Report from NSF

Allena K Opper

- Experimental Nuclear Physics Program Scope
- Announcements
  - Solicitation
  - Funding opportunities and mechanisms
- 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

Neutrinoless Double Beta Decay

Reorganization of NSF Particle Astrophysics Program

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

- Proposals submitted 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/

Highlights – MRI Awards

- PRad experiment – *"High Precision Measurement of the Proton Charge Radius"*.

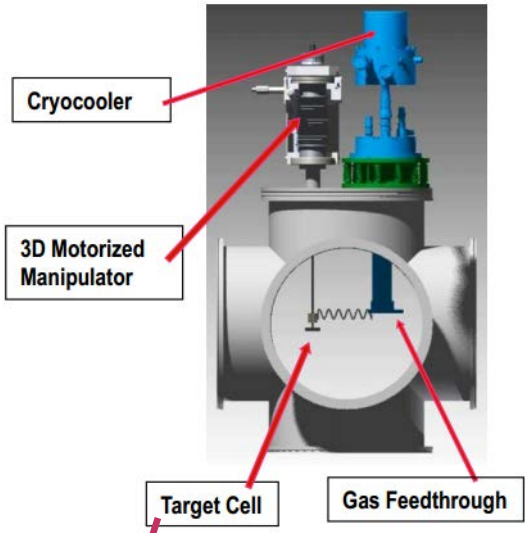
- PRad target – Windowless cryo-cooled hydrogen gas flow target.

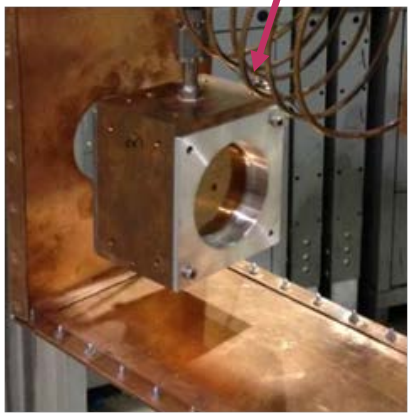
- Target development by JLAB Target Group

- Student Training:
  - 3 undergraduate students (MSU and NCA&T)
  - 3 graduate students (Duke U. and MSU)

- More Senior Personnel:
  - 2 postdocs (Duke U.)

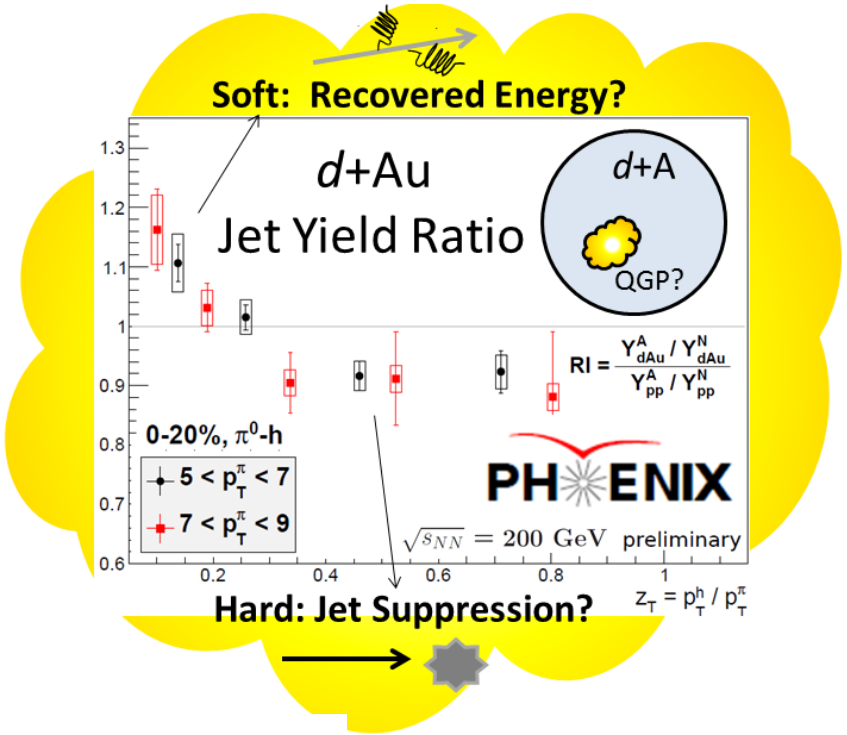
- **Target is ready for installation in Hall B beamline**



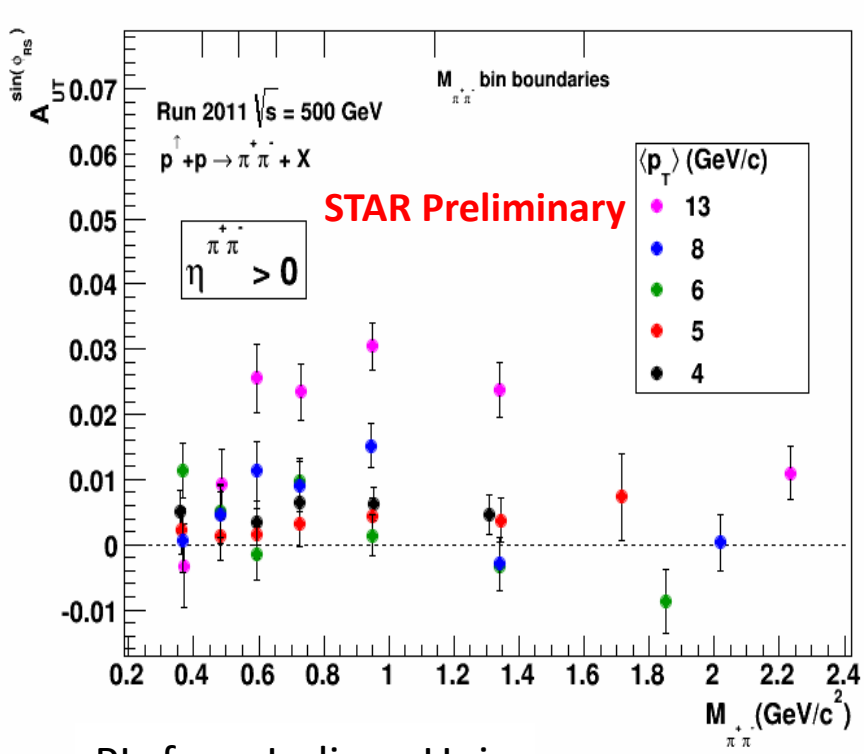


Highlights

- QGP-like collectivity confirmed for relativistic small collisions systems (p+A and d+A) *EXCEPT* no A+A like jet energy loss observed
- New observable based on two-particle angular correlations → QGP-like Jet Energy Loss in d+A



- Spin dependent correlations between 2 charged pions → **first large, transverse spin asymmetries at mid-rapidity**
- Proportional to proton's transversity, most poorly known PDF

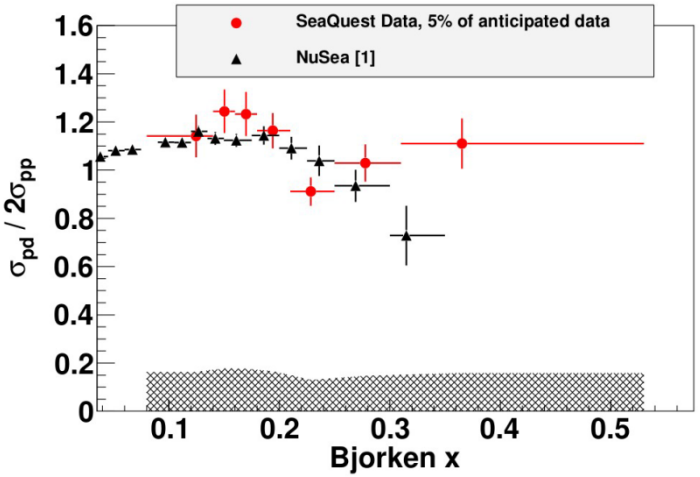


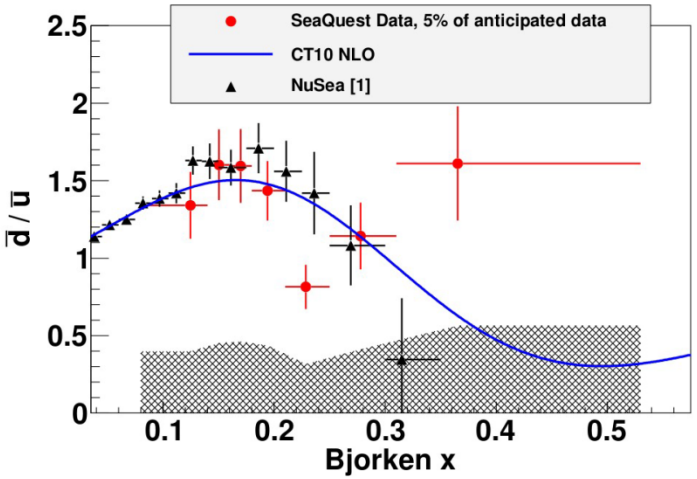
PIs from Indiana Univ

J Frantz, Ohio U

Drell-Yan @ high x

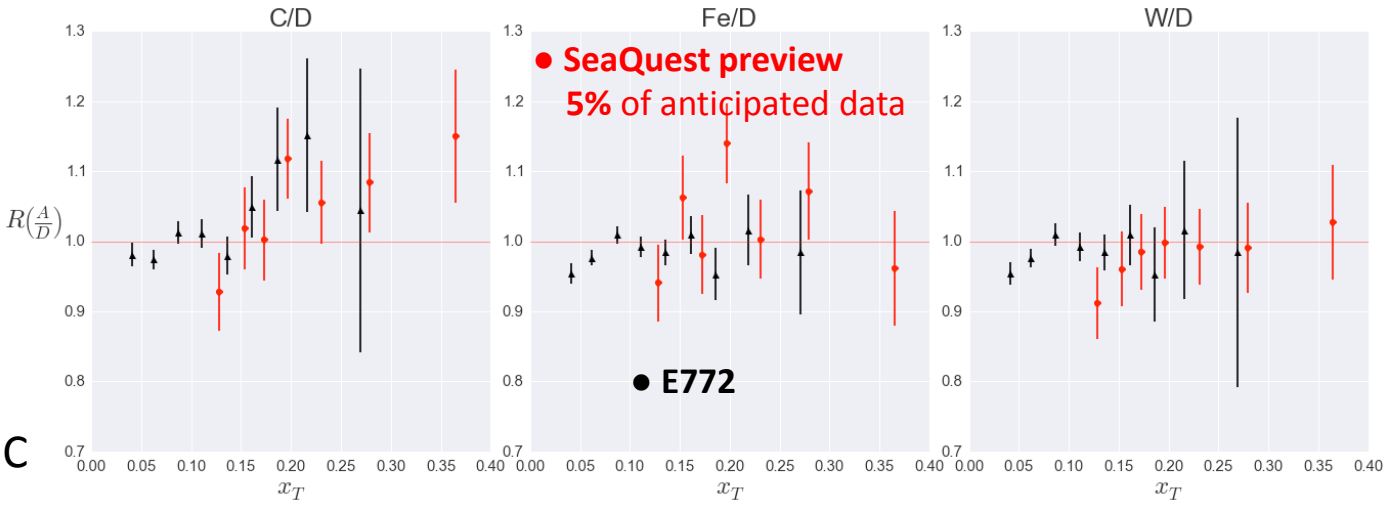
April 2015:
first results,
5% of expected data





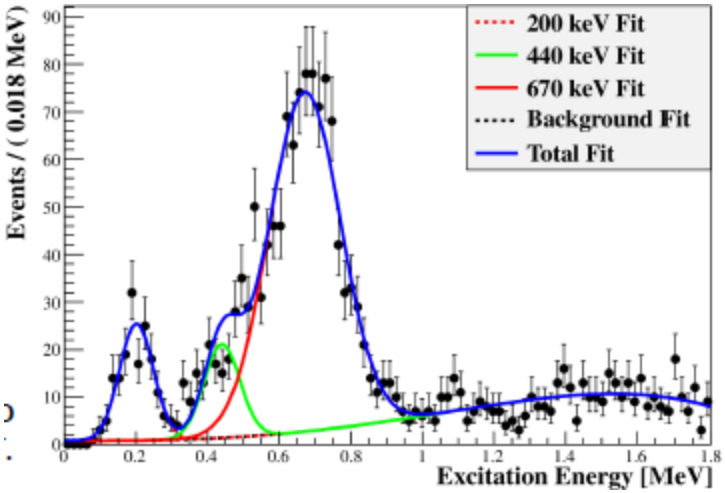
Is there no ***EMC Effect*** *in* ***Drell-Yan*** *σ (pA) / σ (pD) ? ... valence-only effect?*

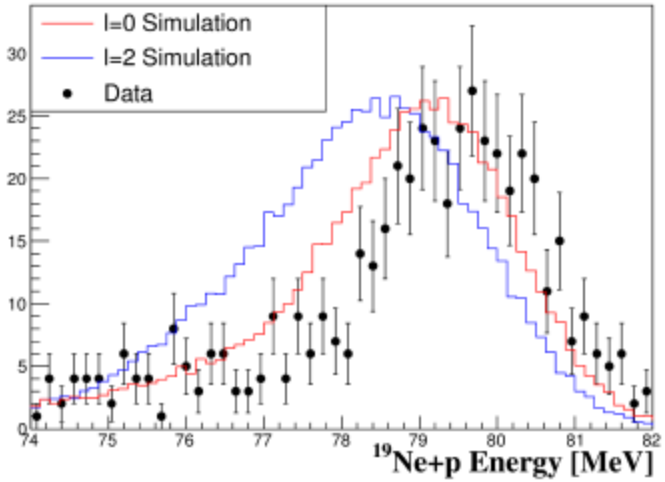
Heavy Targets



from Naomi Makins, UIUC

rp-Process Nucleosynthesis





- **The ^{19}Ne(p,γ)^{20}Na reaction is the first (p,γ) reaction in rp-process nucleosynthesis.**
- Measured (d,n) to resonances with a radioactive beam of ^{19}Ne at FSU's RESOLUT facility
- Unambiguous spin-parity & energy determinations:
- 670 keV 1+ (l=0) resonance, at higher energy than reported
- 440 keV 3+ (l=2) resonance with (l=0) excited state proton-branch
- Astrophysical (p,γ) rate is higher than assumed, because of ^{19}Ne excited state capture
- No “bottleneck” for X-ray bursters
- FSU graduate student J. Belarge

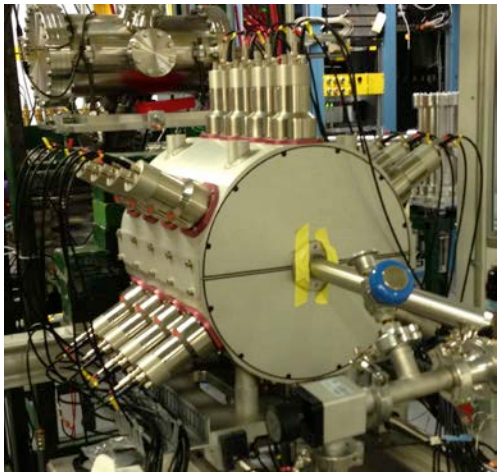
FLORIDA STATE UNIVERSITY

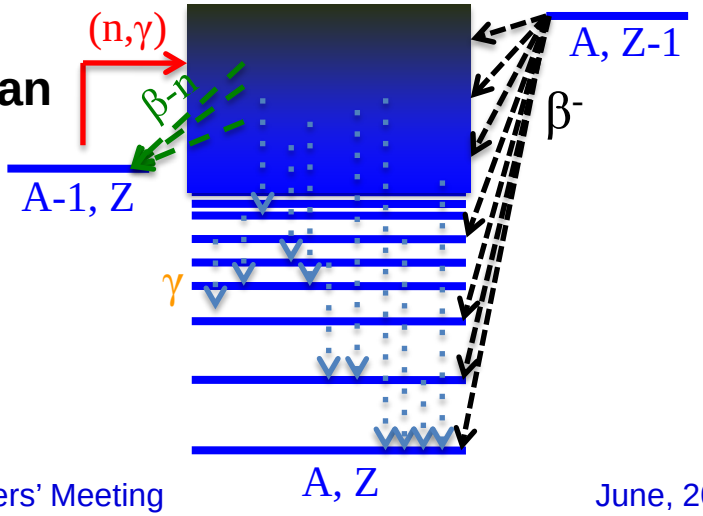
from Sam Tabor, FSU

New Technique Constrains Important Neutron-Capture Rates in r-Process Nucleosynthesis

- For many cases uncertainties > x 100
- Technique uses β^- decay to populate the same nucleus as an (n,γ) reaction → determine its level density and γ-strength function. Knowledge of these can reduce the uncertainty of (n,γ) reaction rates to factors of 2-3. Makes measurements on relevant nuclei possible.
- Addresses one of the most important issues in nuclear astrophysics: **The origin of the elements heavier than iron (r process path and site)**

The Summing NaI (SuN) detector





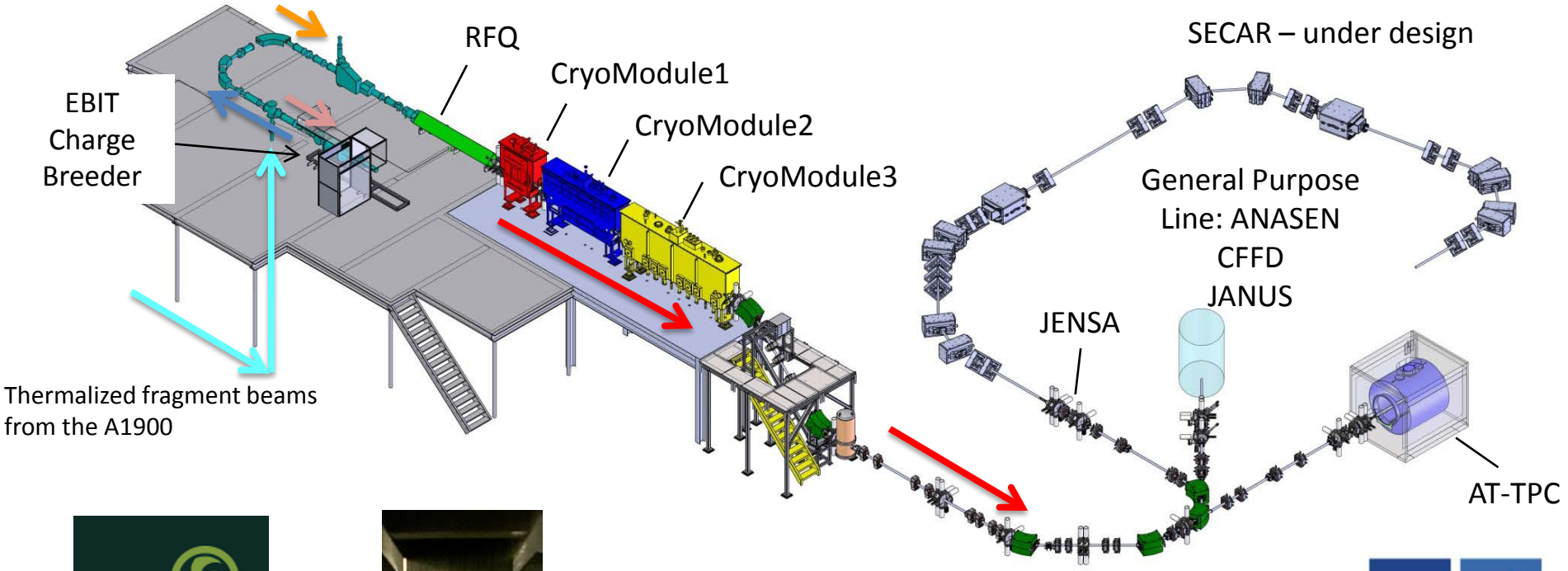
NSCL

JINA–CEE

from Artemis Spyrou, MSU

Re-Accelerator Facility at NSCL – Completed

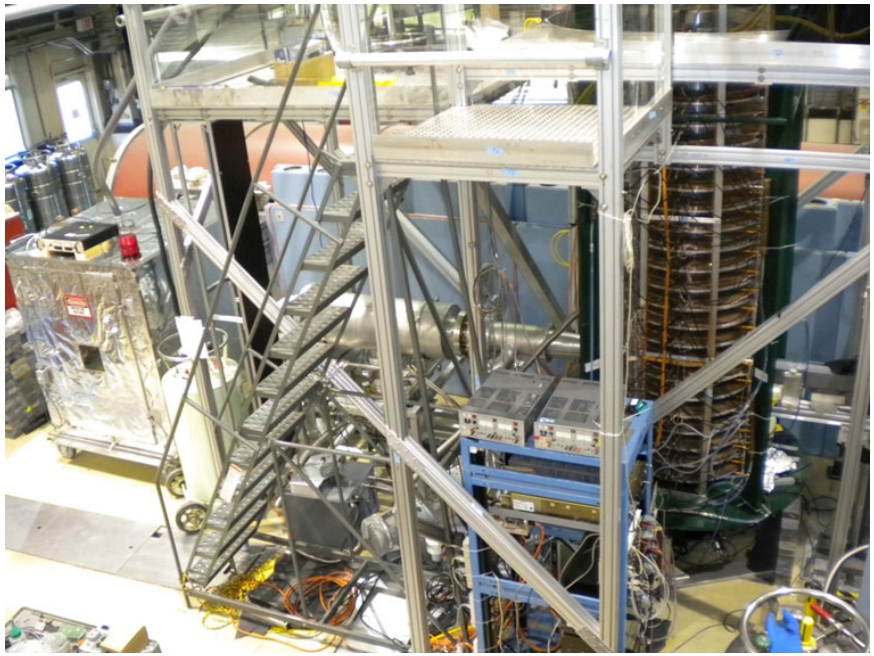
- First re-accelerator coupled to an in-flight rare isotope production facility



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

Precision Measurements

aCORN: Measure correlation between outgoing electron and $\overline{\nu}$ in neutron beta decay ("little a") at NIST moved to new beamline with 10 X higher neutron flux



from F Wietfeldt, Tulane Univ

CUORE-0:

Tower of 52 XLS (13 floors)

~ 11 kg ^{130}Te

Data 2013 – 2015

→ 5 keV resolution

$T_{½} > 3 \times 10^{28}$ yr

CUORE Collaboration

Announcements: Solicitation for NSF Physics Division Investigator-Initiated Research Projects 14-576 (new solicitation out soon 15-XXX)

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

- Deadlines:
  - October 28, 2015 for Particle Astrophysics
  - **N*ovember 13, 2015 for Experimental Nuclear Physics & Theoretical Nuclear Physics***
  - December 3, 2015 Computational Physics
  - February 3, 2016 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

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

REU Supplements

- Available to NSF grantees to fund an undergraduate student (US citizen or permanent resident) for the summer.
- Usually $5,000
- 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 23, 2015 (for MPS)
- Contact program directorfor 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
- ***FY15: Physics received 24 proposals, NP received 8 proposals***
  - Currently being reviewed; highly competitive
- Next deadline: Jan. 13, 2016

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.
- A priority of the division (and the directorate) is to increase the resources available for mid-scale.

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…

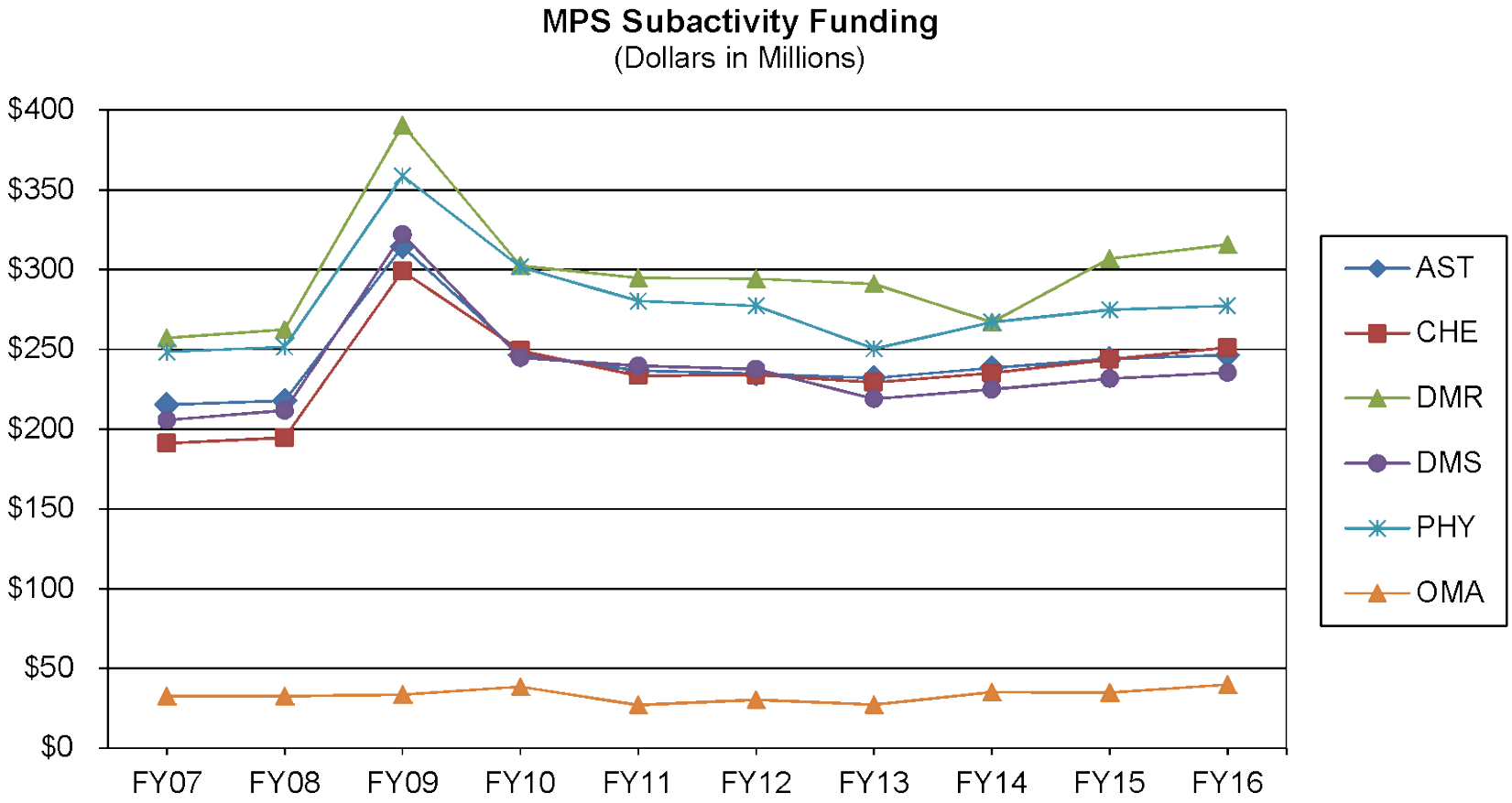
NSF FY15 Operating Budget & FY16 Request

	FY 12 (M$)	FY 13 (M$)	FY 14 (M$)	FY15 Estimate (M$)	Change from FY14	FY16 Request (M$)	Change from FY14
NSF Total	7,105	6,902	7,131	7,344	+2.9%	7,724	+8.3%
R&RA	5,758	5,559	5,775	5,934	+2.7%	6,186	+7.1%
MPS	1,309	1,249	1,268	1,337	+5.4%	1,366	+7.8%

R&RA: Research and Related Activities (includes directorates)
MPS: Mathematical and Physical Sciences

NSF Priority Areas in which PHY participates: Brain, **CIF21**, Optics and Photonics

NSF MPS Funding Trends



FY 2009 funding reflects both the FY 2009 omnibus appropriation and funding provided through the American Recovery and Reinvestment Act of 2009 (P.L. 111-5).

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	Change Over FY 2015 Estimate 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	22.50 ?	-	-
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

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	X,XXX	X,XXX	X,XXX + $0\nu\beta\beta$	X,XXX	X,XXX	YY,YYY	23,000	2,280		1,367	YY,YYY

MRI: competes each year; supplemental one-time acquisition/development funds
Mid-scale: ad hoc competition; supplemental construction funds

NSF/MPS/Physics Personnel

- France Cordova – Director (6 year term started April 2014)
- 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
- Jean Cottam – Particle Astrophysics Program Director
- Jim Whitmore – Particle Astrophysics Program Director

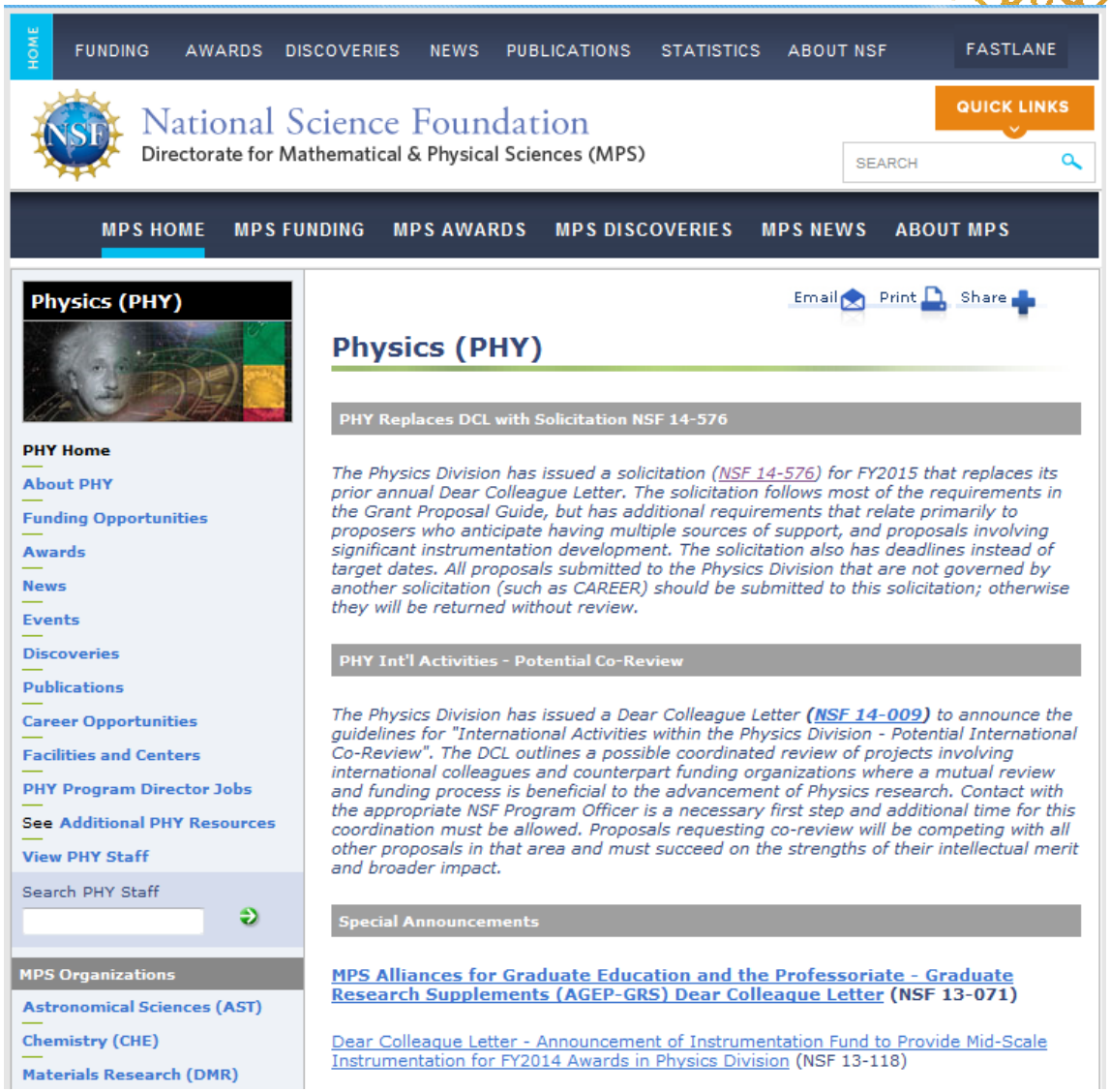
Gail Dodge – returned to ODU in August

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



Backup Slides

Announcements: Diversity

The Physics Division is in a year-long study on increasing diversity in the research community:

- Collecting Best Practices from community, PFCs, Facilities, …
- PHY Web Site http://www.nsf.gov/mps/phy/broadening_participation/index.jsp
  - Departments, Faculty, Postdocs, Students,
  - Recruitment and Retention
  - Statistics and Reports
  - Networks and Organizations

Announcements:
Diversity (continued)

- Send feedback and comments on the website to: Program Director for Integrative Activities in Physics, Dr Kathleen McCloud.

- Providing demographic data voluntary and response rate is very low. NSF needs your help:
  - Data collected are **not** used for research
  - Selecting “prefer not to report” is an option in the system
  - Please encourage the people supported by your NSF awards to respond to the participation reporting system and to include their demographic information

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 Amount	FY 2014 Actual Percent	FY 2015 Estimate Amount	FY 2015 Estimate 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%
Eng Programs	*673.13*	*715.20*	*754.86*	*81.73*	*12.1%*	*39.66*	*5.5%*
SBIR/STTR	*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.