



September NSAC Meeting

NSF OVERVIEW

DR. C. DENISE CALDWELL
SENIOR ADVISOR (OD)



National Science Foundation
Directorate for Mathematical and
Physical Science (MPS)

MPS Senior Staff



David Berkowitz
Assistant Director



Tie Luo
Deputy AD



Dean Evasius
Office of Strategic Initiatives (OSI) Head



Amanda May
Staff Associate for Budget



Jason Stoughton
Staff Associate for Science Communications



Catalina Achim
Staff Associate



Kimberly Bryant
Directorate Operations Officer



Allena Opper
Senior Advisor for Facilities (Acting)



Tim Spuck
Staff Associate for Facilities




Chris Smith
Astronomical Sciences Division Director (Interim)




Lin He
Chemistry Division Director (Acting)



Germano Iannacchione
Materials Research Division Director



David Manderscheid
Mathematical Sciences Division Director



Saul Gonzalez
Physics Division Director



Jim Neff
Deputy DD



George Richter-Addo
Deputy DD (Acting)



Miriam Deutsch
Deputy DD (Acting)



Junping Wang
Deputy DD



Michael Cavagnero
Deputy DD (Acting)



Input to Decision Making



Acts of Congress (ACA, NQI, Chips and Science, etc.)



Administration Priorities (Climate Change, Biotechnology, etc.)



NASEM Studies (Astro2020, decadal surveys, special topics, etc.)



Advisory Committees (NSAC, HEPAP, AAAC, MPSAC)



Workshop Reports

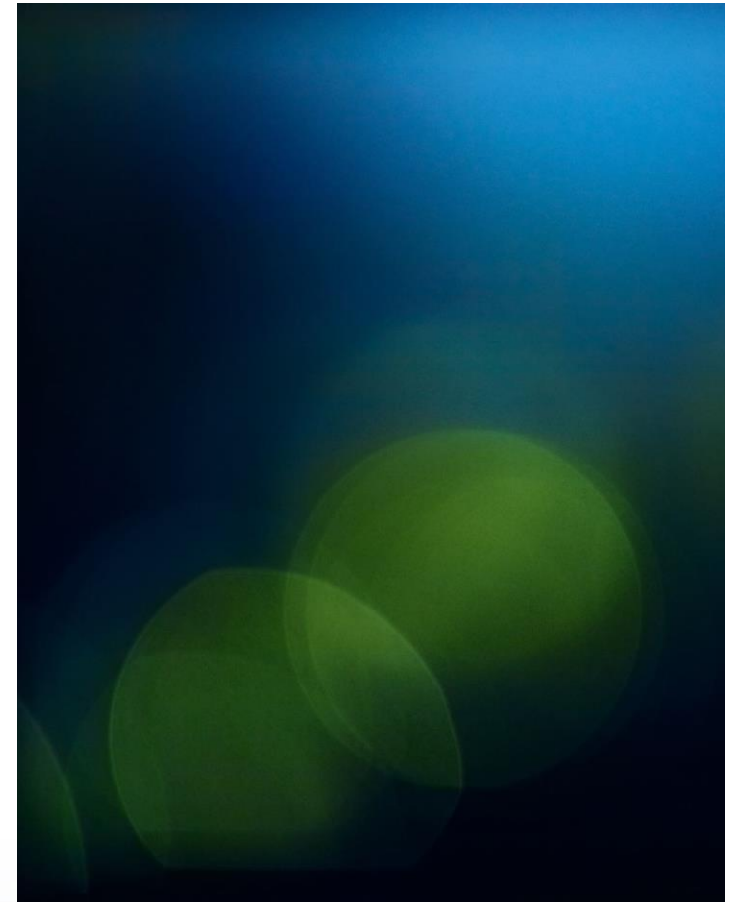
(<https://new.nsf.gov/funding/opportunities/nsf-national-quantum-virtual-laboratory-nqvl>)



Proposals (New ideas from community)



Program Director Expertise





NATIONAL SCIENCE FOUNDATION SUMMARY TABLE

FY 2025 BUDGET REQUEST TO CONGRESS

(Dollars in Millions)

Change Over FY 2023 Base Plan

NSF by Account	FY 2023 Base Plan ¹	FY 2024 (TBD)	FY 2025 Request	Amount	Percent
Research & Related Activities²	\$7,631.02	-	\$8,045.32	\$414.30	5.4%
STEM Education²	\$1,229.28	-	\$1,300.00	\$70.72	5.8%
Major Res. Equip. & Fac. Construction	\$187.23	-	\$300.00	\$112.77	60.2%
Agency Operations & Award Mgmt.	\$463.00	-	\$504.00	\$41.00	8.9%
Office of Inspector General	\$23.39	-	\$28.46	\$5.07	21.7%
National Science Board	\$5.09	-	\$5.22	\$0.13	2.6%
Total, NSF Discretionary Funding	\$9,539.01	-	\$10,183.00	\$643.99	6.8%



NSF FY2025 Budget Request to Congress

MPS Funding

(Dollars in Millions)

	FY 2023 Base Plan ¹	FY 2024 (TBD)	FY 2025 Request	Change over FY 2023 Base Plan	
				Amount	Percent
Astronomical Sciences (AST)	\$288.21	-	\$318.53	\$30.32	10.5%
Chemistry (CHE)	264.99	-	264.99	-	-
Materials Research (DMR)	334.50	-	345.72	11.22	3.4%
Mathematical Sciences (DMS)	248.40	-	248.40	-	-
Physics (PHY)	308.65	-	312.90	4.25	1.4%
Office of Strategic Initiatives (OSI)	215.20	-	191.09	-24.11	-11.2%
Total	\$1,659.95	-	\$1,681.63	\$21.68	1.3%



FY2024 NSF Appropriations

FY2025 NSF Request

Total \$9.06 billion Request \$11.3 billion

Total \$10.183 billion

The Three NSF Pillars

The NSF Strategic Plan 2022-2026



Advancing the frontiers of
research and innovation



Ensuring accessibility
and inclusivity



Being a leader in the global
S&E enterprise

NSF will pursue a vision based upon 3 pillars.

These pillars rest on a foundation of people, ideas, partnerships, and the translation of fundamental research into benefits for society.



FY 2025 President's Request to Congress

**\$10.183
Billion**

+\$1.123 billion
+11.0 % above
FY2024 Enacted



STRENGTHENING
ESTABLISHED NSF



INSPIRING
MISSING MILLIONS



ACCELERATING
TECHNOLOGY AND
INNOVATION

Advance Emerging Industries for National and Economic Security

Build a Resilient Planet

Create Opportunities Everywhere

Strengthen Research Infrastructure



Emerging Industries, FY 2023-FY 2025

Emerging Industries Funding^{1,2}

(Dollars in Millions)

	FY 2023	FY 2024 (TBD)	FY 2025 Request	Change over	
	Base Total			FY 2023 Base Total Amount	Percent
Advanced Manufacturing	\$354.39	-	\$386.67	\$32.28	9.1%
Advanced Wireless	154.02	-	167.90	13.88	9.0%
Artificial Intelligence	663.22	-	729.16	65.94	9.9%
Biotechnology	384.80	-	421.18	36.38	9.5%
Microelectronics/Semiconductors	152.25	-	174.97	22.72	14.9%
Quantum Information Science	266.73	-	294.37	27.64	10.4%

¹ Investments have funding overlap and thus should not be summed.

² The funding levels shown represent NSF's total investment for this area and include contributions from across all directorates and offices.



Emerging Industries - Semiconductors

Future of Semiconductors (FuSe)

24 research and education projects with a total investment of \$45.6 million in FY 2023
Partners: Ericsson, IBM, Intel and Samsung.

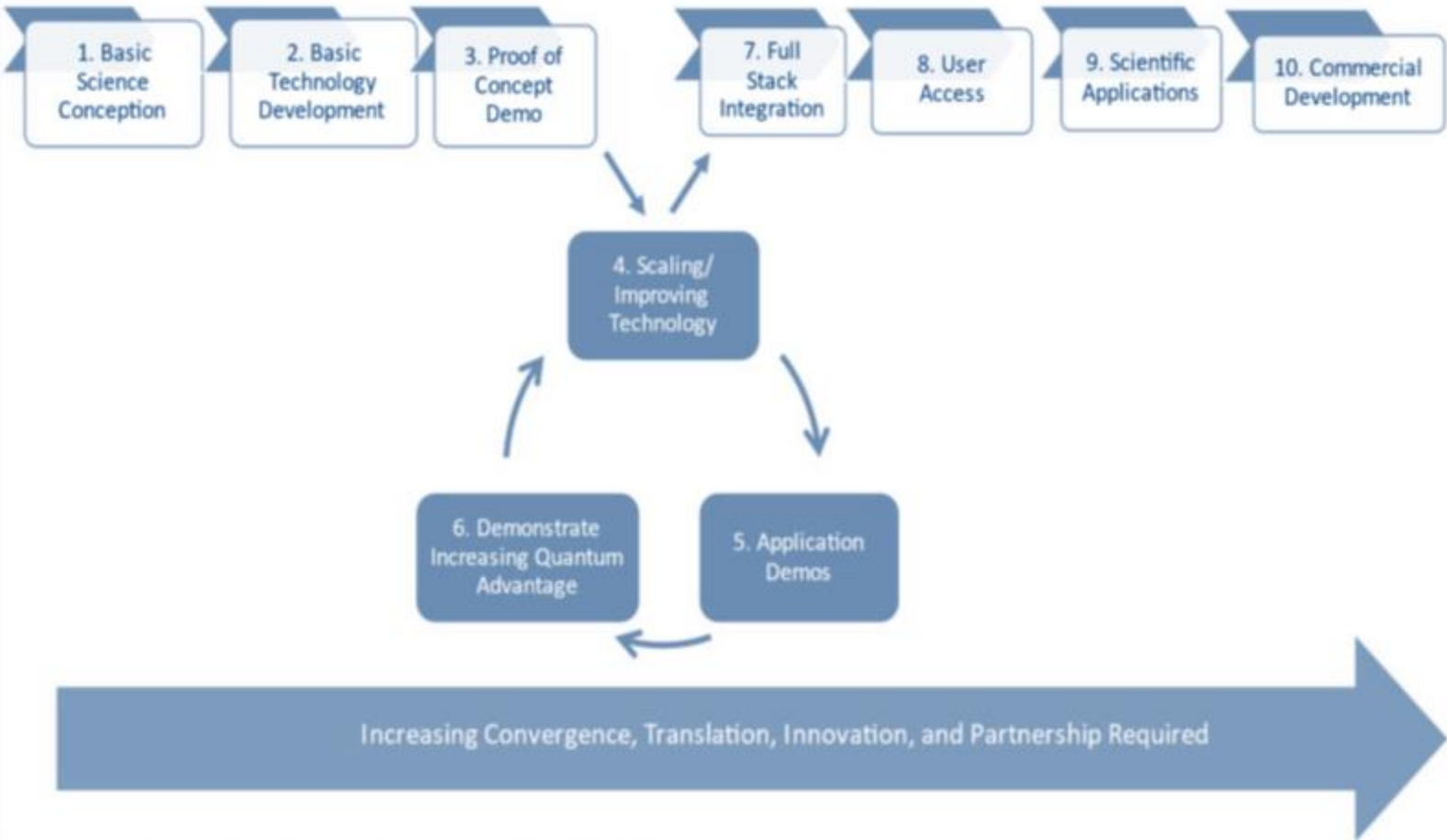
Announcement of FY 2024 awardees from FuSe2 to come soon.

NEW! NSF-DOC MoU paves the way for the creation of a National Network for Microelectronics Education led by a Network Coordination Hub that will oversee a suite of regional consortia and other efforts that offer consistent, rigorous, engaging curricula, instructional materials, experiential opportunities and more to talent throughout the U.S.

[U.S. National Science Foundation and Department of Commerce partner to advance semiconductor workforce development | NSF - National Science Foundation](#)



NSF National Quantum Virtual Laboratory (NQVL)



Co-design

Discoverers, developers, builders, end users



Contributors

Across diverse NSF networks like QLCIs and ExpandQISE



Prototypes

Tools and materials are available to all in the network

Figure 1. The quantum information development cycle.

<https://arxiv.org/abs/2210.14757>



NSF National Quantum Virtual Laboratory (NQVL)

Quantum Science and Technology Demonstrations (QSTD): II. Design & Implementation Phases

An overarching shared infrastructure designed to facilitate the translation from basic science and engineering to the resultant technology. Using a co-design approach, the NQVL aims to begin with fundamental knowledge, and working with end users develop through a prototyping phase application-oriented quantum technologies.

First 5 pilot projects identified.

See NSF National Quantum Virtual Laboratory advances with first five pilot projects | NSF - National Science Foundation

Review for second 5 underway



MPS Artificial Intelligence Institutes

National Artificial Intelligence Research Institutes
Accelerating Research, Transforming Society, and
Growing the American Workforce

PROGRAM SOLICITATION

NSF 23-610

Theme for GROUP 1 Awards in FY 2024:

- AI for Astronomical Sciences
- Jointly funded with the Simons Foundation

Theme for GROUP 2 Awards in FY 2025:

- AI for Discovery in Materials Research
- Jointly funded with Intel Corporation



AI Research Institute for Fundamental Interactions



Molecule Maker Lab Institute (MMLI): An AI Institute for Molecular Discovery, Synthetic Strategy, and Manufacturing



NSF Investment in Sustainable Chemistry

- In response to the 2021 National Defense Authorization Act (NDAA) and the 2022 CHIPS and Science Act.
- NSF works closely with OSTP through its NSTC Sustainable Chemistry Strategy Team to support Sustainable Chemistry, both through the core and center research programs as well as through metaprograms and solicitations.
- NSF also supports the integration of sustainable chemistry into all levels of schooling and professional development.t.

Core Program Investment

Critical Aspects of Sustainability (CAS) Metaprogram through the core program investment to improve the sustainability of resources for future generations while maintain or improve current products in order to offer **technologically-advanced, economically competitive, environmentally-benign and useful materials** to a global society.

Includes an interdisciplinary, collaborative team of program officers from many directorates/divisions within NSF (MPS, ENG, BIO, GEO, and TIP).

Special Funding Call

Molecular Foundations for Sustainability: Sustainable Polymers Enabled by Emerging Data Analytics (MFS:SPEED, NSF 24-567) to support fundamental research enabling the accelerated discovery and ultimate manufacturing of sustainable polymers using state-of-the-art data science, and to enhance development of a cross-disciplinary workforce skilled in this area.



PEPSICO

IBM



• BASF
We create chemistry

MPS Missing Millions Programs

Mathematical and Physical Sciences Ascending Postdoctoral Research Fellowships (MPS-Ascend)
FY 24: 20 awards

Mathematical and Physical Sciences Ascending Faculty Catalyst Awards (MPS-AFCA)
Supports MPS-Ascending postdoctoral research fellows who transition into tenure track faculty positions

Launching Early-Career Academic Pathways in the Mathematical and Physical Sciences (LEAPS-MPS)
FY 24: 65 awards

MPS Partnerships Programs (PAARE; PREC; PREM; PREP; PRIMES)
Supports partnerships between minority serving institutions and MPS centers, institutes, and facilities.
Announcement of FY 2024 awardees to come soon.



Budget Theme: Strengthen Research Infrastructure

*NSTC Definition: Research and Development Infrastructure (RDI) is defined as “facilities or systems used by scientific and technical communities to conduct research and development (R&D) or foster innovation.” The report goes on to note that “RDI elements include experimental and observational infrastructure, knowledge infrastructure, and research cyberinfrastructure—all of which are integrated resources relied upon by our Nation’s R&D enterprise.”

NSF follows this broadly inclusive definition for RI throughout

*National Strategic Overview for Research and Development Infrastructure



Mid-scale Research Infrastructure Program (MsRI 1 and 2)

- Mid-scale Research Infrastructure-1 (MsRI-1) [NSF 24-598](#)
 - Total request: \$6M - \$20M
 - Implementation = “shovel ready”
 - Design/development = to prepare MsRI implementation proposal
- Mid-scale Research Infrastructure-2 (MsRI-2) [NSF 23-570](#)
 - Total request: \$20M - \$100M
 - “Shovel ready”
- Solicitations published in alternate years
- Solicitation scope: NSF-wide

Complemented by MRI (less than \$4M) and programs in AST (MSIP) and PHY



MPS Mid-Scale RI-2 Activity

Mid-scale RI-2: A first-of-its-kind X-ray facility for new science at the high magnetic field frontier

Award Number:1946998; Principal Investigator: Joel Brock; Co-Principal Investigator: Eric Palm, Jacob Ruff, Elke Arenholz, Carlos Cabrera, Jorge Colón; Organization: Cornell University; NSF Organization: DMR Start Date:01/01/2021; Award Amount:\$27,284,021.00

Mid-scale RI-2: Advanced Millimeter Survey Instrumentation in Chile

Award Number:2153201; Principal Investigator: Mark Devlin; Co-Principal Investigator: Suzanne Staggs, Jeffrey McMahon, Jo Dunkley; Organization: University of Pennsylvania; NSF Organization: AST Start Date:05/15/2023; Award Amount:\$30,256,310.00



MPS Mid-Scale RI-1 Activity

Mid-scale RI-1 (M1:IP): Zettawatt-Equivalent Ultrashort Pulse Laser System (ZEUS)

Award Number: PHY-1935950; Principal Investigator: Karl Krushelnick; University of Michigan - Ann Arbor; Award Amount: \$16,669,886

Mid-scale RI-1 (M1:IP): NSF National EXtreme Ultrafast Science (NEXUS) Facility

Award Number: CHE-1935885; Principal Investigator: Lawrence Baker; Ohio State University; Award Amount: \$10,484,658

Mid-scale RI:1 (M1:IP): A world-class Neutron Spin Echo Spectrometer for the Nation: UD-NIST-UMD Consortium

Award Number: DMR-1935956; Principal Investigator: Norman Wagner; University of Delaware; Award Amount: \$11,802,857

Mid-scale RI-1 (M1:DP): Next Generation Event Horizon Telescope Design

Award Number: AST-1935980; Principal Investigator: Sheperd Doeleman; Smithsonian Institution Astrophysical Observatory; Award Amount: \$14,625,302



MPS Mid-Scale RI-1 Activity

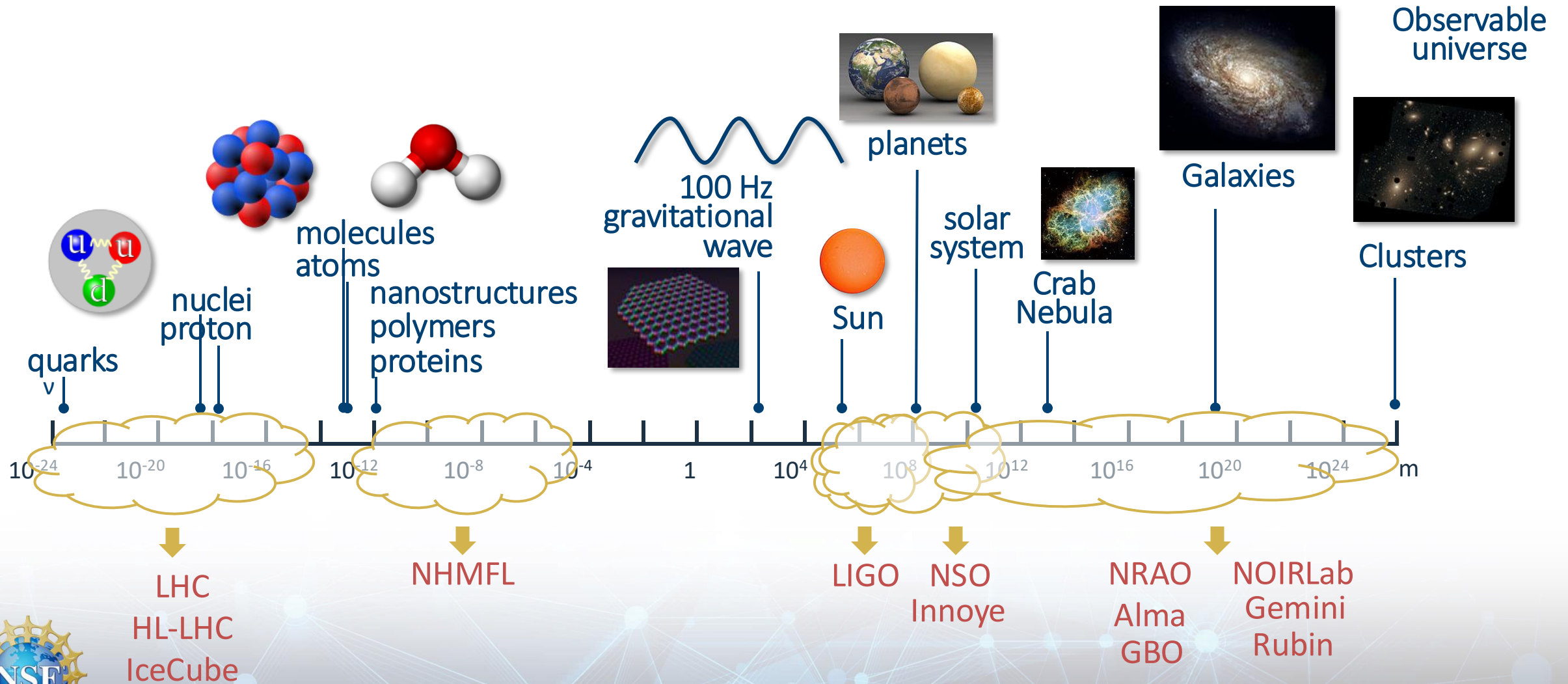
Mid-Scale RI-1 (M1:DP): Preliminary & Final Design of the 40T All Superconducting Magnet Award Number: DMR-2131790; Principal Investigator: Mark Bird; Florida State University; Award Amount: \$15,822,376

Mid-Scale RI-1(M1:DP): Next Generation Radar Designs Award Number: AST-2131866; Principal Investigator: Anthony Beasley; Associated Universities, Inc.; Award Amount: \$4,763,357

Research Infrastructure: Midscale RI-1 (M1:DP): OMEGA-EP-Pumped Optical Parametric Amplifier Line (EP-OPAL) Facility Design Award Number: PHY-2329970; Principal Investigator: Jonathan Zuegel; University of Rochester; Award Amount: \$17,976,642



MPS Major Facilities Portfolio



MPS Breaking News

“NSF-DOE Vera C. Rubin Observatory will capture the faint light of distant brown dwarfs to help scientists understand the Milky Way's formation and evolution”



Credit: NSF-DOE Rubin Observatory/AURA/B. Quint

[Link: NSF-DOE Rubin Observatory will detect thousands of elusive brown dwarfs, unlocking Milky Way mysteries | NSF - National Science Foundation](#)



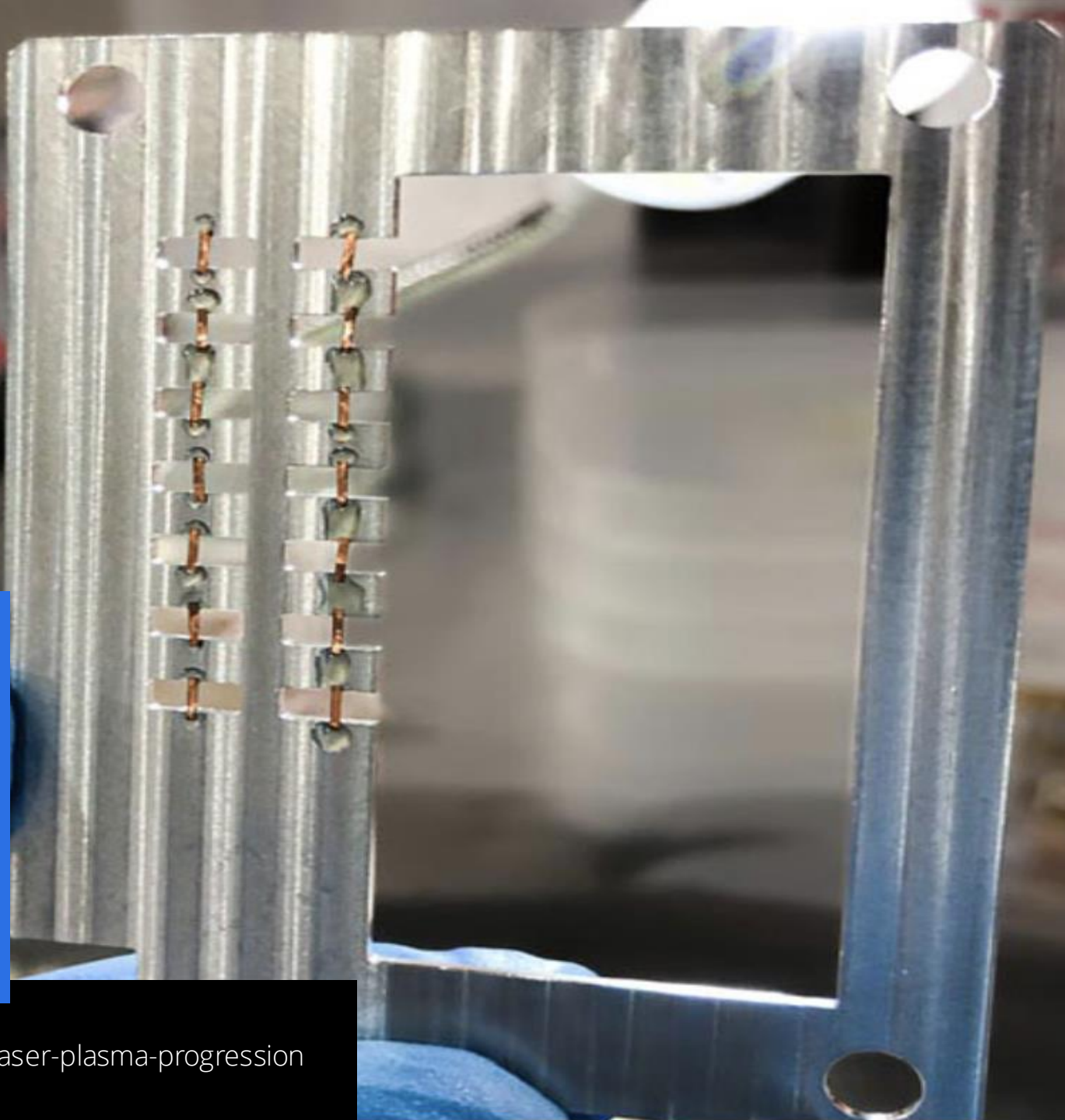


Science Highlight

Tracking plasma progression in a picosecond.

Physicists develop a new method to study high-density plasmas using X-ray Free Electron Lasers.

Source: University of Nevada , Reno/ Michelle Werdann and Hiroshi Sawada



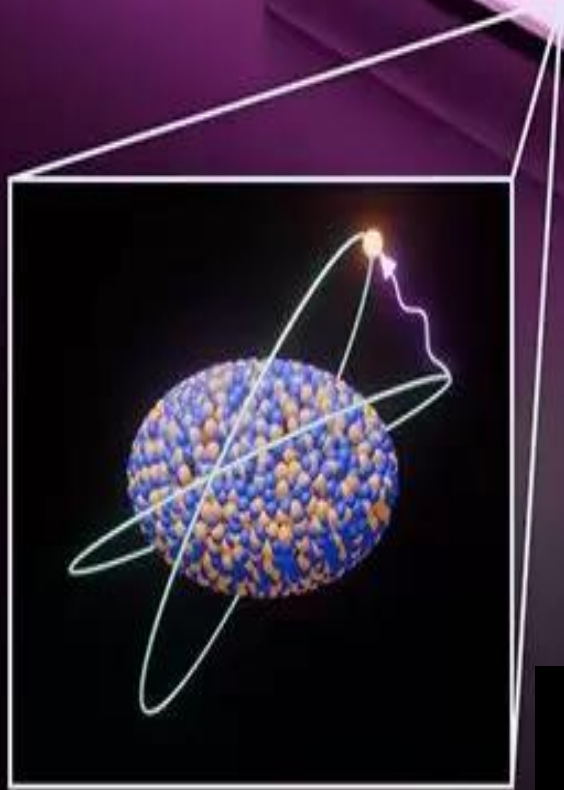
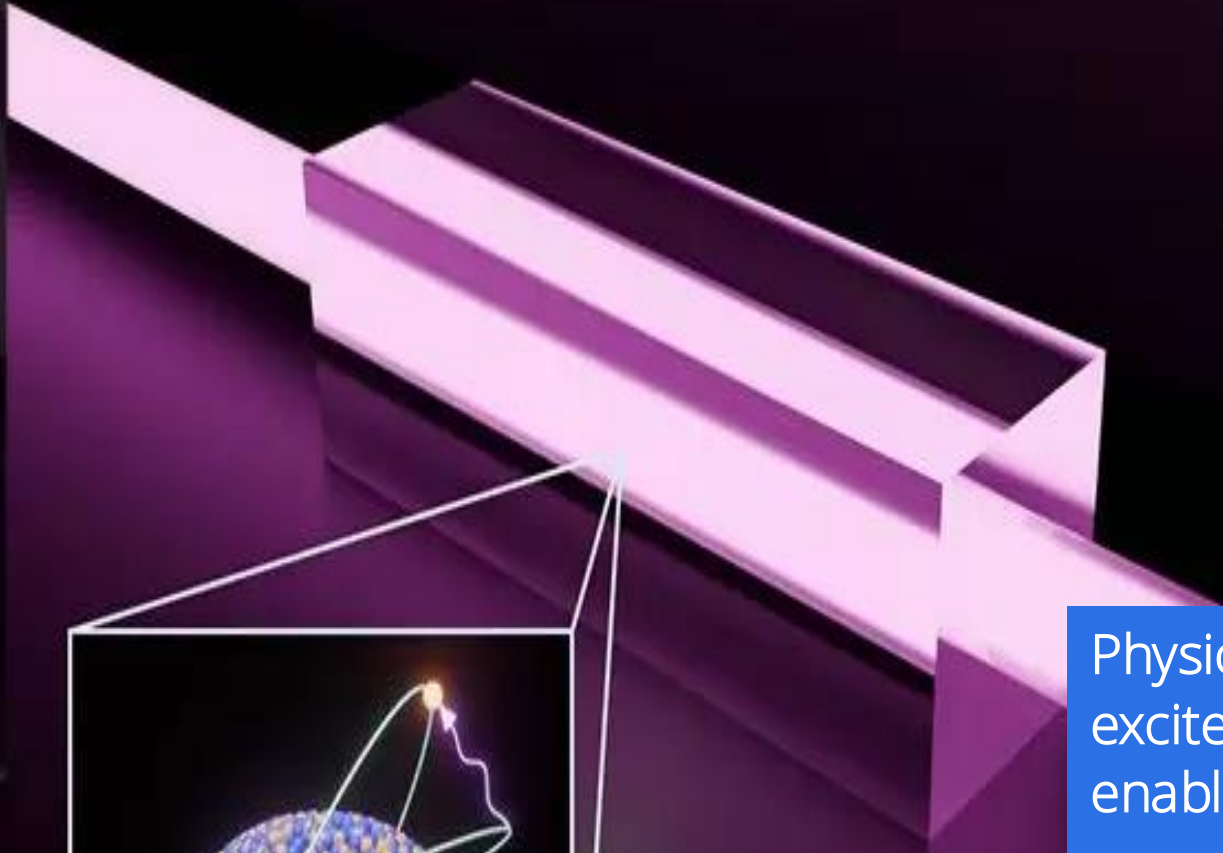


Science Highlight

'Quantum coherence' survives in ultracold molecules.

Scientists are exploring quantum coherence, the ability of particles to be in multiple states simultaneously. The persistence of quantum coherence through chemical reactions, where bonds break and form, is under scrutiny.

Source: Augusto/Adobe Stock (generated with AI)



Science Highlight

Physicists' laser experiment excites atom's nucleus, may enable new type of atomic clock.

Findings reveal potential for new measurement technology so accurate it might determine if some fundamental properties of nature are changing.

Source: Ricky Elwell, Hudson Group, UCLA

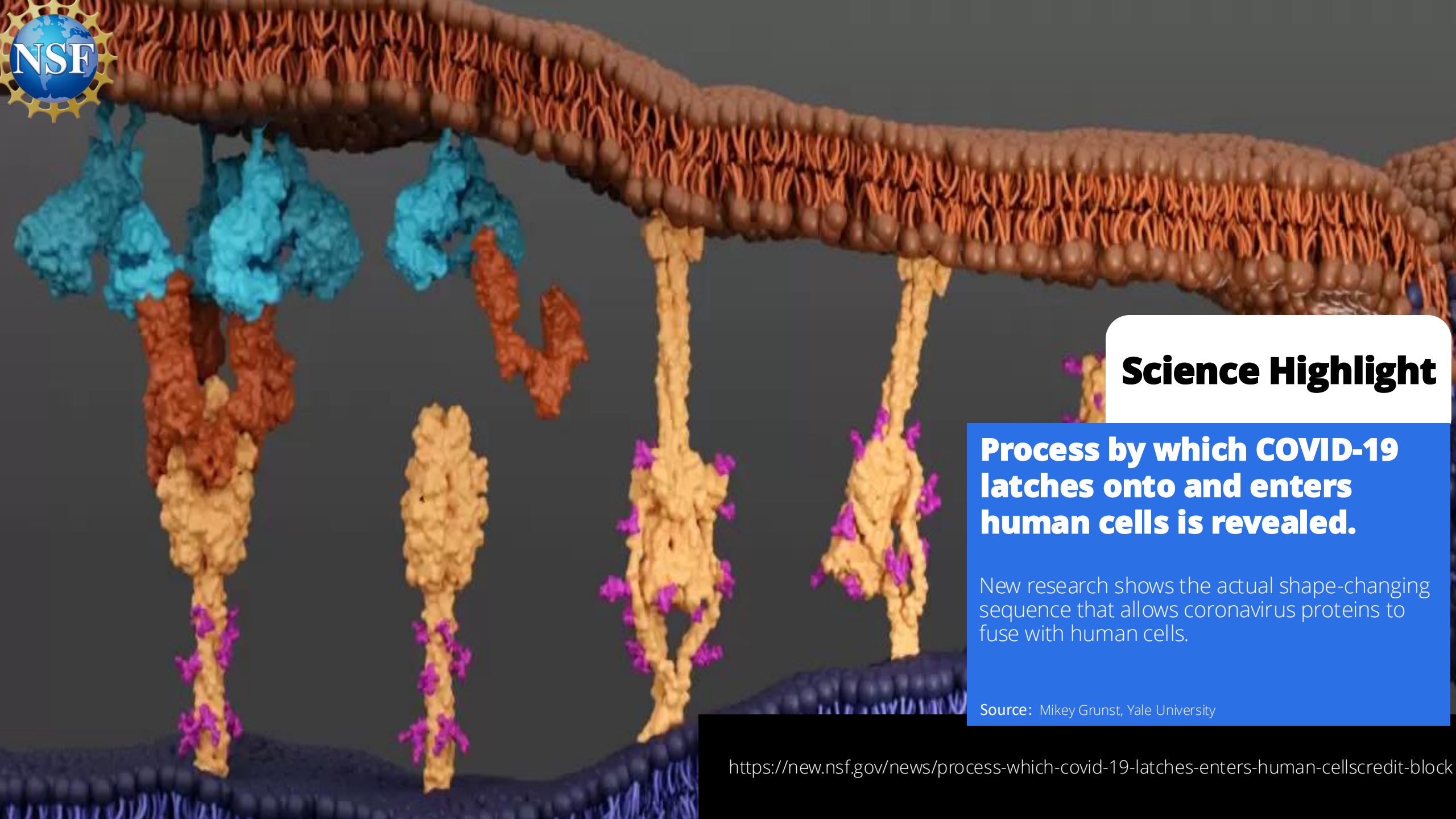


Science Highlight

Physicists create first-ever Bose-Einstein condensate made of molecules.

The ultracold, exotic form of matter had previously been achieved only with atoms of a single element, such as rubidium.

Source: Sebastian Will/ Will Lab/ Columbia University



Science Highlight

Process by which COVID-19 latches onto and enters human cells is revealed.

New research shows the actual shape-changing sequence that allows coronavirus proteins to fuse with human cells.

Source: Mikey Grunst, Yale University

