

The Center for Nuclear Astrophysics Across Messengers (CeNAM)

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Michigan State University



An Increasing Number of Fields and Subfields Need to Come Together to Formulate and Address the Open Questions in Nuclear Astrophysics





Centers and Networks Fostering Interdisciplinarity are Key in Nuclear Astrophysics



Kellogg Lab 1959




NIC conference
1990-

Nuclei in the Cosmos Conference Started in Vienna, Austria


US:



1999-2013



2014-2021



2022-

Europe:

CARINA 2006- → EUROGENESIS → ENSARx → ChETEC Action → ChETEC INFRA

VISTARS NAVI

UKAKUREN EMMI CanPAN

BRIDGCE IANNA

IReNA 2020 -

- Centers gaining in importance and size
- as number of subfields increases
 - as number of scientists increases

International Research Network for Nuclear Astrophysics (IReNA) – Connects Astrophysics, Nuclear Physics, ...

 **CaNPAN** Canadian Nuclear Physics for Astrophysics Network
10 Groups from 6 institutions



BRIDGE UK
70 members from 19 institutions



Joint Institute for Nuclear Astrophysics

Replaced by CeNAM



Center for Nuclear Astrophysics across Messengers
97 Institutions, 164 Senior Participants



EU COST Action Nuclear Astrophysics Network
Headquartered at Keele University UK
30 European Countries



Japanese Forum for Nuclear Astrophysics
16 Institutions
119 Scientists



Extreme Matter Institute
Headquartered at GSI Darmstadt, Germany
13 Institutions, 400 scientists

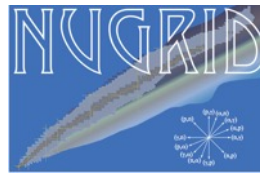
NEW



LIGO-Virgo-Kagra Collaboration
>2000 Scientists



Ibero American Network for Nuclear Astrophysics
27 Scientists from 6 accelerator laboratories in 6 countries.



Computational Network
PI: Edinburgh UK, Victoria Canada, Budapest Hungary, York, UK, Keele, UK
24 Institutions, 64 scientists

Young Researchers Organization Blog

A platform for physicists to share insights, ideas, and experiences.

ABOUT THE BLOG

THE WRITERS

THE TEAM

How to Network at Academic Conferences

3/25/2025

[0 Comments](#)

by Jihye Hong

As a graduate student, you'll definitely have the chance to attend an academic conference at some point—whether to share your research with the scientific community or deepen your knowledge. Conferences are a great opportunity to realize how many people are deeply

Categories

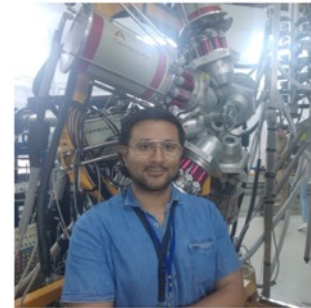
[All](#)
[Games](#)
[Life In Academia](#)
[Abroad](#)
[Parenting](#)
[PhD](#)
[Social](#)
[Work Environment](#)
[Work-Life Balance](#)

Lucas Garrido Gómez



James Keegans

David Godos Valencia

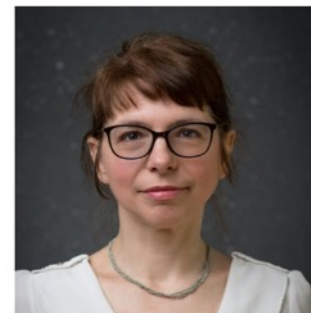


Maria Lugaro

Jihye Hong



Chirag Rath



IReNA Plans

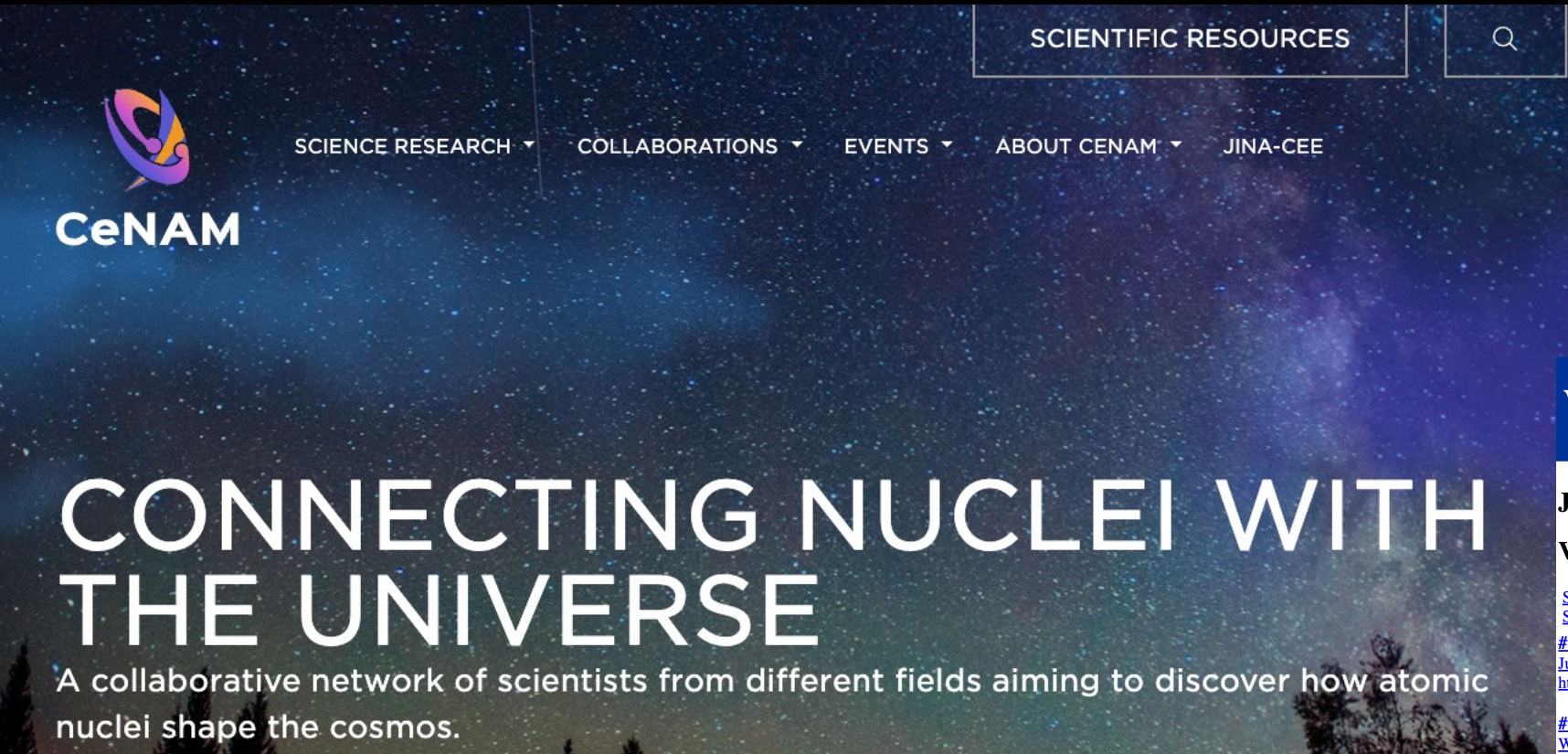
IReNA NSF Accelnet program support ends September 2025

- We plan to continue to maintain IReNA as a framework for international coordination between various networks and centers in nuclear astrophysics
- Financial support for workshops/visits will have to come from individual networks or ad-hoc funding initiatives
- We plan to continue: (with help from member networks)
 - Website and participant lists in collaboration with member networks
 - Online seminar series
 - News from networks
 - Young Researcher Organization



New CeNAM Website (Adapted from JINA-CEE)

Cenamweb.org



- Continue to provide community resources (Jobs, Events, Data, Virtual Journal)
- CeNAM is an open collaborative framework - Signup form to join CeNAM

Virtual Journal of Nuclear Astrophysics

Edited by [Honey Arora](#), Michigan State University and [Fry Fang](#), University of Notre Dame

JINA - Virtual Journal of Nuclear Astrophysics, 9 May 2025

Volume 23, Issue 11 (44 Articles)

[Search this issue...](#)

[Search all issues...](#)

1 - DeepHMC : a deep-neural-network accelerated Hamiltonian Monte Carlo algorithm

[Jules Perret](#), [Marc Ar'ene](#), [Edward K. Porter](#)

<https://arxiv.org/abs/2505.02589>

2 - Final Moments III: Explosion Properties and Progenitor Constraints of CSM-Inter

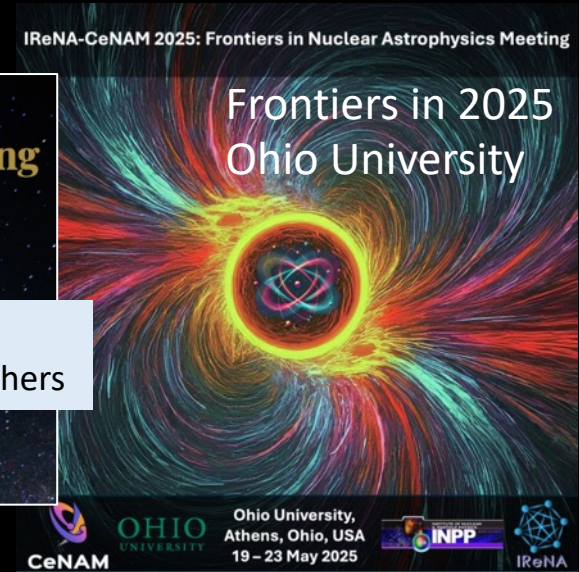
[W. V. Jacobson-Gal'an](#), [L. Dessart](#), [K. W. Davis](#), [K. A. Bostroem](#), [C. D. Kilpatrick](#), [R. Margutti](#), [A. C. Pellegrino](#), [D. A. Howell](#), [J. P. Anderson](#), [C. R. Angus](#), [K. Auchettl](#), [T. G. Brink](#), [R. Cartier](#), [D. A. Coulte](#), [Guo](#), [A. Haynie](#), [G. Hosseinzadeh](#), [A. L. Ibiq](#), [S. W. Jha](#), [D. O. Jones](#), [D. Langeroodi](#), [N LeBaron](#), [E. A. Me](#), [Taggart](#), [V. A. Villar](#), [R. J. Wainscoat](#), [X-F. Wang](#), [A. R. Wasserman](#), [S. Yan](#), [Y. Yang](#), [J. Zhang](#), [W. Zheng](#)

<https://arxiv.org/abs/2505.04698>

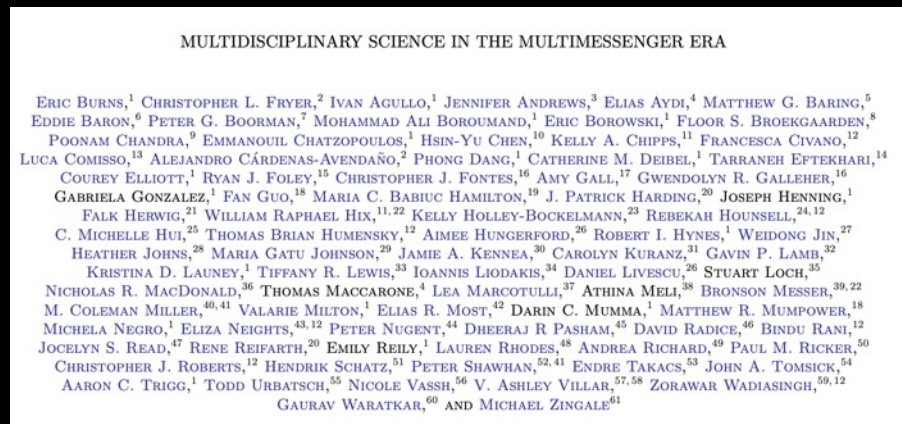
Current Editors: Honey Aurora and Fry Fang

CeNAM Builds on Successful Activities in 2024-2025

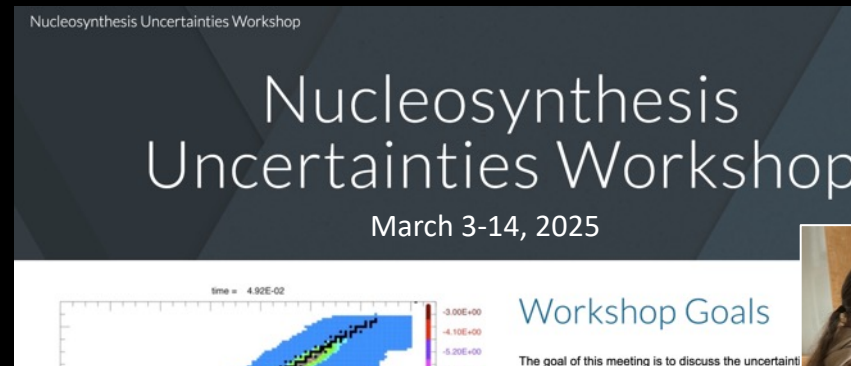
DOE NP Funding for a few workshops



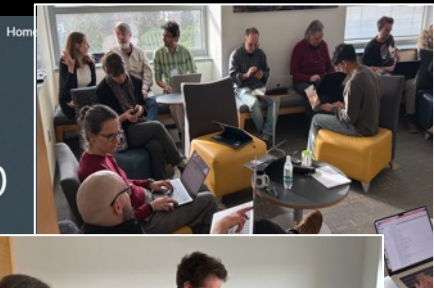
Unique multi-disciplinary workshop bring together different fields and funding agencies



White paper: arXiv:2502.03577



- Focus on outstanding (sometimes ignored) challenges and uncertainties
- Unique workshop format focused on collaborative work
- Joint publications in preparation



3rd TDAMM Workshop

- Unique workshop to discuss interdisciplinary science in the time-domain multi-messenger era – strong nuclear physics participation
- 169 Participants from Nuclear, Astrophysics, Gravity, Plasma, Atomic, Condensed Matter, Computational, Fluid Dynamics, High Energy Density
- Bring together funding agencies and funding areas
- White paper published [arXiv:2502.03577](https://arxiv.org/abs/2502.03577)

MULTIDISCIPLINARY SCIENCE IN THE MULTIMESSENGER ERA

ERIC BURNS,¹ CHRISTOPHER L. FRYER,² IVAN AGULLO,¹ JENNIFER ANDREWS,³ ELIAS AYDI,⁴ MATTHEW G. BARING,⁵ EDDIE BARON,⁶ PETER G. BOORMAN,⁷ MOHAMMAD ALI BOROUHAND,¹ ERIC BOROWSKI,¹ FLOOR S. BROEKGAARDEN,⁸ POONAM CHANDRA,⁹ EMMANOUIL CHATZOPOULOS,¹ HSIN-YU CHEN,¹⁰ KELLY A. CHIPPS,¹¹ FRANCESCA CIVANO,¹² LUCA COMISSO,¹³ ALEJANDRO CÁRDENAS-AVENDAÑO,² PHONG DANG,¹ CATHERINE M. DEIBEL,¹ TARRANEH EFTEKHARI,¹⁴ COUREY ELLIOTT,¹ RYAN J. FOLEY,¹⁵ CHRISTOPHER J. FONTES,¹⁶ AMY GALL,¹⁷ GWENDOLYN R. GALLEHER,¹⁶ GABRIELA GONZALEZ,¹ FAN GUO,¹⁸ MARIA C. BABIUC HAMILTON,¹⁹ J. PATRICK HARDING,²⁰ JOSEPH HENNING,¹ FALK HERWIG,²¹ WILLIAM RAPHAEL HIX,^{11,22} KELLY HOLLEY-BOCKELMANN,²³ REBEKAH HOUNSELL,^{24,12} C. MICHELLE HUI,²⁵ THOMAS BRIAN HUMENSKY,¹² AIMEE HUNGERFORD,²⁶ ROBERT I. HYNES,¹ WEIDONG JIN,²⁷ HEATHER JOHNS,²⁸ MARIA GATU JOHNSON,²⁹ JAMIE A. KENNEA,³⁰ CAROLYN KURANZ,³¹ GAVIN P. LAMB,³² KRISTINA D. LAUNEY,¹ TIFFANY R. LEWIS,³³ IOANNIS LIODAKIS,³⁴ DANIEL LIVESCU,³⁶ STUART LOCH,³⁵ NICHOLAS R. MACDONALD,³⁶ THOMAS MACCARONE,⁴ LEA MARCOTULLI,³⁷ ATHINA MELI,³⁸ BRONSON MESSER,^{39,22} M. COLEMAN MILLER,^{40,41} VALARIE MILTON,¹ ELIAS R. MOST,⁴² DARIN C. MUMMA,¹ MATTHEW R. MUMPOWER,¹⁸ MICHELA NEGRO,¹ ELIZA NEIGHTS,^{43,12} PETER NUGENT,⁴⁴ DHEERAJ R PASHAM,⁴⁵ DAVID RADICE,⁴⁶ BINDU RANI,¹² JOCELYN S. READ,⁴⁷ RENE REIFARTH,²⁰ EMILY REILY,¹ LAUREN RHODES,⁴⁸ ANDREA RICHARD,⁴⁹ PAUL M. RICKER,⁵⁰ CHRISTOPHER J. ROBERTS,¹² HENDRIK SCHATZ,⁵¹ PETER SHAWHAN,^{52,41} ENDRE TAKACS,⁵³ JOHN A. TOMSICK,⁵⁴ AARON C. TRIGG,¹ TODD URBATSCH,⁵⁵ NICOLE VASSI,⁵⁶ V. ASHLEY VILLAR,^{57,58} ZORAWAR WADIASINGH,^{59,12} GAURAV WARATKAR,⁶⁰ AND MICHAEL ZINGALE⁶¹



[Home](#)
[Meeting and Schedule](#)
[Travel and Accommodation](#)

3rd TDAMM Workshop

Multidisciplinary Science in the Multimessenger Era

September 23-26, 2024

Baton Rouge, LA

Lead:
E. Burns
C. Fryer

LSU, DOE's CeNAM, NASA



3rd TDAMM Workshop

- Time Domain Multi-Messenger Science is a high priority frontier with tremendous scientific discovery potential:
 - mapping the complete origin of the elements
 - conducting precision cosmology across the universe
 - understanding extreme matter
 - ...
- A change in approach is needed
 - Fidelity of models and uncertainty treatment not adequate for new data from astronomy, new nuclear facilities, new laser facilities --> quantitative precision era
 - Need end-to-end approach similar to National Security Administration that across all subfields
 - outlines all steps
 - creates connections/work-flow
 - addresses and propagates key uncertainties
 - Can serve as a model for other interdisciplinary fields

Key-Subfields:

- Astro
- Gravity
- Nuclear
- Plasma
- Atomic
- Condensed Matter
- Computational
- Fluid Dynamics
- High Energy Density
- Transport

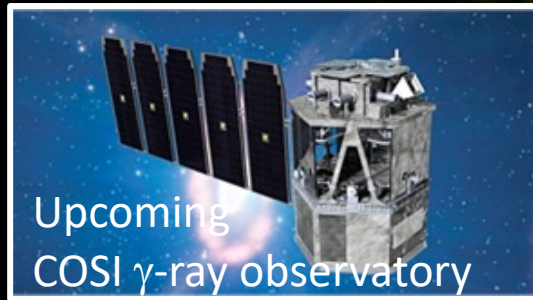
Uncertainties in Nuclear Astrophysics Workshop

Hosted by INT March 3-14

Lead organizer: C. Fryer

How can we get physics out of current and future gamma-ray observations of core collapse supernovae?

No talks – just work



Nuclear
Uncertainties

Astrophysicist Learning Point:
Nuclear uncertainties can have large impact on γ -ray emitter yields



Astrophysical
Model
Uncertainties
(**Progenitor!**, 3D,
Trajectory
approximation,
numerics)

Nuclear physicists LP:
What nuclear physics matters depends on model assumptions
→ Lots of new insights from 3D



[Click to view full size](#)

Large number of potential g-ray emitters

NASA/JPL-Caltech/CXC/SAO



CeNAM

GravNu 2025

July 7 - 11, 2025

Gravitational-wave astronomy meets nuclear astrophysics

at the Nicholas and Lee Begovich Center for Gravitational-Wave Physics and Astronomy,
California State University Fullerton

Organized by Jocelyn Reed



New CeNAM will build the interdisciplinary, world leading expert community needed for nuclear astrophysics using proven approach

- New proposal: 164 Senior Personnel from 97 Institutions (Universities, Colleges, 6 US National Laboratories)
- No official final funding decision, but recommended by program officer
- Now building participant database of early career and senior scientists – CeNAM is an open framework – feel free to join!
(Goal – maintain a list of scientists interested in interdisciplinary connections and activities)

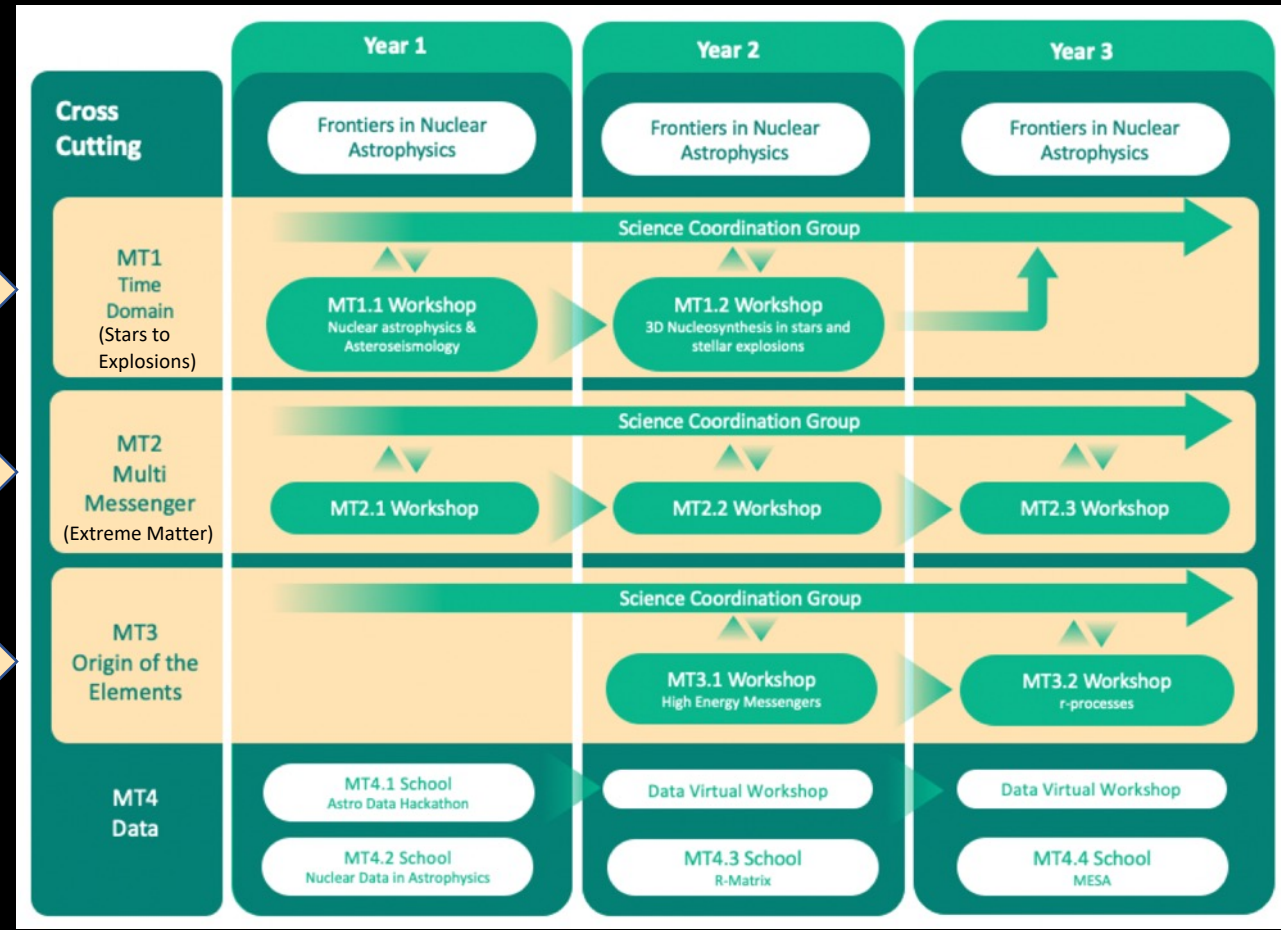




Coming Soon: Interconnected elements of proposed CeNAM framework maximize effectiveness and create sustained community impact

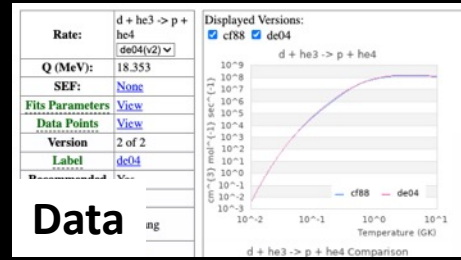
Science coordination groups

- Strong community interest
- Framework for individual scientific efforts to be part of a broader coordinated interdisciplinary effort to achieve larger-scale multi-physics science objectives



CeNAM is an open framework to maximize community impact:

- Open for active participation in CeNAM
- CeNAM workshops, schools, and data are open for all





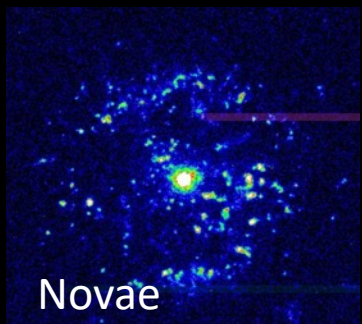
Thank You CeNAM New Proposal Team

- Hendrik Schatz, Michigan State University
- Phil Adsley, Texas A&M University
- Ani Aprahamian, University of Notre Dame
- Melina Avila, Argonne National Laboratory
- John Beacom, Ohio State University
- Earl Bellinger, Yale University
- Carl Fields, University of Arizona
- Anna Frebel, MIT
- Chris Fryer, LANL
- Falk Herwig, University of Victoria (Canada)
- Raphael Hirschi, Keele University (UK)
- Alex Ji, University of Chicago
- Zach Meisel, Airforce Institute of Technology
- Yong-Zhong Qian, University of Minnesota
- Jocelyn Read, California State University Fullerton
- Sanjay Reddy, INT
- Andrea Richard, Ohio University
- Ingo Tews, LANL
- Michael Wiescher, University of Notre Dame
- Paul Woodward, University of Minnesota

Conclusions

- Centers and networks are critical for nuclear astrophysics
- With the multi-messenger and time-domain frontiers opening up and many new capabilities in experimental and theoretical nuclear physics, astronomy, cosmo-chemistry, and astro physical modeling we need to evolve and expand the community and create the connections and approaches needed to take full advantage of the new science opportunities
- Understanding stars is as important as understanding explosive events
 - Progenitor properties shape explosive processes
 - Dynamic processes in stars can have huge impact and require TDAMM modeling tools
 - Asteroseismology opens new pathways to probe stellar processes
- The community agrees: (2023 NP Long Range Plan)
 - **“Multi-disciplinary collaborative centers built around nuclear experiment and theory will expedite discoveries and allow the field of nuclear science to lead the quest to understand the cosmos through novel observations”.**
- IReNA/CeNAM and ChETEC-INFRA address this need together with other international networks— new CeNAM hopefully coming soon
 - Feel free to join IReNA and/or CeNAM

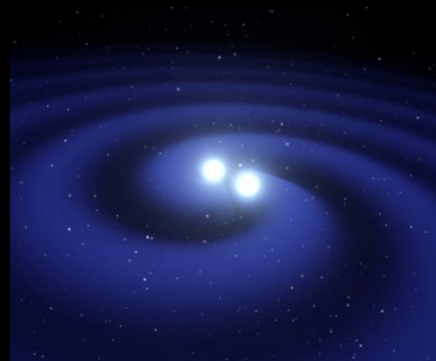
3rd TDAMM Workshop - Sites



Novae



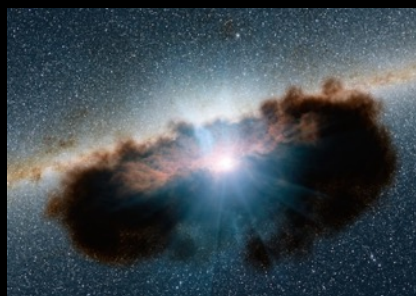
Magnetars



Neutron Star Mergers



Gamma-ray Bursts



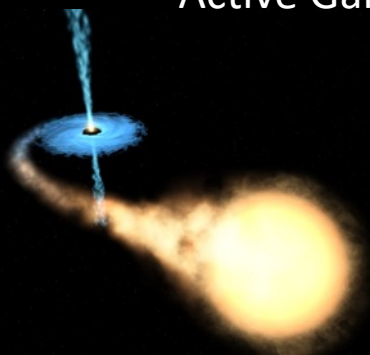
Active Galactic Nuclei



Tidal Disruption Events



Fast Blue Optical Transients



X-ray Binaries



Core Collapse Supernovae



Thermonuclear Supernovae



Fast Radio Bursts