

January 2023 CAB meeting

Happy New Year and a look back at 2022

[10 ways Fermilab advanced science and technology in 2022](#)

An article contains more information on this year's discoveries and advances in technologies at Fermilab.

News article: 10 ways Fermilab advanced science and technology in 2022

- Published results that made news: **CDF announcement** of the [most precise measurement of the mass of the W boson](#)
- **Excavated caverns** and built detector components for **DUNE**
- **Constructed** first building and assembled components for first 650-MHz cryomodule for **PIP-II**
- Advanced Fermilab's **Short-Baseline Neutrino Program**
- Started collecting more data with the **CMS detector** and prepared for future upgrades at the LHC
- **Advanced quantum information science**
- Assembled magnets and detector components for the Mu2e experiment
- Completed the new engineering research center - **IERC**
- Strengthened its commitment to equity, diversity and inclusion-EDI
- Delivered STEM education to households near and far-STEM

2022 Fermilab highlights video

<https://www.youtube.com/watch?v=Q27Yik2pckM>

1:48

News

SBND detector move, December 1

[Neutrino detector moves across Fermilab, video 1:54](#)

Local media coverage: [ABC Chicago coverage.mov](#) and [Fox News Chicago coverage.MOV](#)

Quantum news

[It's colossal: Creating the world's largest dilution refrigerator](#)

Quantum wormhole result. Nov. 30, in [Nature](#)

Holographic Wormhole

The physicists, including Joe Lykken, head of the [Fermilab Quantum Institute](#), realized the wormhole dynamics experimentally on Google's Sycamore quantum processor. The work constitutes a step toward a larger program of experimentally testing models.

Researchers announced on Wednesday that they forged two miniscule simulated black holes - those extraordinarily dense celestial objects with gravity so powerful that not even light can

escape - in a quantum computer and transmitted a message between them through what amounted to a tunnel in space-time.

MEDIA coverage:

New York Times

Physicists create the smallest, crummiest wormhole you can imagine

<https://www.nytimes.com/2022/11/30/science/physics-wormhole-quantum-computer.html>

Reuters

Scientists build 'baby' wormhole as sci-fi moves closer to fact

<https://www.reuters.com/lifestyle/science/scientists-build-baby-wormhole-sci-fi-moves-closer-fact-2022-11-30/>

DUNE Update

[First DUNE science components arrive at SURF](#)

Traveling by rail, sea, interstates and shafts, the first components of the international Deep Underground Neutrino Experiment have arrived at the Sanford Underground Research Facility in Lead, South Dakota. In total, 150 APAs will be built for DUNE: 136 from the UK and 14 from the US.

[Excavation of massive underground caverns for DUNE halfway complete](#)

Deep below the surface in South Dakota, construction crews have been working tirelessly to carve out a network of caverns and tunnels that one day will house a huge neutrino experiment. Their efforts are paying off: With almost 400,000 tons of rock extracted from the earth, the excavation is now half complete.

When complete later this year, this cavern will be around 500 feet long, 65 feet wide and 90 feet high. It will be one of three caverns that will provide space to house particle detector modules and other equipment for the Deep Underground Neutrino Experiment. Photo: David Smith, Fermilab

PIP II Update

October

[New accelerator project completes successful transatlantic transportation test](#)

Successfully performed a transportation test of a “dummy load” between the U.S. Department of Energy’s Fermi National Accelerator Laboratory outside of Chicago and Daresbury Laboratory in England, outside of Liverpool. The test validated the system researchers will use to ship the delicate cryomodules that will make up a large part of a new [linear proton accelerator](#) at Fermilab. The new machine will power the production of neutrinos for the [Deep Underground Neutrino Experiment](#).

[Construction contract awarded for particle accelerator complex at Fermilab](#)

Construction may now begin on the PIP-II Linac Complex. The tunnel and building will house the new linear particle accelerator that will power the physics programs and neutrino research at Fermilab for the coming decades.

The Linac Complex is the long building in the foreground and the associated tunnel below grade; it will house a 215-meter-long linear particle accelerator that will power the world's most powerful high-energy neutrino beam



Other Science News

[Searching in the deep for rare, charming Higgs decay at the LHC](#)

Fermilab scientists are digging deep into data from the CMS experiment at CERN's Large Hadron Collider, searching for very rare decays of the Higgs boson.

Nicholas Smith, a Fermilab research associate, and scientist Nhan Tran have been analysts on this study, applying deep neural network methods to discriminate $H(cc)$ events from the background events.

IERC naming resolution - [announcement of the IERC naming resolution](#):

Congressman Bill Foster

Foster, Underwood, Durbin, Duckworth Introduce Legislation to Name Fermilab Research Center After Renowned Physicist Dr. Helen Edwards

<https://foster.house.gov/media/press-releases/foster-underwood-durbin-duckworth-introduce-legislation-to-name-fermilab>

Senator Dick Durbin

[Durbin, Duckworth, Foster, Underwood Introduce Legislation To Name Fermilab Research Center After Renowned Physicist Dr. Helen Edwards](#)

<https://www.durbin.senate.gov/newsroom/press-releases>

[Translating particle physics into musical notes: Roger Zare named Fermilab's 2023 guest composer](#)

Fermilab's 2023 guest composer Roger Zare,

Zare creates compositions for full orchestras, wind ensembles and single instruments, while serving as a visiting assistant professor of music at the Hayes School of Music at Appalachian State University.

While Zare isn't a scientist himself, he appreciates the complexity of physics; Zare's piece called "Far from Equilibrium" was a collaboration between the composer, Chicago-based astrophysicist Elizabeth Hicks and choreographer Megan Rhyme.

[Sculpting physics into a visual masterpiece: Ricardo Mondragon named Fermilab 2023 artist-in-residence](#)

Ricardo Mondragon is a visual artist who takes inspiration from harmonies in physics and transforms them into materials.

He is from Mexico and has been combining the scientific wonders of the world with art for almost 10 years.

- He works on pieces for up to a year using a multi-step process in which he takes electrical waveforms and translates them into various wave shapes and chooses the material that best suits how he wants to portray his work.

- Currently, the artist is sculpting a piece made of birch wood

Symmetry

- Finding art in astrophysics technology: artist Lennart Lahuis
- Physics books of 2022
- Feeling the universe in the "Particle Shrine": A Fermilab physicist who studies neutrinos who teamed up with a creative tech and musician to produce shows about the art of physics. Even one based on the Super-K detector in Japan.
- Energy consumption, cost and considerations that could shape the future of accelerator R&D

Videos

[Neutrinos from the Big Bang | Even Bananas](#)

Studying neutrinos can revolutionize our understanding of the early universe and the Big Bang theory.

Don Lincoln – [How fast is gravity?](#)

Gravity holds the universe together. In this video, Don Lincoln describes a fascinating observation that definitively measures the speed of gravity.

Don Lincoln – [How can you look inside a supernova?](#)

Fermilab's Dr. Don Lincoln talks about how Fermilab researchers are building a detector that can peer into the core of the supernova as it is exploding. Neutrinos provide a microscope that cannot be duplicated by any other means.

Fermilab in the news **Quantum Wormholes**

Nasdaq

What Is Quantum Computing and How Will It Transform the Future?

<https://www.nasdaq.com/articles/what-is-quantum-computing-and-how-will-it-transform-the-future>

msn (China)

[New DOE Breakthrough: Detecting Dark Matter With Quantum Computers](#)

Big Think

[Google's quantum computer suggests that wormholes are real](#)

Business News

[Google's quantum computer suggests wormholes are real](#)

Popular Science

[Scientists modeled a tiny wormhole on a quantum computer](#)

Physics World

[Quantum teleportation opens a wormhole in space-time](#)

New Atlas

[Traversable wormhole recreated in a quantum computer for first time](#)

CNN

[Scientists simulate 'baby' wormhole without rupturing space and time](#)

2022 research highlights with Fermilab:

msn.com

[8 times physics blew our minds in 2022](#)

Science News

[These science discoveries from 2022 could be game changers](#)

New Scientist

[Biggest science news stories of 2022 as chosen by New Scientist](#)

New Scientist (Subscription only)

[The W boson gave particle physicists a major shock in 2022](#)

SLIDE

CNN Opinion, Don Lincoln

[Finally, good news that inspires some hope for climate change](#)

Big Think – Don Lincoln

[New physics? Ultra-precise measurement in particle physics confounds scientists](#)

Big Think–Don Lincoln

[The case for dark matter has strengthened](#)

Yahoo News

[COD fashion students design PPE for Fermilab’s Boston Dynamics SPOT robot](#)

The Patch (Glen Ellyn)

[COD fashion students design PPE for Fermilab’s Boston Dynamics robot](#)

COD video link: https://youtu.be/RIqhKkYb_NU

WwWhat’s News

COLOSSUS: The largest and most powerful refrigerator ever created

<https://www.whatsnew.com/2022/12/13/colossus-el-refrigerador-mas-grande-y-mas-poderoso-jamas-creado/>

Black Hills Pioneer

[First DUNE science components arrive at SURF](#)

Black Hills Pioneer

[The making of DUNE](#)

The Rapid City Journal – Jan. 12

[DUNE physics experiment taking shape underground](#)