Office of Science and HEP Overview

Regina Rameika
Associate Director for High Energy Physics
March 24, 2026

U.S. DEPARTMENT of ENERGY | Office of Science

Energy.gov/science

U.S. DEPARTMENT of ENERGY | Office of Science

Our Mission:

Deliver scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States.

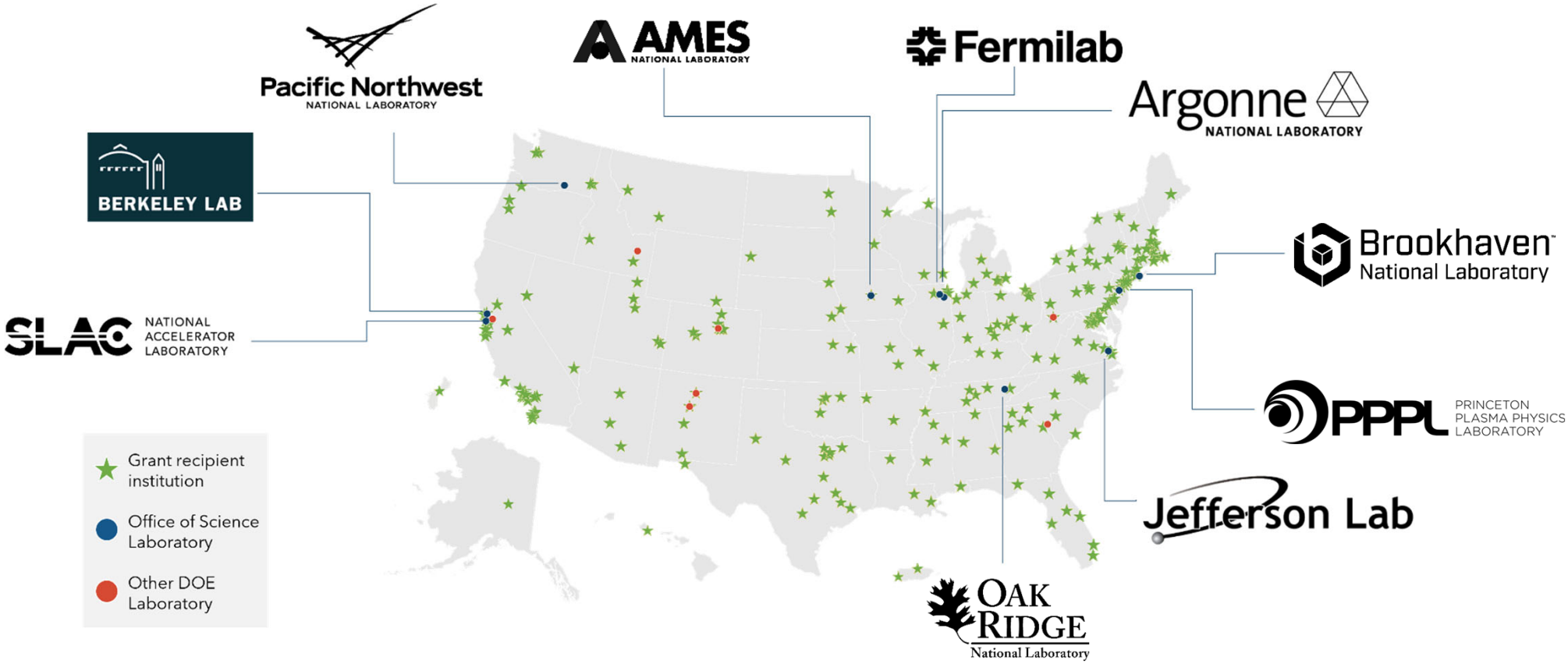
Nearly **28,000** researchers supported at more than **300** institutions and **17** DOE national laboratories

Steward **10** of the 17 DOE national laboratories

Nearly **43,000** users of **28** Office of Science scientific user facilities

$8.4B
(FY26 Enacted)

Where we are, who we support



Office of Science Leads USG Investment in Basic Research for Physical Sciences

Advanced Scientific Computing Research	Delivering world-leading supercomputing, quantum, and AI capabilities
Basic Energy Sciences	Leading the discovery and design of new materials and chemical processes for advanced batteries, microelectronics, and quantum systems
Biological and Environmental Research	Driving discovery and integration of biological, Earth, and environmental systems to secure the nation's energy, economy, and infrastructure
Fusion Energy Sciences	Developing the foundations of fusion and plasma science to build a fusion energy source
High Energy Physics	Building tools for exploring our universe and discovering the elements of matter and energy
Nuclear Physics	Solving fundamental questions about nuclear matter at the forefront of physics and energy sciences
Isotope R&D and Production	Ensuring national preparedness by producing and securing unavailable or scarce isotopes

Office of Science Leads USG Investment in Basic Research for Physical Sciences

Advanced Scientific Computing Research	Delivering world-leading supercomputing, quantum, and AI capabilities
Basic Energy Sciences	Leading the discovery and design of new materials and chemical processes for advanced batteries, microelectronics, and quantum systems
Biological and Environmental Research	Driving discovery and integration of biological, Earth, and environmental systems to secure the nation's energy, economy, and infrastructure
Fusion Energy Sciences	Developing the foundations of fusion and plasma science to build a fusion energy source
High Energy Physics	Building tools for exploring our universe and discovering the elements of matter and energy
Nuclear Physics	Solving fundamental questions about nuclear matter at the forefront of physics and energy sciences
Isotope R&D and Production	Ensuring national preparedness by producing and securing unavailable or scarce isotopes

Office of Science User Facilities Accelerate Innovation

FY 2025
28 scientific user facilities
nearly **43,000** users

OLCF

ALCF

NERSC


ESnet


EMSL


ARM

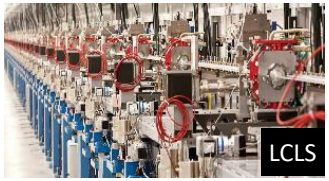

JGI


SNS

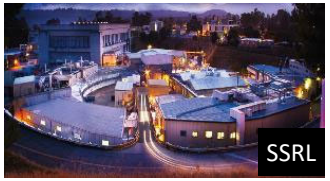

HFIR


ALS


APS


LCLS


NSLS-II


SSRL


CFN


CINT


CNM

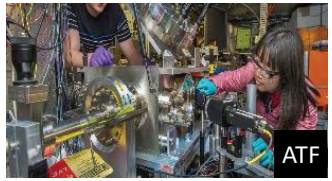

CNMS


TMF


DIII-D

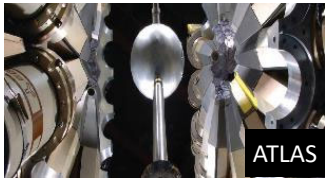

NSTX-U


FACET


ATF


Fermilab AC


CEBAF


ATLAS


RHIC


FRIB

U.S. DEPARTMENT of ENERGY
Office of Science

[DOE Genesis Mission National Science and Technology Challenges]

Genesis Mission will revolutionize American science and innovation

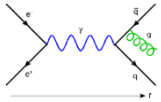
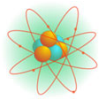
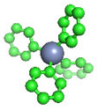
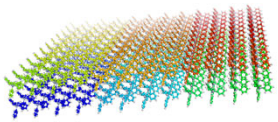
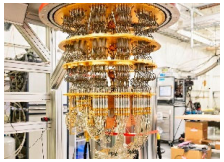
- Genesis Mission establishes the world's **most powerful scientific platform to accelerate discovery**, strengthen national security, and drive energy innovation.
- Integrates DOE's world-class **supercomputing power, unique scientific data, and AI capabilities** into a unified system to shrink discovery cycles from years to months
- Will harness scientific datasets to train scientific foundation models and create AI agents for testing hypotheses, automating research workflows, and accelerating scientific breakthroughs
- Recent collaborations with industry partners further underscore the commitment to unite government, industry, and academia to redefine American leadership in AI
- Supports American Science Cloud, (open platform for the Genesis Mission), as well as research on S&T challenges through the Transformational AI Models Consortium and program investments
- Investments in AI workforce development will grow the domestic talent to address the Nation's most challenging scientific problems







SC's QIS Portfolio Spans its Technical Breadth

	Subatomic	Nuclear	Molecular	Material	Quantum Device
Length Scale:					

SC's portfolio of fundamental science and enabling capabilities and infrastructure for QIS spans its six core science programs and the Isotope Program.

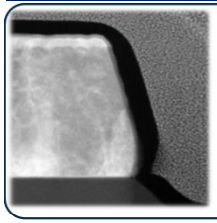
ASCR	BES	FES	BER	HEP	NP	IP
Quantum Algorithms; Computer Science; Networking; Testbeds and HPC	New Quantum Phenomena; Quantum Computing for Materials and Chemistry; Infrastructure	Qubit Synthesis; Quantum Computing and Sensing for Fusion and Plasma Science	New Quantum-Enabled Methods for Bioimaging and Biosensing	Quantum Theory, Sensing, and Computing for Physics; Technology Development	Spin Qubits; Quantum Computing, Simulators and Sensors; Nuclear Clocks	Isotope Research, Production, and Distribution for QIS

National QIS Research Centers | Q-NEXT, C^2QA, SQMS, QSA, QSC

Enabling Infrastructure | X-ray light and neutron sources, NSRCs, Foundries, Quantum Testbeds, QC User Program, …

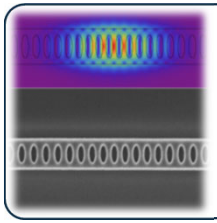
FIVE CENTERS, ONE MISSION – Achieve Critical Breakthroughs in Quantum Science, Technology and Engineering for Scientific Discovery

Addressing key roadblocks to quantum utility with unique solutions



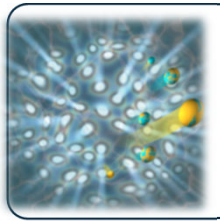
Overcoming errors

- Eliminating material decoherence
- Resource-efficient error correction
- Advanced cryogenics



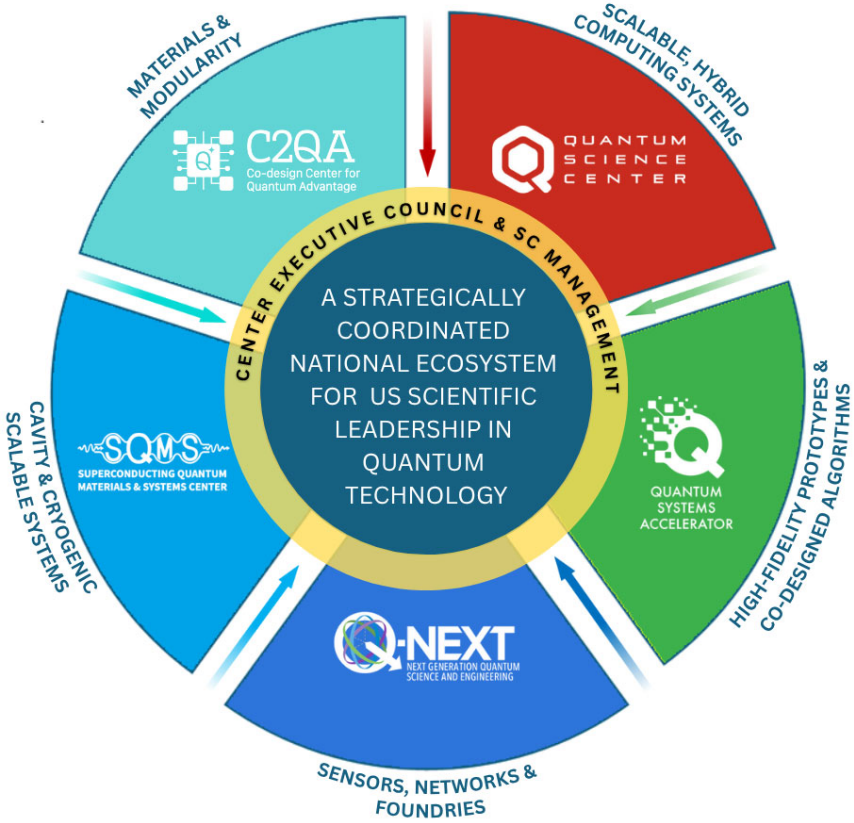
Unlocking scaling

- Distributed entanglement
- Cross-platform architectures
- Hybrid quantum-accelerated HPC



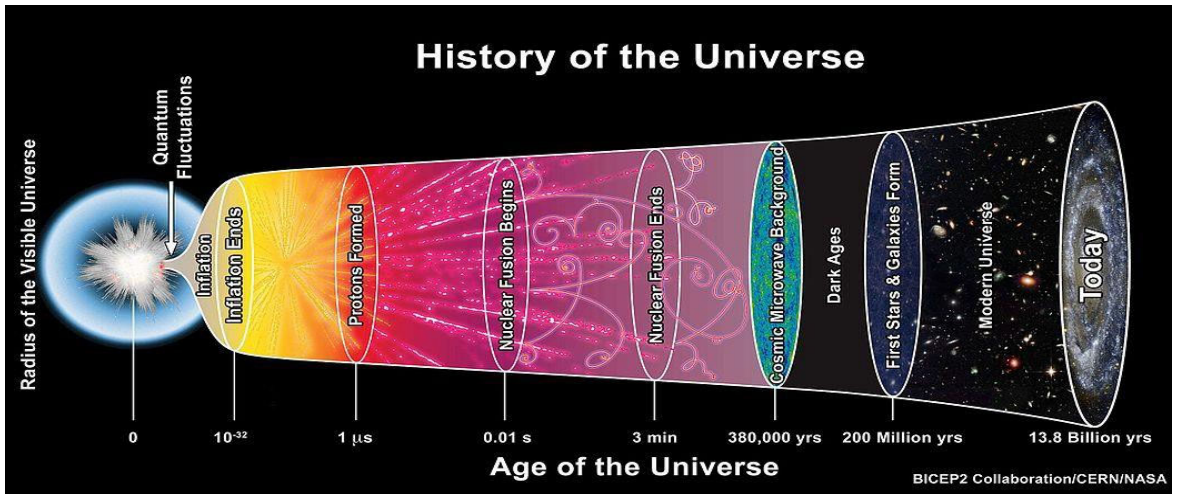
Enabling impact

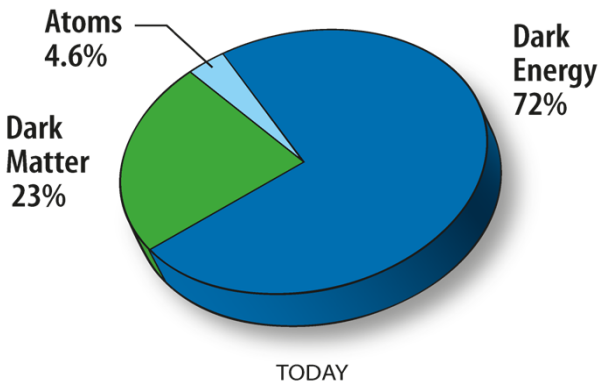
- Quantum simulations of materials
- Interconnected quantum sensors
- New algorithms for scientific research



A few partnership highlights to address fundamental mysteries

National Challenge : Unifying physics from the Quarks to the Cosmos





HEP Cosmic Frontier - Dark Matter (Direct-Detection) through 2035
➔variety of technologies, masses and particle types

2020 | 2025 | 2030 | 2035

ADMX-G2 (Axion search at U. Washington)

Run 1D-extended starts in Jan.2026

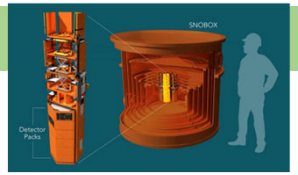
LZ (WIMP search in South Dakota)

Operations started Nov. 2021 & continues through 2028.

Credit Matthew Kapust, SURF

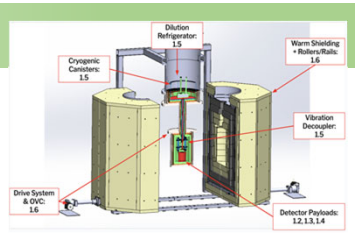
SuperCDMS-SNOLAB (low mass DM search in Canada)

Now cooling down; Commissioning & Operations starts in 2026.

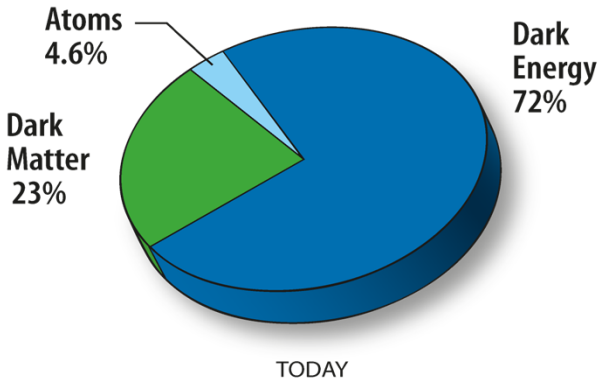


TESSERACT (low mass DM search in France)

P5 recommendation: ASTAE/Dark Matter New Initiatives
➔HEP selected TESSERACT to go forward; now in Fabrication.



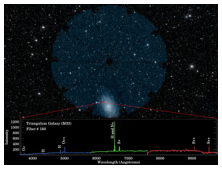
Partnerships include:

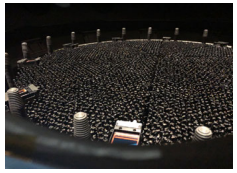


HEP Cosmic Frontier – Cosmology experiments – through 2035

→Dark Energy (Optical/NIR Imaging & Spectroscopic), Dark Ages (Radio)

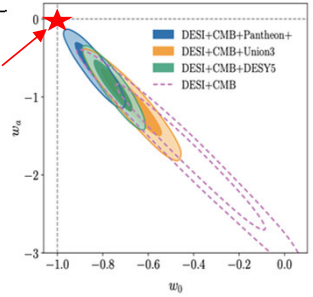
2020 | 2025 | 2030 | 2035





Credit: DESI collaboration

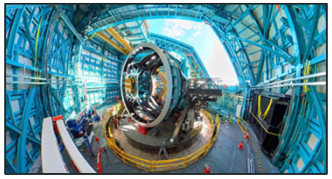
ΛCDM



Partnerships include:

DESI 3-year results (March 2025) – most precise measurement of Universe's expansion history over 11 billion years; Hints that Dark Energy may be dynamic, rather than Einstein's cosmological constant!

DESI – at Kitt Peak National Observatory



Rubin First Look (June 2025)

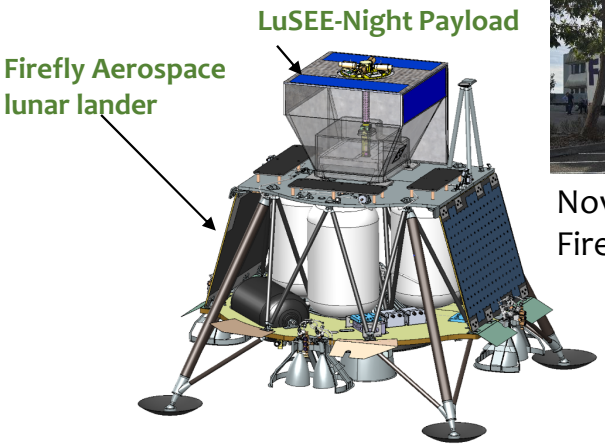
Credit: NSF-DOE Vera C. Rubin Observatory

NSF-DOE Vera C. Rubin Observatory w/LSST-Camera in Chile – 10-year survey starting soon

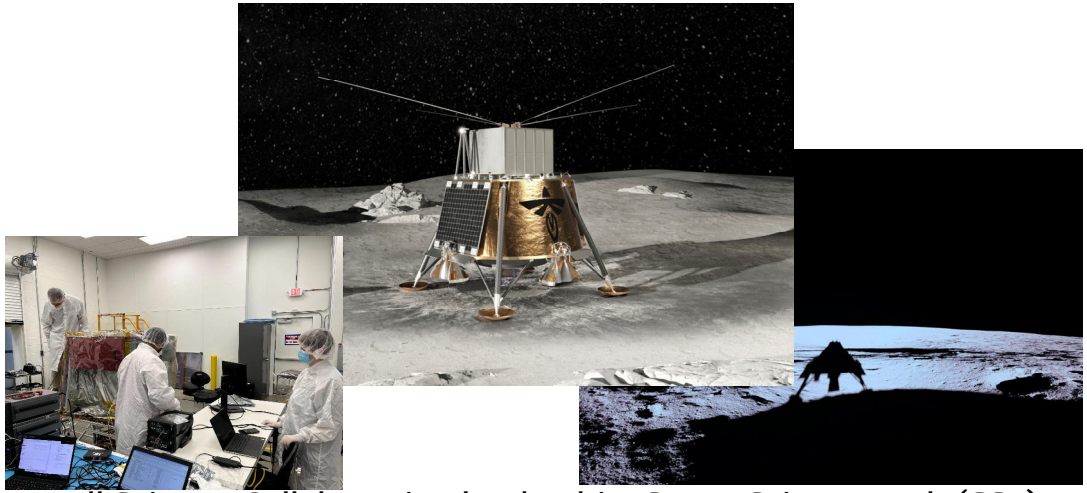
Dark Ages: LuSEE-Night - a DOE/NASA Partnership

LuSEE-Night is a radio spectrometer that will make the most precise measurements to date of the low-frequency radio sky below 50 MHz. → Pathfinder that will place most sensitive constraints to date on the **Dark Ages signal.**

- Payload on a NASA Commercial Lunar Payload Services (CLPS) mission, to be installed on the far side of the moon



Nov. 2025: Delivery to Firefly



- BNL leads DOE project and operations roles and provides overall Science Collaboration leadership. Space Sciences Lab (SSL) leads the overall LuSEE-Night. BNL delivered all flight hardware to SSL as of Oct. 2024, for payload integration.

Recent news:

- Successful environmental testing at Space Dynamics Lab in Utah (May – Oct. 2025)
- Delivered to Firefly Aerospace on Nov. 12, 2025, to get ready for launch in early FY 2027

NASA Research at the BES Advanced Light Source

OSIRIS-REx Mission

RETURNED SAMPLE:
Asteroid Bennu

TECHNIQUES:
Scanning transmission x-ray microscopy (STXM)

Synchrotron infrared nanospectroscopy (SINS)

FINDINGS:

Minerals and amino acid precursors evolved on asteroids that delivered these basic building blocks of life to Earth

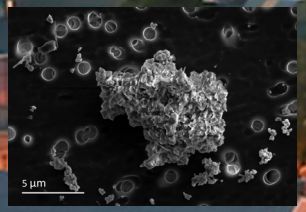
Stardust Mission

RETURNED SAMPLE:
Interplanetary dust

TECHNIQUES:
Scanning transmission x-ray microscopy (STXM)

Fourier-transform infrared (FTIR)

FINDINGS:



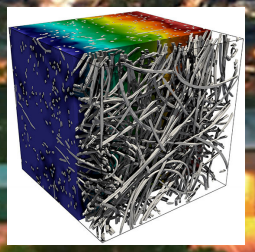
Comet dust contained composite organic-inorganic mineral grains that are likely to be the original "bricks and mortar" of the solar system

Artemis Mission

SAMPLE:
Spacecraft heatshield

TECHNIQUE:
Microtomography

FINDINGS:



High-resolution 3D imaging of heatshield components at high temperature to support materials modeling and the development of new materials

NP: Nuclear Data Inter-Agency Working Group (NDIAWG)

- The NDIAWG, led by NP, was formed jointly in 2016 with NNSA, DTRA, and DHS
- The NDIAWG enables coordination and collaboration at the federal program level.
- Representatives meet twice annually to discuss and provide updates.
- Membership has increased from 8 to 17 since 2020 from continued outreach and identification of nuclear data needs.

NP: Nuclear Theory Highlight

- JHUAPL (BNL, LBNL, UCB, SLB) "Berkeley Atlas" project is improving data on isotopes relevant for surveying the surface of Saturn's moon Titan (launching mid-2028).
  - https://dragonfly.jhuapl.edu/
- Targeted measurements to drive down uncertainties in relevant nuclear data.

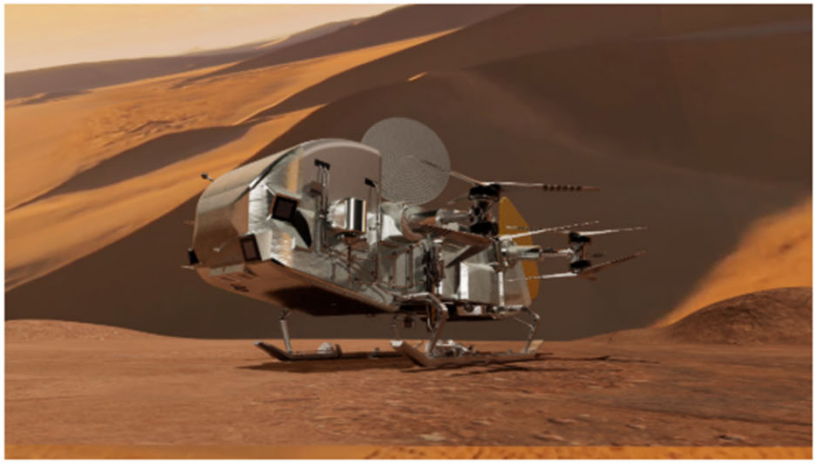
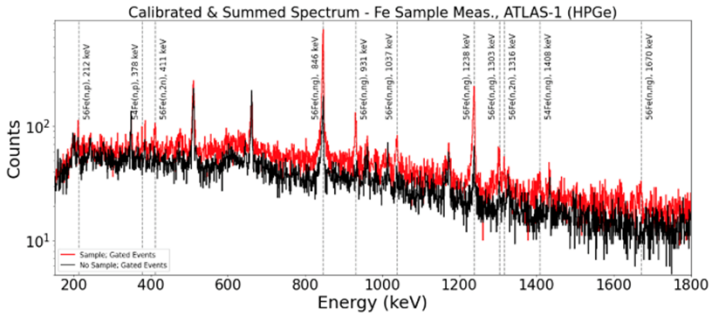


IMAGE CREDIT: NASA/Johns Hopkins APL/Steve Gribben

Iron Target Measurements

γ-ray peak (keV)	Process	Statistical Uncertainty*	Type
212	^{56}Fe(n,p)^{56}Mg	16%	Bonus
411	^{56}Fe(n,2n)^{55}Fe	13%	Bonus
846	**^{56}Fe(n,n'γ) ^{56}Fe**	**2%**	**Proposed**
931	^{56}Fe(n,n'γ) ^{56}Fe	7%	Bonus
1037	^{56}Fe(n,n'γ) ^{56}Fe	11%	Bonus
1238	**^{56}Fe(n,n'γ) ^{56}Fe**	**3%**	**Proposed**
1303	^{56}Fe(n,n'γ) ^{56}Fe	9%	Bonus
1408	**^{54}Fe(n,n'γ) ^{54}Fe**	**17%**	**Proposed**
1670	^{56}Fe(n,n'γ) ^{56}Fe	15%	Bonus

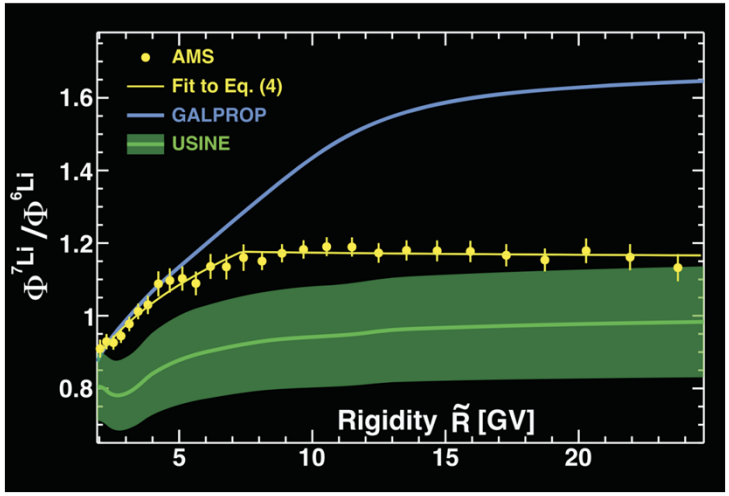


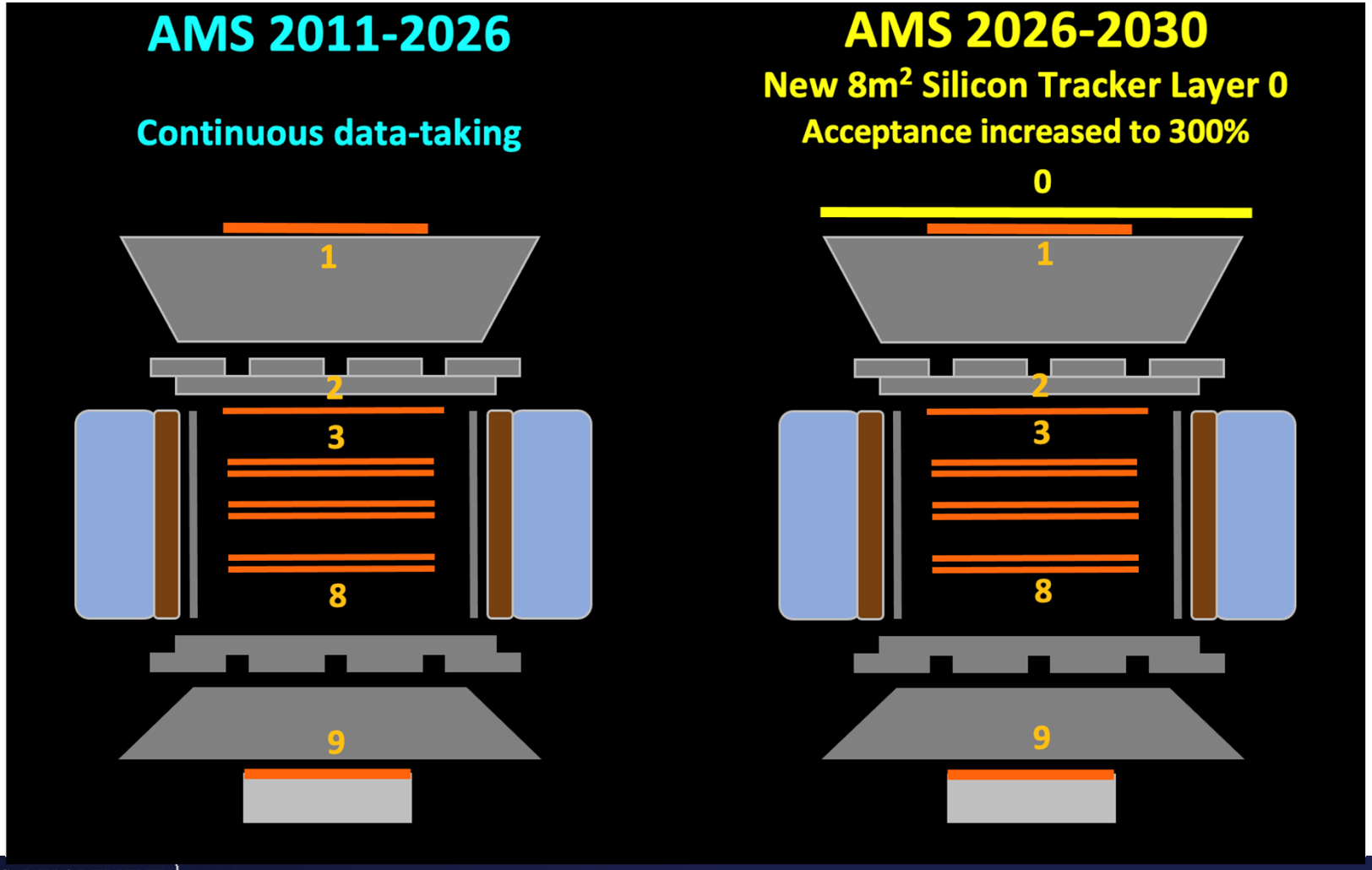
** In the "ATLAS-1" detector, one of four HPGe detectors in our array*

Type = "Proposed" means it was in our NDIAWG proposal, "Bonus means this is extra science, beyond the scope of the original proposal.

Alpha Magnetic Spectrometer : AMS

- Orbiting the Earth at an altitude of 200 nautical miles, the AMS collects exquisite data about cosmic nuclei
- The Alpha Magnetic Spectrometer (AMS-02), has collected over **250 billion cosmic ray events** since its installation in 2011. Its precision measurements of antimatter and various nuclei have challenged existing models of cosmic ray propagation and the origin of the universe.




AMS 2011-2026
Continuous data-taking
1
2
3
8
9
AMS 2026-2030
New 8m² Silicon Tracker Layer 0
Acceptance increased to 300%
0
1
2
3
8
9

Summary

- The Office of Science supports the Nation's best minds, using the world's best facilities, to keep America at the forefront of discovery.
- From astronomy to zeolites, our researchers are unveiling secrets of the basic building blocks of matter, such as quarks, neutrinos, and the Higgs boson.
- They peer deep into outer space to understand the dark matter and dark energy that seem to dominate the universe and yet have eluded our attempts to observe them directly.
- They peer deep into inner space, too, examining and manipulating matter at nanoscale and atomic resolutions.


THANK YOU!