National Science Foundation – Nuclear Physics

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

https://beta.nsf.gov/careers/openings/mps/phy/phy-21-001
www.nsf.gov/careers/rotator

Funding Announcements

PHY Investigator Initiated Research NSF 21-593

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

- Deadlines: First Tuesday in December for *Experimental & Theoretical Nuclear Physics*
  → December 7, 2021 5 pm in your home institution's time zone
- Follow instructions that are specific to this solicitation; non-compliant proposals may be returned without review
- Must conform to the NSF Proposal & Award Policies & Procedures Guide (PAPPG) https://www.nsf.gov/pubs/policydocs/pappg22_1/index.jsp
  - Updated instructions regarding Current and Pending Support and Biographical Sketches of senior personnel

Questions – contact cognizant program director.

Funding Opportunities:
Major Research Instrumentation (MRI)

- Two tracks:
  - Track 1 $100 k < $ from NSF < $1 M; max of 2/university
  - Track 2 $1 M < $ from NSF < $4 M; max of 1/university
- Two types: development and acquisition; “shovel ready”
- Deadlines & details
  - January 1 – January 19, annually (a window of opportunity)
  - https://www.nsf.gov/od/oia/programs/mri/
  - https://www.nsf.gov/pubs/2018/nsf18513/nsf18513.htm
  - *Contact your program directors well ahead of time to discuss & avoid pitfalls*
  - 30% cost share req’d for PhD granting institutions
  - Awards above $1M compete across the entire Foundation

Funding Opportunities (cont): PHY Mid-scale Instrumentation

- Design and Construction *or* Acquisition of Instrumentation
  - "shovel ready"
  - R & early D, operations *funded by research programs*
- ~ $4M < TPC < ~ $20M; over multiple years
- Selection based on
  - merit review
  - exceptional opportunity
  - research community priorities.
- Currently 3 ENP Midscale projects (nEDM, LEGEND-200, MOLLER)
- For more info, see PHY Solicitation & talk with PHY program directors

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, …)
  - US Citizen, US National, or US Permanent Resident
- Stipend, tuition, benefits, and IDC (~$60k)
- Renewable up to two times, no deadline for submission however, early submission suggested

REU Supplements – emphasis on URMs in STEM fields

- US Citizen, US National, or US Permanent Resident

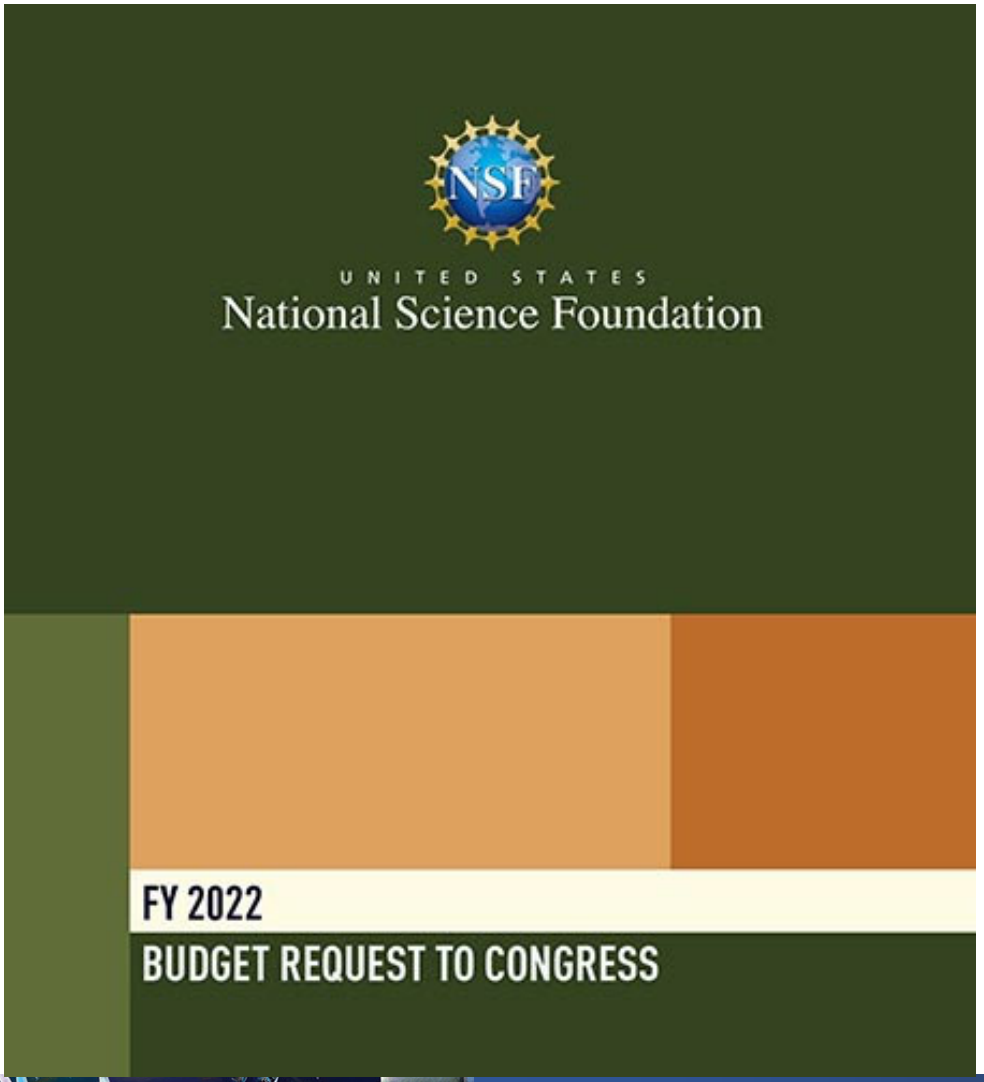
LEAPS and ASCEND

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

- Designed to launch careers of pre-tenure faculty in MPS fields, emphasis on *minority-serving institutions (MSIs), predominantly undergraduate institutions (PUIs), and Carnegie Research 2 (R2) universities* with the goal of achieving excellence through diversity
- Due date = 07-jan-2022 Awards = 24 months, up to $250k

ASCEND - Postdoctoral Research Fellowships NSF 22-501

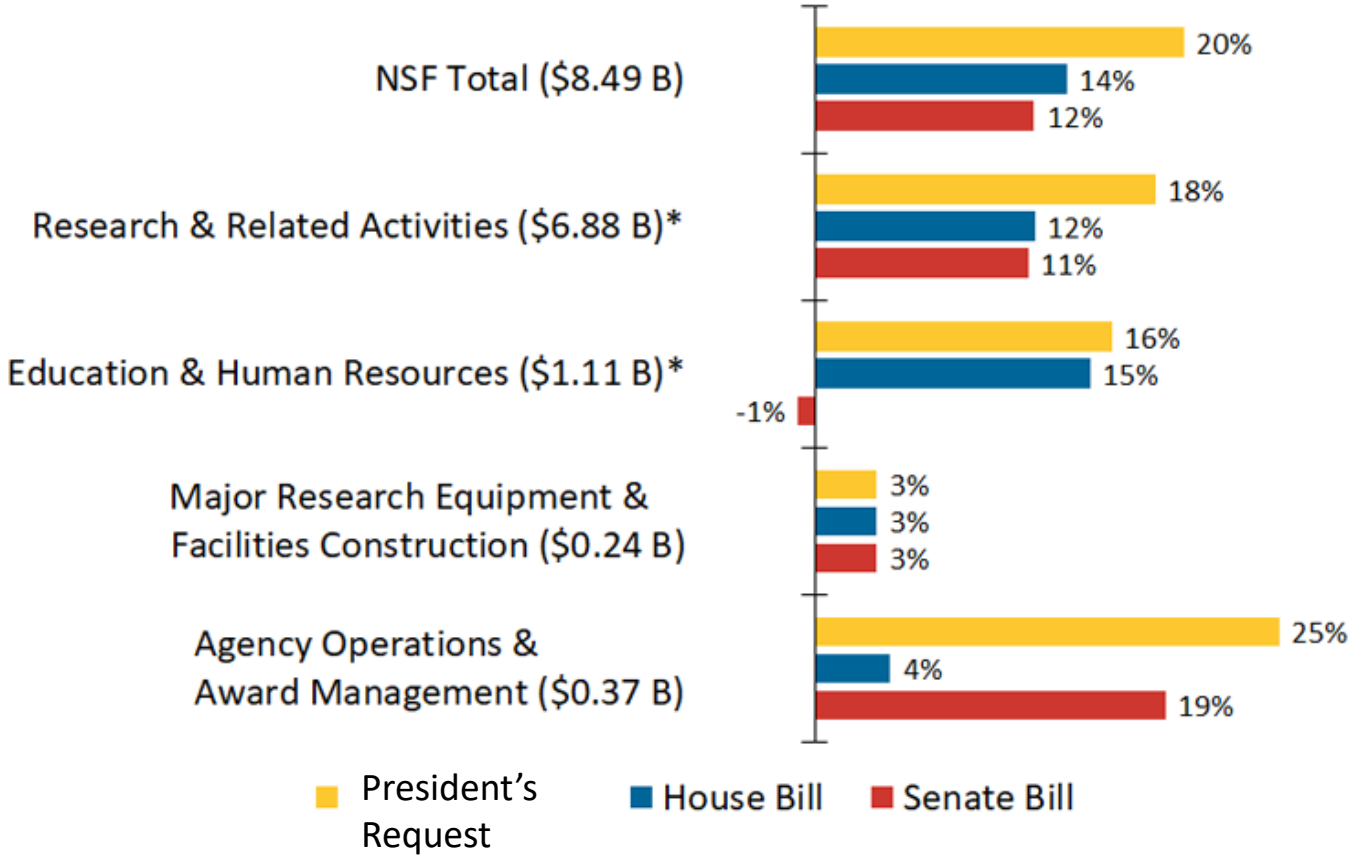
- Goal: to support Postdoctoral Fellows who will broaden the participation of groups that are underrepresented in Mathematical and Physical Sciences (MPS) fields in the U.S.
- And to prepare PD Fellows to transition from a postdoctoral position into the first few years of an academic faculty position
- Fellowships are awards to individuals, not institutions, and are administered by the Fellows
- Due date = 06-jan-2022 $100k/year for up to 3 years



- Enhance fundamental research and development;
- Address racial equity in science and engineering;
- Address climate science and sustainability research;
- Strengthen U.S. leadership in emerging technologies; and
- Construct additional major research facilities.

FY22 Budget Proposals – NSF

$ in ( ) = FY21 estimates



* Figures account for consolidation of the Graduate Research Fellowship Program budget in the EHR directorate.

FY22 President's Budget Request ($M) – Education and Human Resource Directorate BP Programs

	FY 2020 Actual	FY 2021 Estimate	FY 2022 Request	Change over FY 2021 Estimate Amount	Change over FY 2021 Estimate Percent
Broadening Participation: Focused Programs					
ADVANCE	$18.00	$18.00	$20.50	$2.50	13.9%
Alliances for Grad Ed & the Professoriate (AGEP)	8.00	8.00	12.00	$4.00	50.0%
Ctrs of Research Excellence in Science & Tech (CREST)	24.00	24.00	39.00	$15.00	62.5%
Excellence Awards in Science & Engineering (EASE)[1]	7.33	5.00	7.64	$2.64	52.8%
Historically Black Colleges & Universities Undergraduate Program (HBCU-UP)	35.00	36.50	46.50	$10.00	27.4%
Improving Undergraduate STEM Education: Hispanic Serving Institutions (IUSE:HSI)	45.00	46.50	56.50	$10.00	21.5%
NSF INCLUDES	20.75	20.00	46.50	$26.50	132.5%
Louis Stokes Alliances for Minority Participation (LSAMP)	47.49	49.50	69.50	$20.00	40.4%
NSF Scholarships in STEM (S-STEM)[2]	79.91	132.75	121.85	-10.90	-8.2%
Tribal Colleges & Universities Program (TCUP)	15.00	16.50	21.00	$4.50	27.3%
Subtotal, Focused Programs	**$300.48**	**$356.75**	**$440.99**	**$84.24**	**23.6%**

Young Scholars Program @ UIUC

- Six-week summer program for HS students URG & teachers (with stipends)
- Mentoring by GS, PD, and faculty
- Research projects, talks, social time, college prep, capstone poster symposium
- Initiated by UIUC Nuclear Physics Group → expanded to entire college

2021

- Total of 23 students
- Virtual format: pros and cons

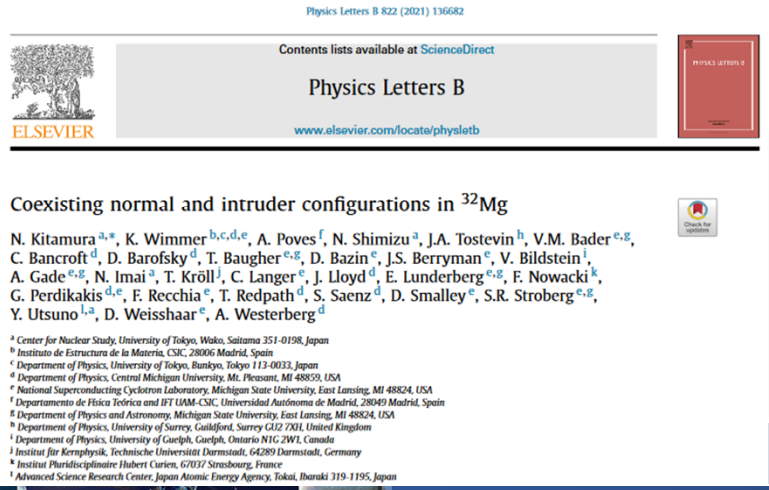
Future options

- "Doughnut" model:
  bring students to campus for first and last (symposium) week

Third and Last GRETINA Campaign at NSCL

GRETINA will return to MSU for early FRIB science

- 2012 – 2020: NSCL hosted GRETINA three times @ S800 spectrograph (NSCL I-III)
- NSCL III finished in FY21: 14 experiments, 2 under COVID safeguards
- So far, >60 papers came out of NSCL I – III with many more to be published (~15 PhD theses completed)


Physics Letters B 822 (2021) 136682

Contents lists available at ScienceDirect

Physics Letters B

www.elsevier.com/locate/physletb

ELSEVIER

Coexisting normal and intruder configurations in ^{32}Mg

N. Kitamura[a,*], K. Wimmer[b,c,d,e], A. Poves[f], N. Shimizu[a], J.A. Tostevin[h], V.M. Bader[e,g], C. Bancroft[d], D. Barofsky[d], T. Baugher[e,g], D. Bazin[e], J.S. Berryman[e], V. Bildstein[i], A. Gade[e,g], N. Imai[a], T. Kröll[j], C. Langer[e], J. Lloyd[d], E. Lunderberg[e,g], F. Nowacki[k], G. Perdikakis[d,e], F. Recchia[e], T. Redpath[d], S. Saenz[d], D. Smalley[e], S.R. Stroberg[e,g], Y. Utsuno[l,a], D. Weisshaar[e], A. Westerberg[d]

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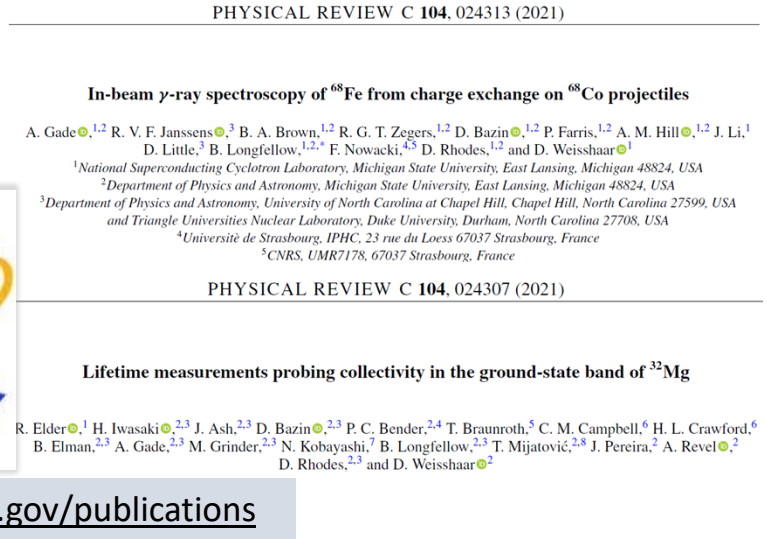
[i] Department of Physics, University of Guelph, Guelph, Ontario N1G 2W1, Canada
[j] Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany
[k] Institut Pluridisciplinaire Hubert Curien, 67037 Strasbourg, France
[l] Advanced Science Research Center, Japan Atomic Energy Agency, Tokai, Ibaraki 319-1195, Japan


PHYSICAL REVIEW C **104**, 024313 (2021)

In-beam γ-ray spectroscopy of ^{68}Fe from charge exchange on ^{68}Co projectiles

A. Gade[1,2] R. V. F. Janssens[3] B. A. Brown,[1,2] R. G. T. Zegers,[1,2] D. Bazin[1,2] P. Farris,[1,2] A. M. Hill[1,2] J. Li,[1] D. Little,[3] B. Longfellow,[1,2,*] F. Nowacki,[4,5] D. Rhodes,[1,2] and D. Weisshaar[1]

[1]National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824, USA
[2]Department of Physics and Astronomy, Michigan State University, East Lansing, Michigan 48824, USA
[3]Department of Physics and Astronomy, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27599, USA and Triangle Universities Nuclear Laboratory, Duke University, Durham, North Carolina 27708, USA
[4]Université de Strasbourg, IPHC, 23 rue du Loess 67037 Strasbourg, France
[5]CNRS, UMR7178, 67037 Strasbourg, France

PHYSICAL REVIEW C **104**, 024307 (2021)

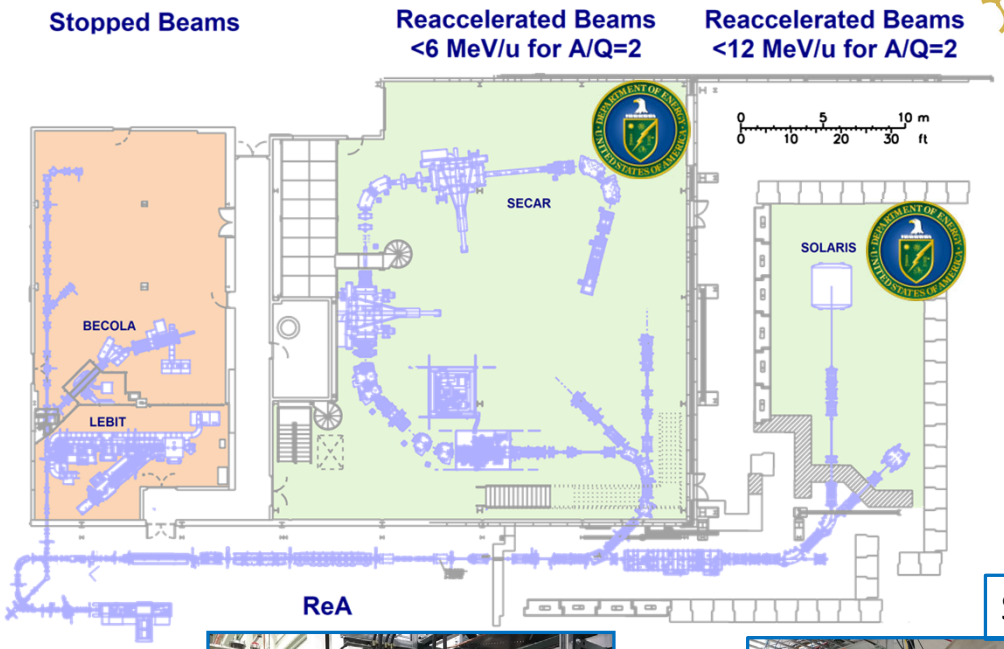
Lifetime measurements probing collectivity in the ground-state band of ^{32}Mg

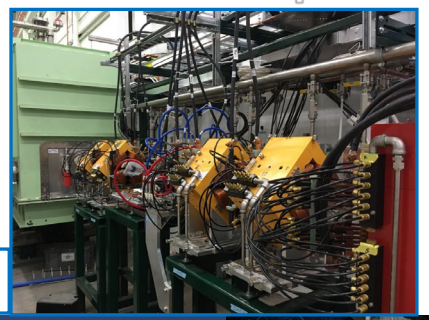
R. Elder[1] H. Iwasaki[2,3] J. Ash,[2,3] D. Bazin[2,3] P. C. Bender,[2,4] T. Braunroth,[5] C. M. Campbell,[6] H. L. Crawford,[6] B. Elman,[2,3] A. Gade,[2,3] M. Grinder,[2,3] N. Kobayashi,[7] B. Longfellow,[2,3] T. Mijatović,[2,8] J. Pereira,[2] A. Revel[2] D. Rhodes,[2,3] and D. Weisshaar[2]

http://gretina.lbl.gov/publications

ReA Stand-Alone Program Running Well

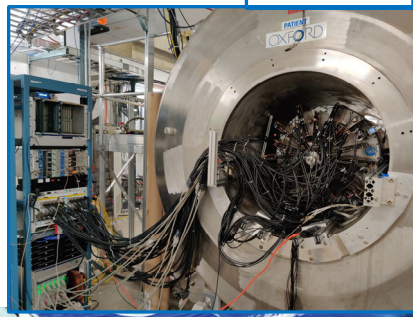
- ReA6 at NSCL is fully operational & ReA Stand-Alone program is underway
- 5 ReA6 experiments completed; experiments with ^{10}Be and ^{7}Be
- New experimental equipment in place and working well
  - SOLARIS (ANL) with AT-TPC
  - SOLARIS with Si detector (ANL)
  - General purpose line
- SECAR recoil separator → direct measurements of astrophysical p- and α-capture reactions at NSCL and FRIB
  - Completed September 2021 on budget and within schedule





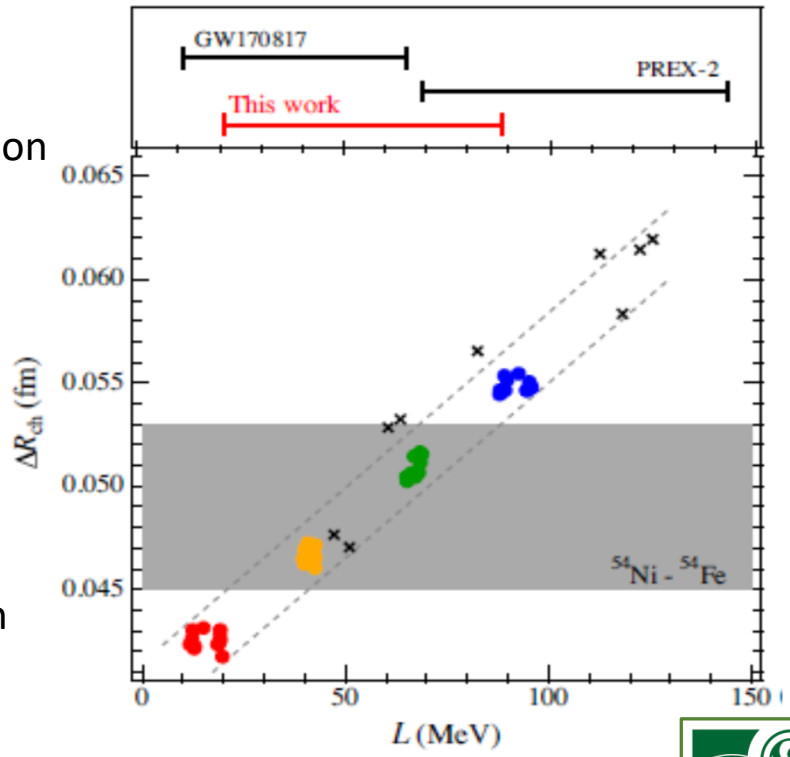
ReA6 Beamline

SOLARIS



EOS Symmetry Energy: Neutron Stars, PV, Mirror Pair Charge Radii

- Nuclear Matter EOS → nuclei structure & stability, nucleosynthesis, NS structure
- For ∞ NM, EOS = $\frac{E}{A}$ – M = $\mathcal{E}_{SNM}(\rho)$ + $\alpha^2 S(\rho)$
  - S(ρ) = "symmetry energy", with ρ dependence = L
- Pressure of n matter → neutrons outward against surface tension
  - Affects NS Radius: NICER + LIGO → 10 <~ L ~< 55 MeV
  - n-skin ($R_n - R_p$) of nuclei (see below)
- PREX @ JLab: elastic e + ^{208}Pb → A_{PV} → R_w → ΔR_{np} → L
- $\Delta R_{np} = R_{ch}(^A_Z X_N) - R_{ch}(^A_N Y_Z) = \Delta R_{ch} \sim |N - Z| \times L$
  - BECOLA @ NSCL:
    ^{54}Ni beam cooled, trapped, co-linear spectroscopy
    → $R_{ch}(^{54}Ni)$ [Z = 28, N = 26]
  - Compare w/$R_{ch}(^{54}Fe)$ [Z = 26, N = 28] → ΔR_{ch} = 0.049(4) fm
  - 21 < L < 88 MeV; somewhat softer than PREX



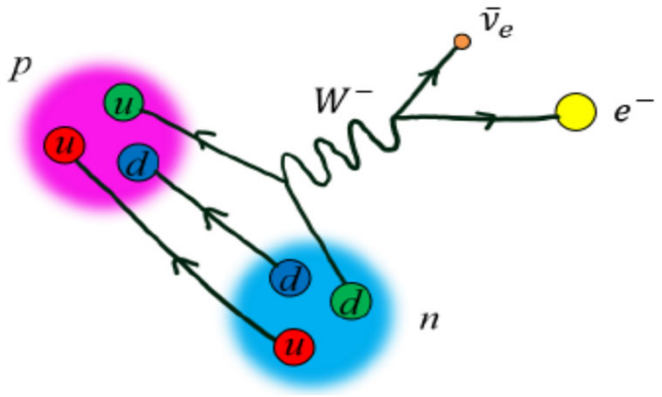
D. Adhikari, et al., Phys Rev Lett, **126**, 172502 (2021)

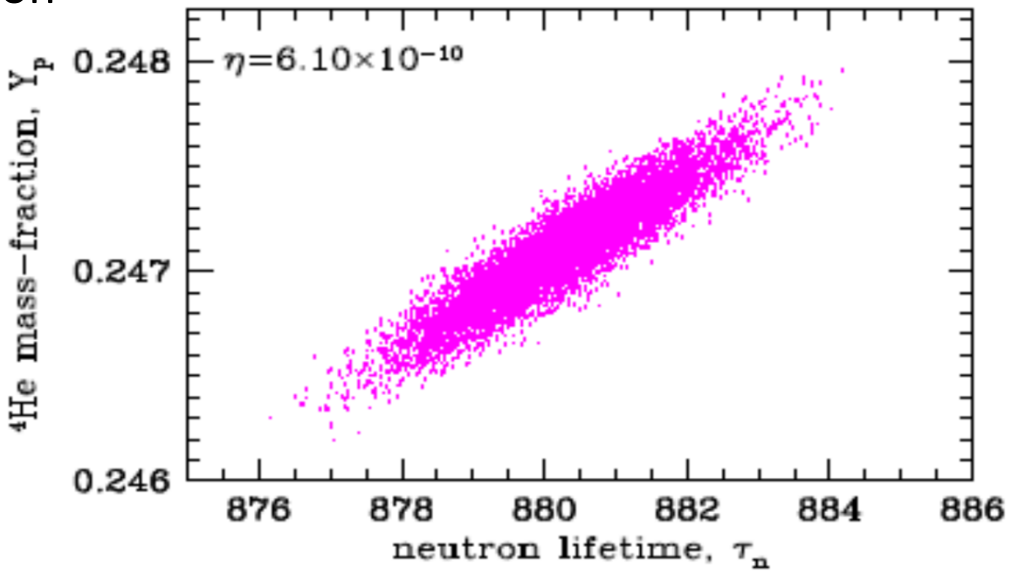
B.T. Reed, et al., Phys Rev Lett, **126**, 172503 (2021)

S.V. Pineda, et al., Phys Rev Lett, **127**, 1825013 (2021)

Improved measurement of free n lifetime

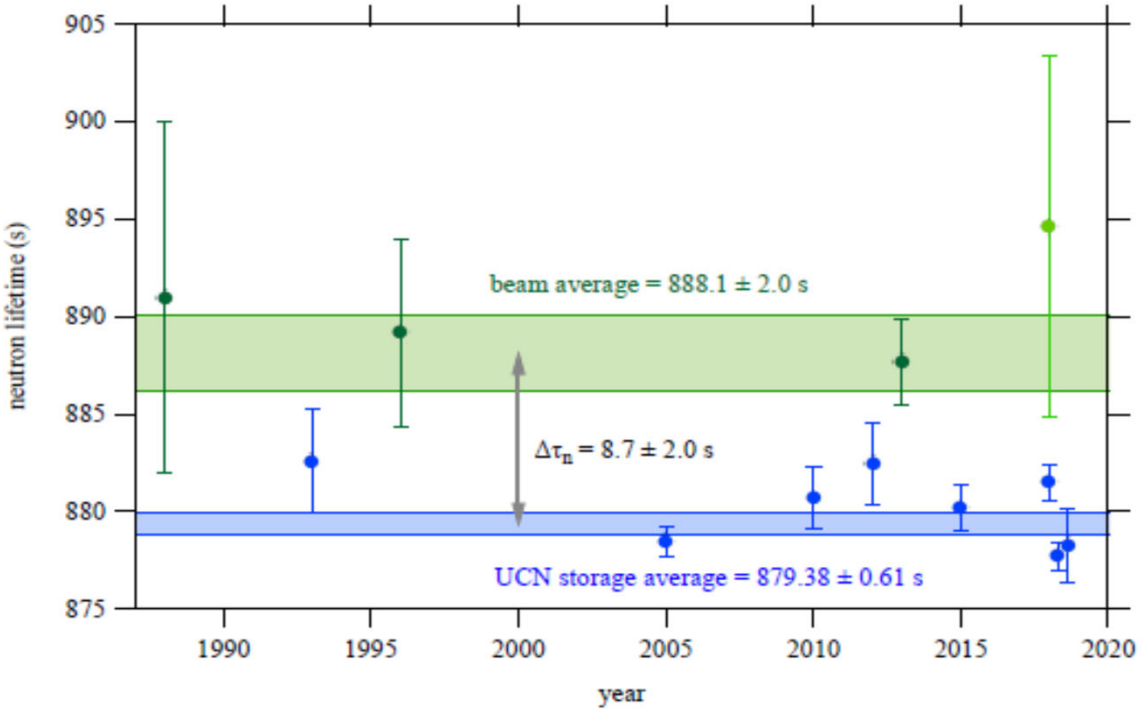
- Free neutron lifetime → weak interaction rates
  - Primordial element formation
    - τ_n dominates theoretical uncertainty of ^{4}He abundance
  - Astronomy: solar cycle, NS formation
  - Electroweak physics

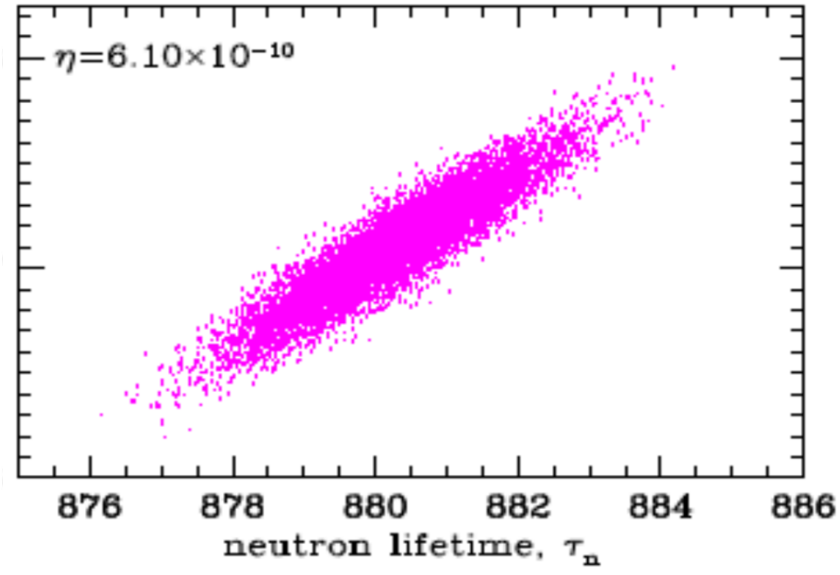




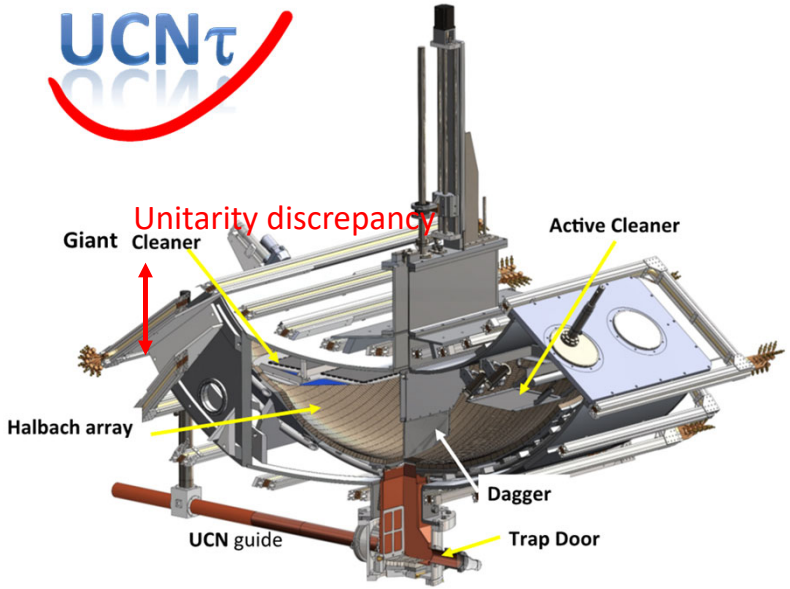
Improved measurement of free n lifetime

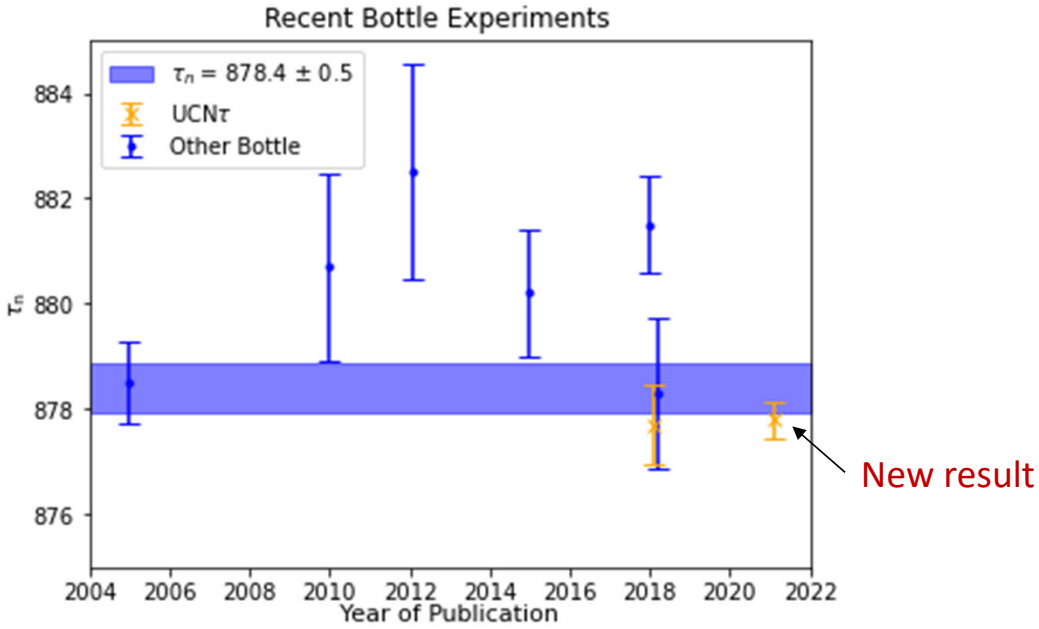
- Free neutron lifetime → weak interaction rates





Improved measurement of free n lifetime

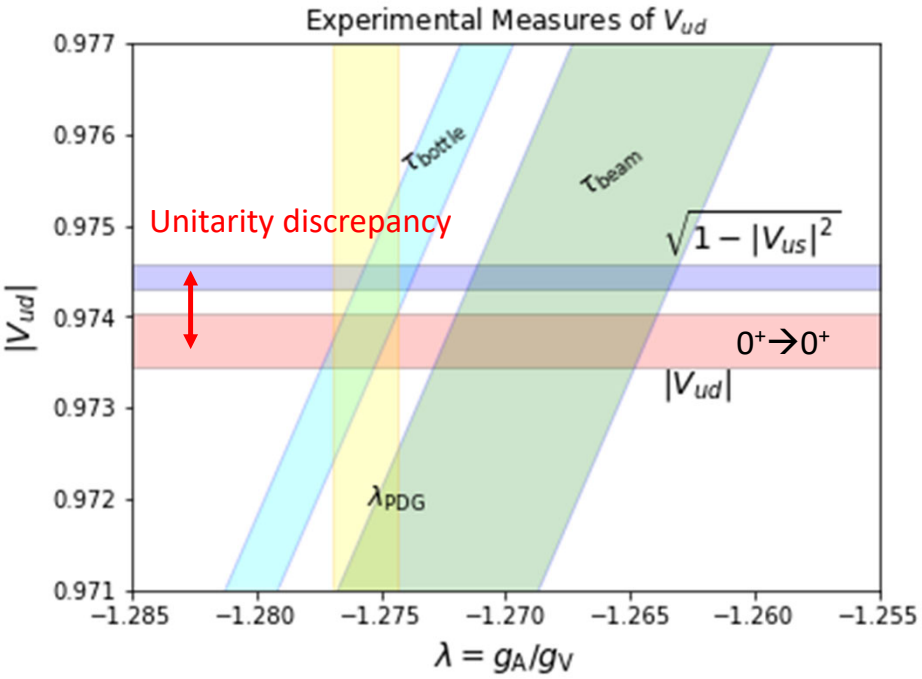


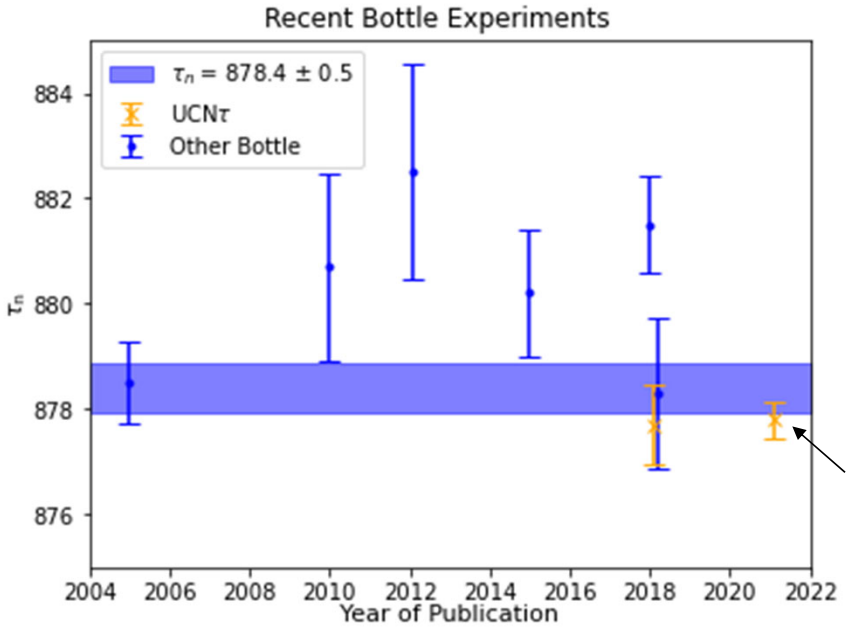


τ_n = 877.75 ± 0.28 (stat) +0.22/-0.16 (sys) s

F.M. Gonzalez, et al., Phys Rev Lett, **127**, 162501 (2021)

Improved measurement of free n lifetime





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F.M. Gonzalez, et al., Phys Rev Lett, **127**, 162501 (2021)

For the latest updates:

https://www.nsf.gov/physics

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