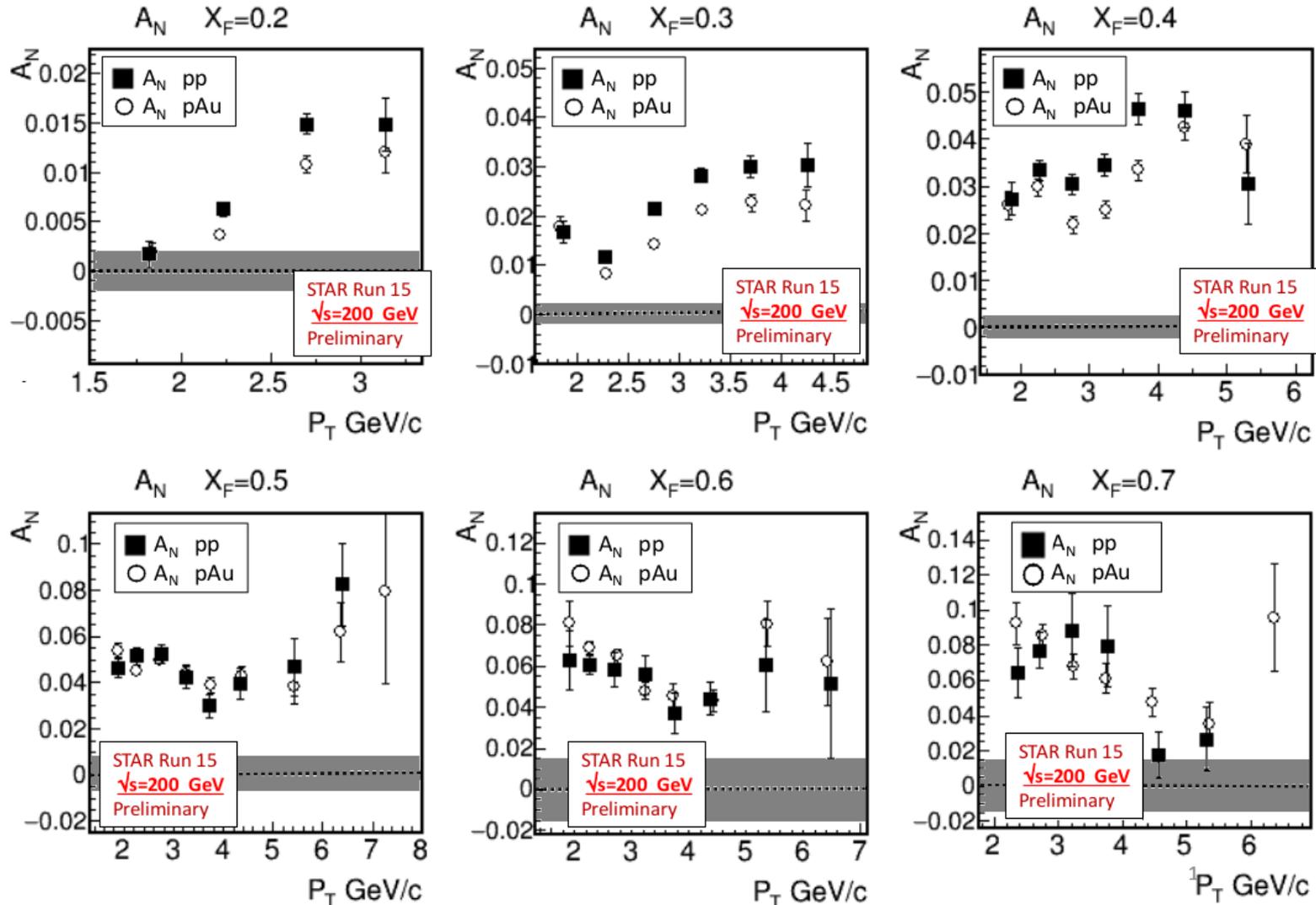


First strong evidence for non-zero gluon polarization in proton!

- ❖ Exploit greatly improved RHIC performance in luminosity, polarization
- ❖ Higher EMC trigger thresholds \rightarrow increased focus on high- p_T region
- ❖ Combination of above \rightarrow factor of 3-4 in stat. precision at high p_T

Transverse Single-Spin Asymmetry

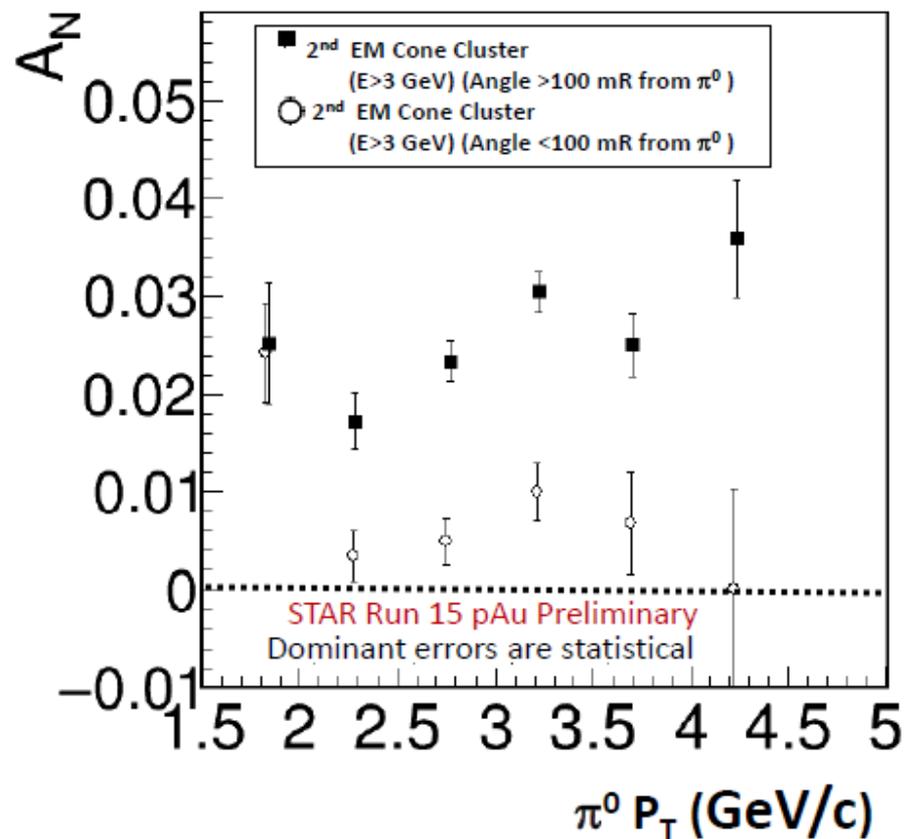
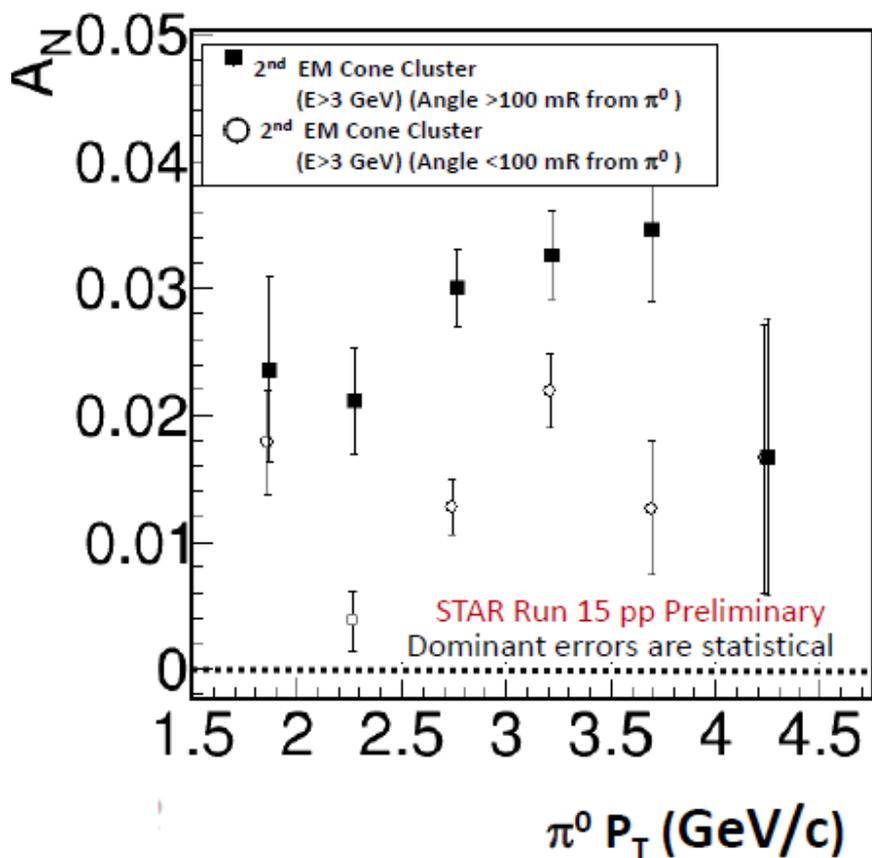
S. Heppelman and C. Dilks (Penn State)





TSSA not associated with Jets

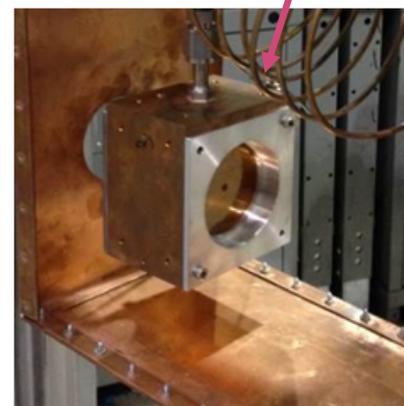
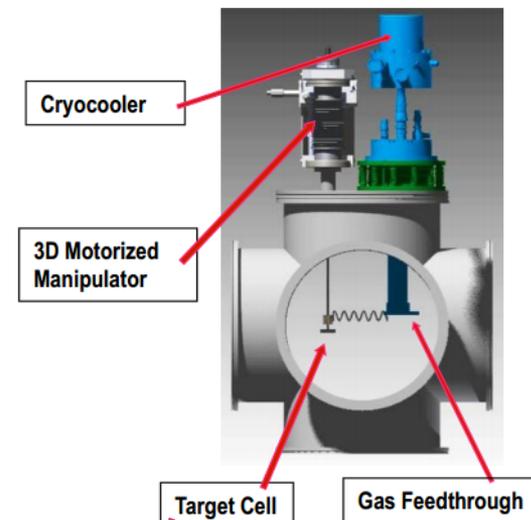
S. Heppelman and C. Dilks (Penn State)





Highlights – MRI Awards

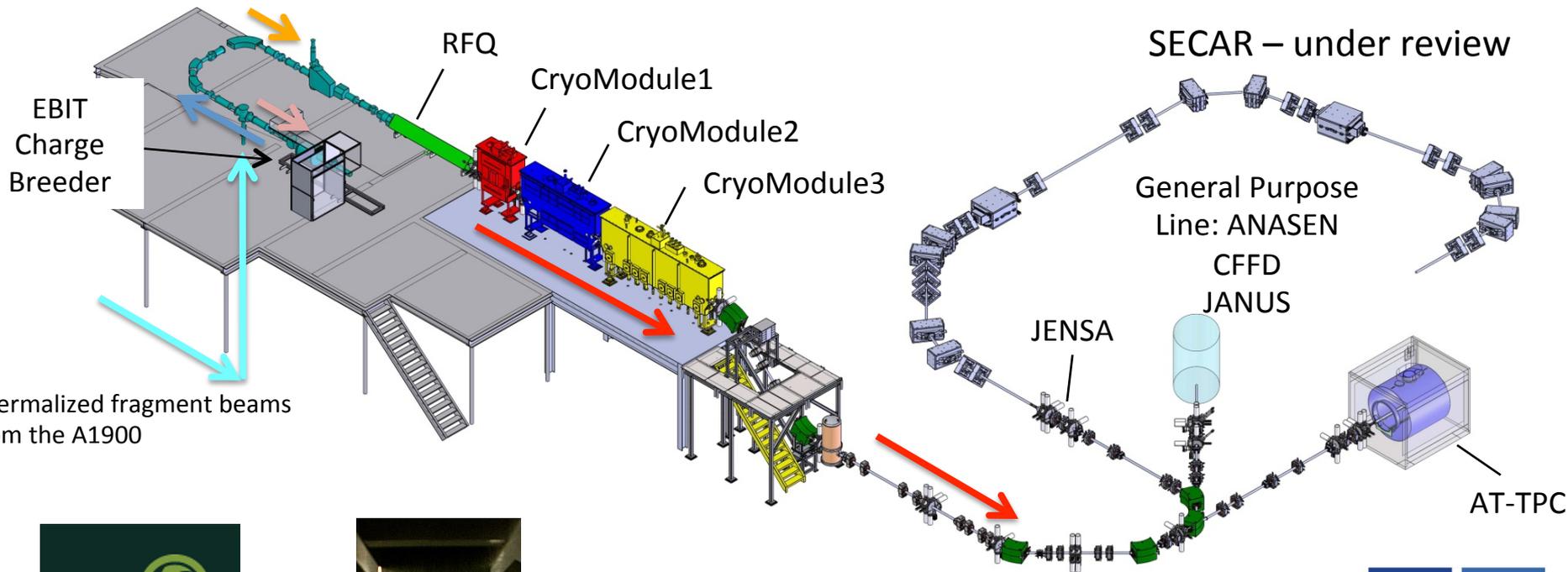
- PRad experiment – *“High Precision Measurement of the Proton Charge Radius”*.
- PRad target – Windowless cryo-cooled hydrogen gas flow target.
- Target development by JLAB Target Group
- Student Training:
 - 3 undergraduate students (MSU and NCA&T)
 - 3 graduate students (Duke U. and MSU)
- More Senior Personnel:
 - 2 postdocs (Duke U.)
- **Just started taking data at JLab**



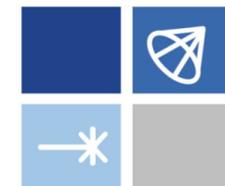
Re-Accelerator Facility at NSCL – Now Running!



- First re-accelerator coupled to an in-flight rare isotope production facility



Nozzle of JENSA gas-jet target
(Colorado School of Mines, ORNL, JINA – funded by DOE Office of Science and NSF)



JINA-CEE

Announcements: New solicitation for NSF Physics Division Investigator-Initiated Research Projects 15-579



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

- **Deadlines:**
 - **November 11, 2016 for *Experimental Nuclear Physics & Theoretical Nuclear Physics***
 - December 1, 2016 Computational Physics
 - February 1, 2017 for Accelerator Science
- Follow Grant Proposal Guide checklist
- Other requests (conf. support, supplements, etc.)
 - Talk with us first (email or phone)
 - Submit at the **same due date as above**
 - Priority goes to summer schools and CEU



REU Supplements

- Available to NSF grantees to fund an undergraduate student (US citizen or permanent resident) for the summer.
 - Typically about 5 requests per year.
- Usually \$5,000 (awarded as a *supplement*)
- Submit in Fastlane as a supplement to current grant.
Must contact program director before submitting request – funds may not be available.



Career Awards

- Must include **excellent research program** as well as **excellent educational plan**
- There are eligibility requirements: e.g., must be assistant professor, untenured
- 5 year awards, \$400,000 minimum
- Full proposal deadline: July 22, 2016 (for MPS)
- **Contact program director for information/advice ahead of time (budget, scope)**
- Solicitation: 15-555
- PECASE nominees are chosen from eligible CAREER winners

Major Research Instrumentation (MRI)



- Two types of awards: development and acquisition
- Contact program directors well ahead of submission to discuss (avoid pitfalls)
- Limited submissions from each university
- Maximum award is \$4M; awards above \$1M compete across the entire Foundation
- ***FY16: Physics received ~35 proposals, NP received 10 proposals***
 - Currently being reviewed; highly competitive
- Next deadline: Jan. 11, 2017



Mid-Scale Instrumentation

- The Physics Division has established a mid-scale instrumentation fund. The intention is to fund projects **above \$4 million** (the MRI limit).
- This funding is NOT available for “operations” so program funds are used to run the experiment.
- **Contact us for more information.** PIs cannot apply to mid-scale directly; all proposals must go through the program. See solicitation **15-579**.
- A priority of the division (and the directorate) is to increase the resources available for mid-scale.

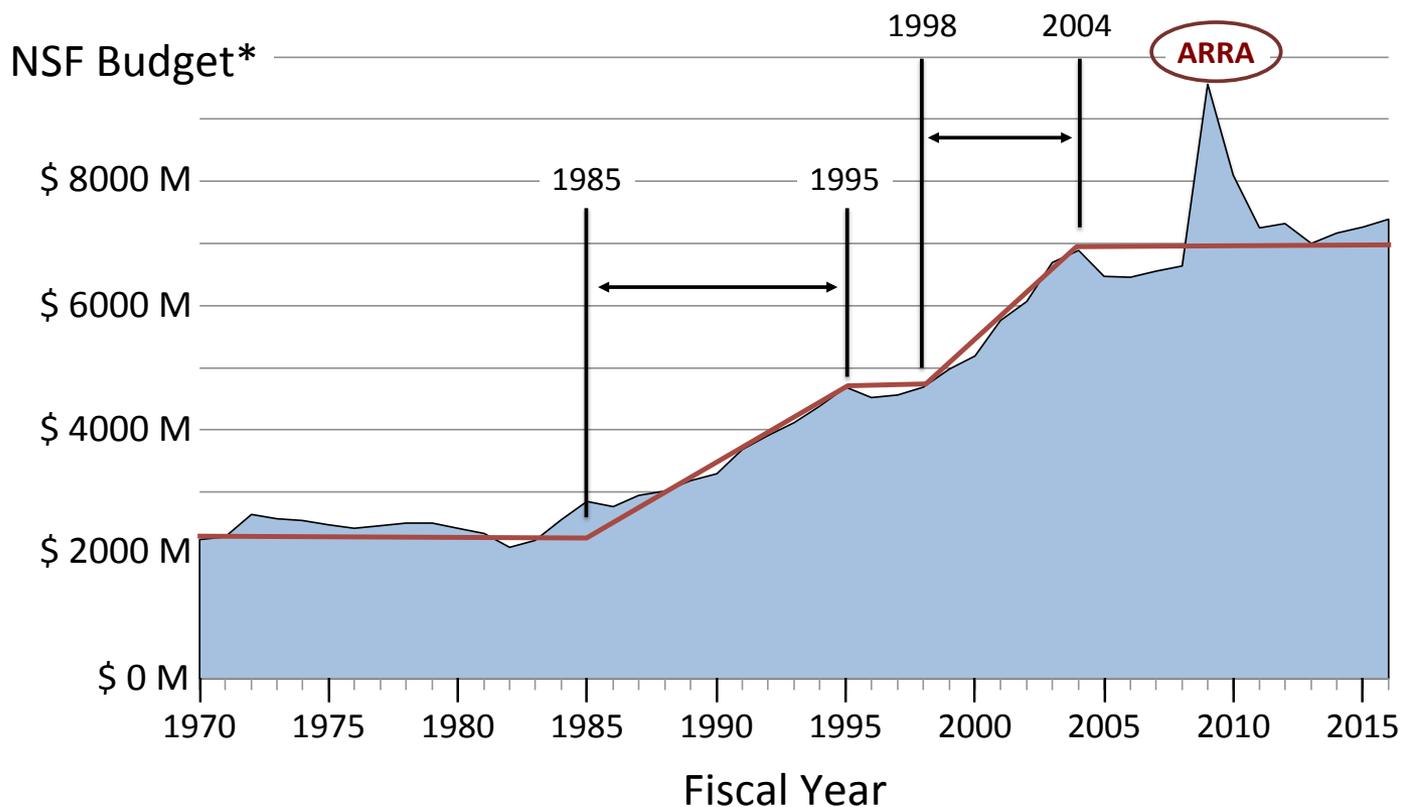
Budget Information





NSF overall trends

NSF Funding History

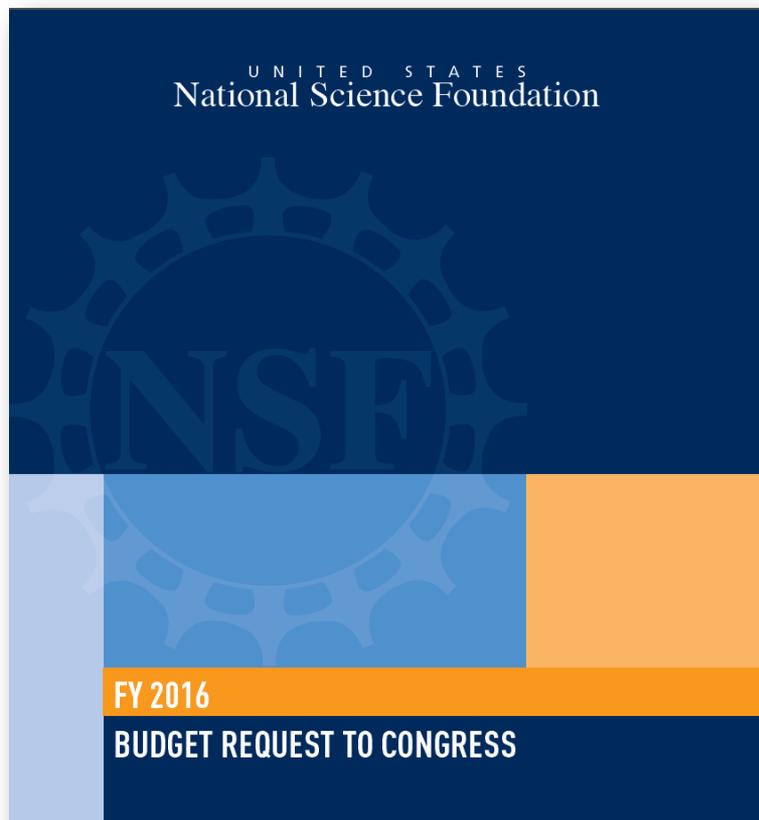


*Constant 2014\$



FY16 as requested

FY 2016 Omnibus Bill



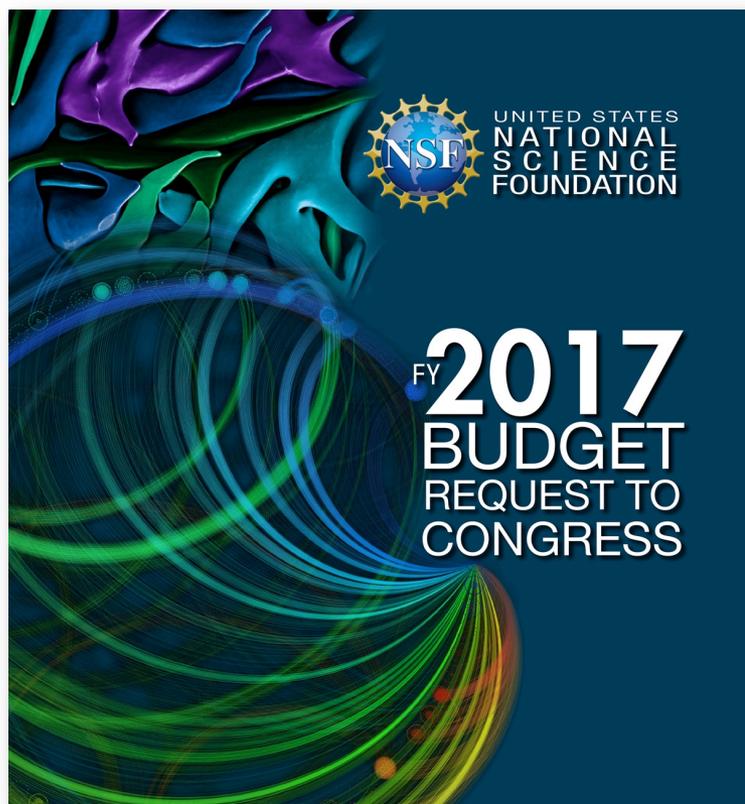
	FY 2015	FY 2016 (request)
NSF	\$ 7344 M	\$ 7724 M 5.2%
R&RA	\$ 5934 M	\$ 6186 M 4.2%

	FY 2016 (estimate)
NSF	\$ 7463 M 1.6%
R&RA	\$ 6034 M 1.7%



New FY17 request

The President's Request to Congress



	FY 2016 (Estimate)	FY 2017 (Total Request)	
NSF	\$ 7463 M	\$ 7964 M	6.7%
R&RA	\$ 6034 M	\$ 6425 M	6.5%
Two Components to R&RA			
Discretionary	\$ 6034 M	\$ 6079 M	0.8%
Mandatory*	--	\$ 346 M	--
Total	\$ 6034 M	\$ 6425 M	6.5%

*Direct spending (not subject to discretionary caps)
One-year duration



NSF PHY FY15 Estimate & FY16 Request

Physics (PHY) Funding

(Dollars in Millions)

	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	Change Over FY 2015 Estimate	
				Amount	Percent
Total, PHY	\$267.09	\$274.99	\$277.37	\$2.38	0.9%
Research	163.82	176.05	176.19	0.14	0.1%
CAREER	8.57	7.44	7.45	0.01	0.1%
Centers Funding (total)	0.02	0.02	-	-0.02	-
Nanoscale Science & Engineering Centers	0.02	0.02	-	-0.02	-
Education	5.38	5.56	5.32	-0.24	-4.3%
Infrastructure	97.89	93.38	95.86	2.48	2.7%
IceCube Neutrino Observatory	3.45	3.45	3.45	-	-
Large Hadron Collider (LHC)	17.37	18.00	18.00	-	-
Laser Interferometer Grav. Wave Obs. (LIGO)	36.43	39.43	39.43	-	-
National Superconducting Cyclotron Laboratory (NSCL)	22.50	23.00	24.00	-	-
Research Resources	11.56	-	-	-	N/A
Mid-scale Research Infrastructure	6.58	10.00	12.48	2.48	24.8%

Totals may not add due to rounding.

Budget Trends – NSF Nuclear Physics



~ 25% = Research

~ 75% = Operations

FY	Hadrons & Light Nuclei (k\$)	Structure & Heavy Ions (k\$)	Fund. Sym. (k\$)	Nucl. Astro. (k\$)	Theory (k\$)	Program Total (k\$)	NSCL (k\$)	JINA JINA -CEE (k\$)	MRI (K\$)	Mid-Scale (K\$)	Total Nuclear Physics (k\$)
2009	7,663	4,734	5,572	N/A	5,825	23,794	22,500	2,000	8,058	9,524	65,877
2010	6,421	6,863	5,532	1,078	3,855	22,672	21,000	2,150	1,134		46,956
2011	5,349	6,485	5,336	1,994	3,719	22,883	21,500	2,150	729		47,262
2012	7,657	3,375	5,855	1,610	3,829	22,326	21,500	2,150	2,744		48,720
2013	5,218	4,259	5,304	1,754	3,474	20,008	21,500	2,150	2,996	490	47,144
2014	5,275	4,215	5,250	2,475	3,514	20,728	22,500	2,280	1,038	1,188	47,733
2015	5,941	3,722	6,818	2,245	4,183	22,908	23,000	2,280	1,801	1,367	51,357

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

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

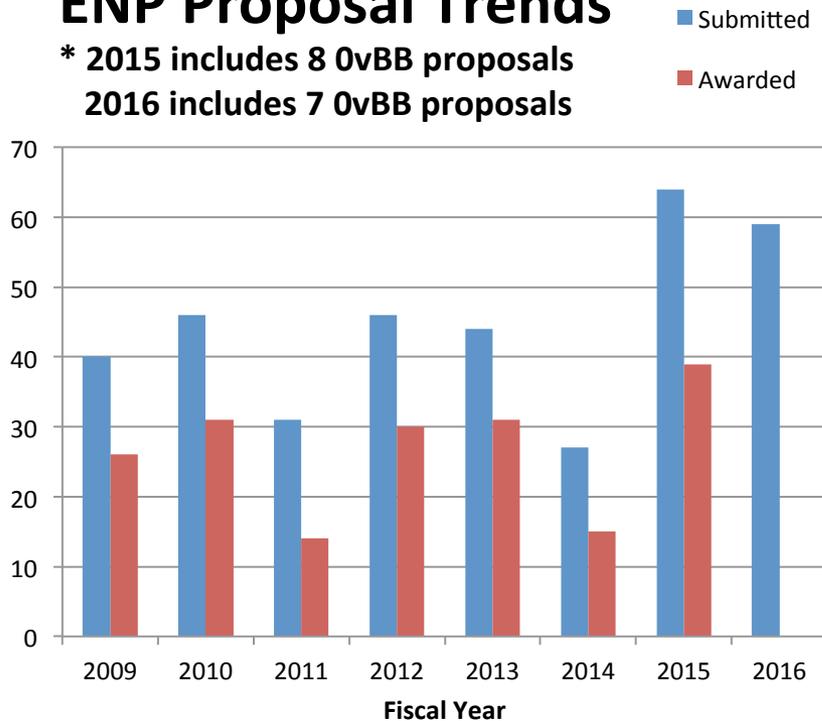
Mid-scale: ad hoc competition; supplemental construction funds

Experimental Nuclear Physics Program



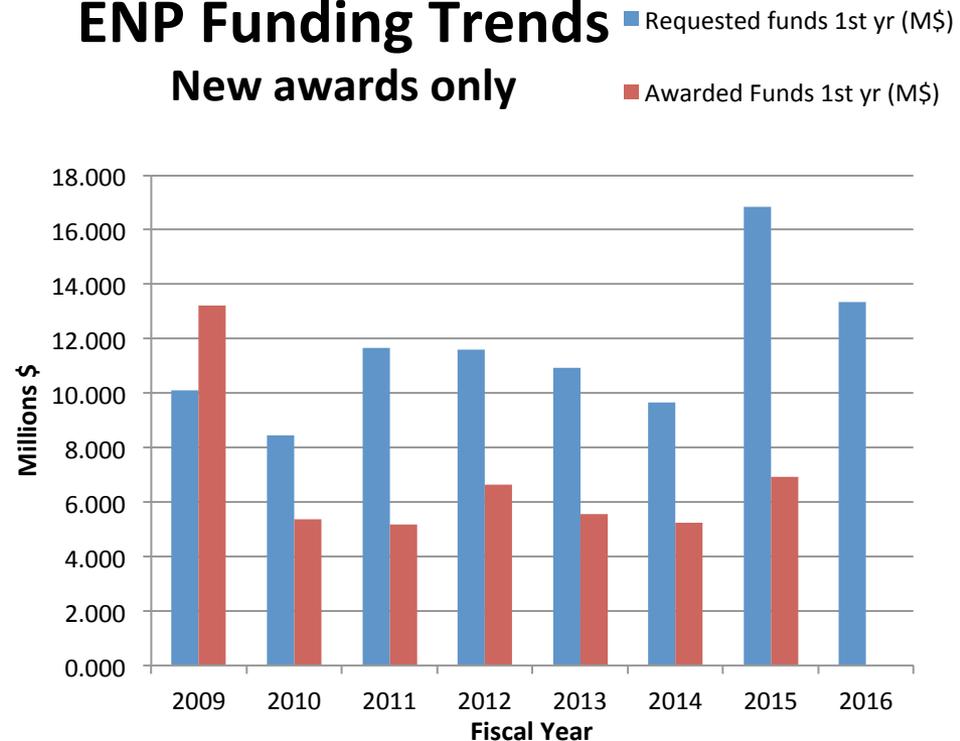
ENP Proposal Trends

* 2015 includes 8 0vBB proposals
2016 includes 7 0vBB proposals



ENP Funding Trends

New awards only





NSF/MPS/Physics Personnel

- **France Cordova** – Director
- **Fleming Crim** – Associate Director for MPS
- **Denise Caldwell** – Physics Division Director
- **Brad Keister** – Deputy Division Director
- **Bogdan Mihaila** – Nuclear Theory Program Director
- ~~**Ken Hicks** – Expt'l Nuclear Physics Program Director~~
- **Allena Opper** – Expt'l Nuclear Physics Program Director

Search for a “rotator” Program Director in
Experimental Nuclear Physics nearly complete!

New person will likely start soon after September 2016

<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:

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- khicks@nsf.gov
or call (703)292-8095
- aopper@nsf.gov
or call (703)292-8958

The screenshot shows the NSF website header with navigation links: HOME, FUNDING, AWARDS, DISCOVERIES, NEWS, PUBLICATIONS, STATISTICS, ABOUT NSF, and FASTLANE. The main title is "National Science Foundation Directorate for Mathematical & Physical Sciences (MPS)". Below the header is a search bar and a "QUICK LINKS" button. The main 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 features a navigation menu on the left with links to: 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 the menu is a search box for PHY Staff. The main content area includes a "Special Announcements" section with two items: "PHY Replaces DCL with Solicitation NSF 14-576" and "PHY Int'l Activities - Potential Co-Review". The "PHY Replaces DCL" announcement 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." The "PHY Int'l Activities" announcement states: "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." The "Special Announcements" section also includes links to "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)".



Backup Slides



Tips on how **NOT** to get funded

- Who needs broader impacts??
 - Referees never pay any attention to this, right? **RWR**
- What is a postdoc mentoring plan?
 - My postdoc doesn't listen to my advice anyhow... **RWR**
- Cram as much as possible into the text.
 - The longer I make it, the more reviewers love it!
- Don't put your work in context.
 - I don't care what the PAC says, my research is brilliant.
- Don't proofread or spell check your text.
 - Any respectable reviewer doesn't care about grammar...



Neutrinoless Double Beta Decay

Reorganization of NSF Particle Astrophysics Program

→ $0\nu\beta\beta$ moved to ENP Program

- Proposals submitted in FY15 to ENP = 53 + 9 = 62
 - Funding also transferred from PA to ENP
 - DOE-NSF Coordination: optimal utilization of national resources in support of R&D to demonstrate down-selection criteria for G2 experiments
 - NSAC $0\nu\beta\beta$ subcommittee charged to assess critical R&D needs and technology schedules
 - In light of the R&D assessments provided by the NSAC subcommittee and within funding availability, the agencies and offices will move forward in a coordinated, unified approach to address these R&D needs, similar to the process used in the joint effort on the second generation dark matter experiments
- <http://science.energy.gov/hep/hepap/meetings/201409/>



Accelerator Science

- The Physics Division program in Accelerator Science has significant interest from NP community. Over 60 proposals were received for consideration in FY15 (12 proposals in FY14)
- Next target date is February 3, 2016.
- Intended to fund accelerator **science**, not R&D for specific projects. Collaboration with a national lab (e.g., prototyping) is OK.



Computational Physics (CP)

- MPS, ENG, and OCI have established a cross-directorate program in **Computational and Data-Enabled Science and Engineering** (CDS&E: PD 12-8084).
- In Physics this program is implemented in the **Computational Physics** program under the **PHY Solicitation**. It focuses on cyber-infrastructure for the disciplines supported by the Physics Division.
 - » **Deadline = December 3, 2015**
 - » **Bogdan Mihaila** bmihaila@nsf.gov

NSF FY16 Request Summary

National Science Foundation Summary Table FY 2016 Request to Congress



(Dollars in Millions)

NSF by Account	FY 2014 Actual	FY 2015 Estimate	FY 2016 Request	FY 2016 Request over:			
				FY 2014 Actual		FY 2015 Estimate	
				Amount	Percent	Amount	Percent
BIO	\$720.84	\$731.03	\$747.92	\$27.08	3.8%	\$16.89	2.3%
CISE	892.60	921.73	954.41	61.81	6.9%	32.68	3.5%
ENG	833.12	892.31	949.22	116.10	13.9%	56.91	6.4%
<i>Eng Programs</i>	673.13	715.20	754.86	81.73	12.1%	39.66	5.5%
<i>SBIR/STTR</i>	159.99	177.11	194.36	34.37	21.5%	17.25	9.7%
GEO	1,321.32	1,304.39	1,365.41	44.09	3.3%	61.02	4.7%
MPS	1,267.86	1,336.72	1,366.23	98.37	7.8%	29.51	2.2%
SBE	256.84	272.20	291.46	34.62	13.5%	19.26	7.1%
OISE ¹	48.31	48.52	51.02	2.71	5.6%	2.50	5.2%
IA ¹	433.12	425.34	459.15	26.03	6.0%	33.81	7.9%
U.S. Arctic Research Commission	1.30	1.41	1.48	0.18	13.5%	0.07	5.0%
Research & Related Activities	\$5,775.32	\$5,933.65	\$6,186.30	\$410.98	7.1%	\$252.66	4.3%
Education & Human Resources	\$832.02	\$866.00	\$962.57	\$130.55	15.7%	\$96.57	11.2%
Major Research Equipment and Facilities Construction	\$200.00	\$200.76	\$200.31	\$0.31	0.2%	-\$0.45	-0.2%
Agency Operations and Award Management	\$305.95	\$325.00	\$354.84	\$48.89	16.0%	\$29.84	9.2%
National Science Board	\$4.25	\$4.37	\$4.37	\$0.12	2.8%	-	-
Office of Inspector General	\$13.84	\$14.43	\$15.16	\$1.32	9.5%	\$0.73	5.1%
Total, NSF	\$7,131.39	\$7,344.21	\$7,723.55	\$592.16	8.3%	\$379.34	5.2%

Totals may not add due to rounding.

¹ This table reflects the realignment, expected in FY 2015, of the Office of International Science and Engineering (OISE) and Integrative Activities (IA) as separate budget activities. All data are presented in the FY 2015 structure for comparability.