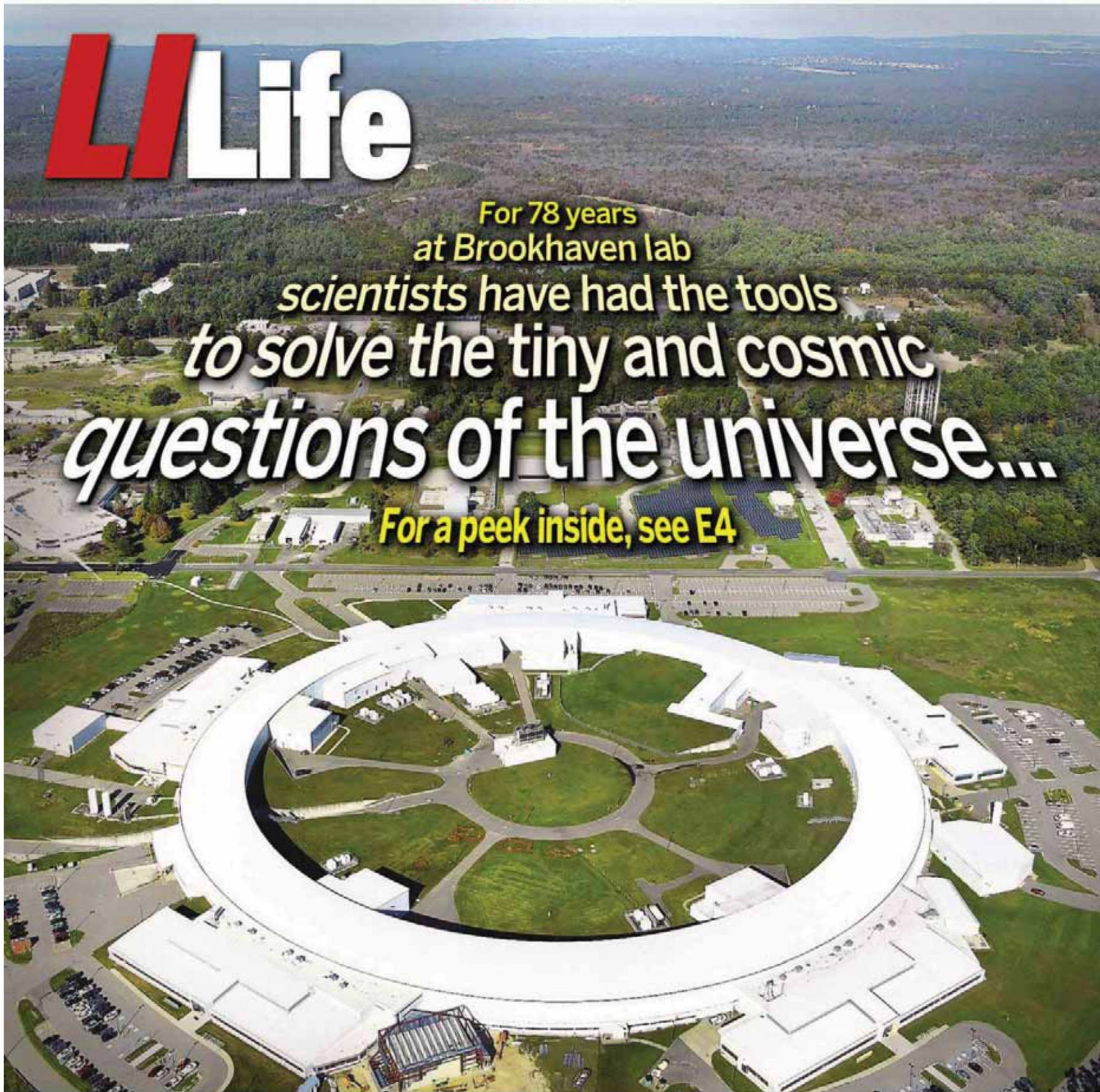


L/ Life

For 78 years
at Brookhaven lab
scientists have had the tools
to solve the tiny and cosmic
questions of the universe...

For a peek inside, see E4



Brookhaven National Laboratory's National Synchrotron Light Source II creates a loop large enough to contain Yankee Stadium.

KEVIN P. COUGHLIN

ACT 2

These over-50 beach boys and gals are on a surfin' safari **INSIDE**

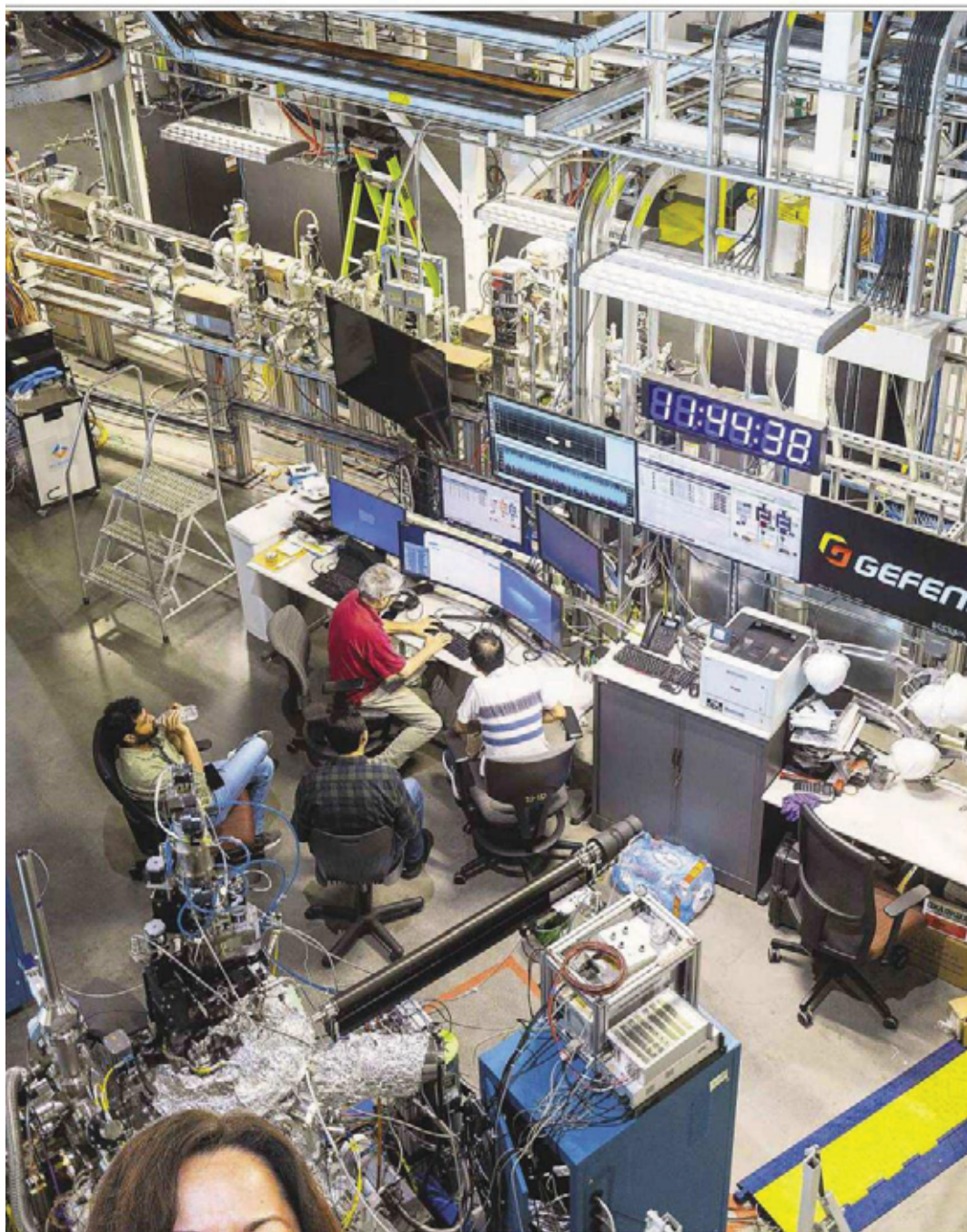


DEBBIE EGAN-CHIN

BUCKET LIST

Pull on your hiking boots for a 125-mile stretch of green and sea in Suffolk County **E2**

S1



NEWSDAY / J. CONRAD WILLIAMS JR.

Inside the National Synchrotron Light Source II, which has a storage ring with magnets that steer electrons racing at nearly the speed of light. One use of the facility is protein crystallography, which is important in drug discovery.

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OPEN HOUSE AT THE LAB

- **Aug. 3:** Fascinating Physics at the Relativistic Heavy Ion Collider
- **Sept. 14:** Discovery and Innovation at the Center for Functional Nanomaterials, Computing and Data Sciences

Tours are free and wheelchair accessible. Those 18 and older must have REAL ID-compliant identification. See bnl.gov/sundays/2025/ for more information.

The lab's Allison McGovern said that after WWII, there was interest in developing a lab on the East Coast to study peaceful uses of the atom. BNL was founded in 1947.

A peek

The facilities and the philosophy that draw thousands of researchers a year

ONLY IN NEWSDAY

BY LIZA N. BURBY
Special to Newsday

An accelerator larger than Yankee Stadium that produces intense X-rays 10 billion times brighter than the sun. A machine that recreates conditions of the early universe and a future facility to peer inside nature's building blocks. The longest and most advanced quantum network in the United States — a new kind of internet — that could revolutionize cybersecurity

Can you believe these facilities are on Long Island? They make up the U.S. Department of Energy-funded Brookhaven National Laboratory, which sits on 5,265 acres in Suffolk County. It's a site so vast it has its own post office and ZIP code — Upton, 11973 — plus 300 buildings and dedicated fire and police departments. Even the National Weather Service is on site.

It's within this campus, which employs 3,000, that 78 years of scientific history — in physics, photon science and biological research — has been made. Scientists at Brookhaven have won seven Nobel Prizes — five in physics and two in chemistry.

And it's the only such lab in the Northeast, said its director, JoAnne Hewett.

"If we go back through history, some of the discoveries that have been pioneered or patented at Brookhaven have changed the world for the better," said Hewett, who in 2023 became the first woman named director for the lab. "We have a very long history of prominent world-leading discoveries about elements of the universe that nobody in hu-

Did you know

Brookhaven National Laboratory sits on 5,265 acres and is so vast it has its own post office and ZIP code — Upton, 11973 — plus 300 buildings and dedicated fire and police departments. Even the National Weather Service is on site.

Camp Upton occupied the site before it became Brookhaven National Laboratory. It was used in both World Wars, including as a training facility during WWI.

Irving Berlin passed through Camp Upton and wrote "God Bless America" there.

COVID-19 research was done at the lab by Pfizer, which used an X-ray technique to develop a vaccine.

The most advanced quantum network in the United States stretches between the lab and Brooklyn. The super secure technology "might someday replace the internet," a scientist said.

— LIZA N. BURBY

mankind knew before, and they've really changed our fundamental picture of how the universe works."

Those discoveries include the research that led to the use of L-DOPA medication to treat motor symptoms for patients with Parkinson's disease; the biotechnology used to scale up production for the COVID vaccine; and the apparatus that helps produce the medical radio isotope technetium-99m (Tc-99m), widely used in medical imaging for heart stress tests and cancer treatment.

Newsday recently got a rare look inside the campus and facilities. Read on to learn more about a place right in our own backyard that has played a significant role in scientific history.

CAMP UPTON

Before the site became Brookhaven National Laboratory, it was Camp Upton in two

inside BNL's science

LIFE 51



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The National Synchrotron Light Source II has a half-mile circumference. It began operating in 2014 and is in use 24 hours a day.



BROOKHAVEN NATIONAL LABORATORY

Camp Upton on the site of the future lab which utilized some of the camp's roads, barracks and below-ground utilities.

World Wars. It was a training facility during WWI, according to Allison McGovern, the lab's cultural resources manager.

"The men learned the art of trench warfare throughout the property, and we have some

traces of that in the landscape. Irving Berlin passed through here and wrote 'God Bless America' at this site," she said.

The federal government revived Camp Upton in World War II primarily as a convalescent hospital, and some of the

barracks remain and are used as offices, she said.

After WWII there was interest in developing a science facility on the East Coast to study peaceful uses of the atom following the Manhattan Project, which produced the first atomic bombs, McGovern said. "Camp Upton was chosen by the Atomic Energy Commission in part because the infrastructure of roads, barracks and below-ground utilities were already there."

Brookhaven National Laboratory was founded in 1947 with a consortium of universities, including Columbia, Cornell, Harvard, Johns Hopkins, Princeton and Yale, the University of Pennsylvania, University of Rochester and Massachusetts Institute of Technology — all institutions that along with Stony Brook University are still on the board today.

'USER FACILITIES'

Brookhaven is one of 17 national labs owned by the U.S. Department of Energy. Since 1998 it has been managed and operated by Brookhaven Science Associates, a partnership between Stony Brook and Battelle, the largest not-for-profit federal contractor in the country.

At the heart of the site, which draws researchers from around the world, are the four "User Facilities" of the DOE Office of Science. Hewett, a theoretical particle physicist, said that facilities allow researchers access to tools they wouldn't otherwise have. These include the Relativistic Heavy Ion Collider, an atom smasher; the National Synchrotron Light Source II, an accelerator bigger than Yankee Stadium; the Accelerator Test Facility; and the Center for Functional Nanomaterials.

"The main philosophy of Brookhaven is to share science," Hewett said. "What national laboratories excel in is that we can do what universities just don't have the mechanism to do because the facilities are too expensive and complex for their home institutions to build."

She said that in 2024, 7,200 users and scientific guests came from around the world to work at the lab.

RELATIVISTIC HEAVY ION COLLIDER

The Relativistic Heavy Ion Collider, known as the RHIC, has been operating for 25 years. Joe Gettler, a communications specialist with the lab, said 2025 is its final year before the mission is complete.

"RHIC produced a form of matter that hasn't existed since the first microseconds after the universe was born — quark-gluon plasma," he said. "We use it to understand where the universe came from. Quarks and gluons are the most basic building blocks of the protons and the neutrons in atoms."

Because the ion collider is close to completing the science that it was built for, DOE, the lab and Thomas Jefferson National Accelerator Facility in Virginia, with support from New York State, are simultaneously preparing for its successor, a \$3 billion Electron-Ion Collider, said Hewett. She called the Electron-Ion Collider the lab's flagship project, which is expected to be completed in the mid-2030s and will be the only one in the world. The 2 1/2 mile-circumference ring, which is partly underground, will be able to image the inside of a proton, she said.

"All of matter is made out of protons, neutrons and electrons, and we know a whole boatload of information about electrons, and that is what has fueled the entire electronic revolution," said Hewett. "It gives us the internet, iPhones, toasters and everything in between. We don't have that same information about the proton, which is the other building block of matter, and the Electron-Ion Collider will give us that information."

See COVER STORY on E6

What this lab *can* do

COVER STORY from E5

NATIONAL SYNCHROTRON LIGHT SOURCE II

The National Synchrotron Light Source II, which began operating in 2014, has a half-mile circumference. It features a linear accelerator, booster and storage ring containing hundreds of magnets that steer electrons racing at nearly the speed of light. Those electrons cast off ultrabright light guided to any of 29 operating beam lines where experiments take place, explained director Elke Arenholz.

“The beam line is an experimental end station that takes that light, primarily in the form of X-rays at different energies, and looks at materials at the atomic level using very different techniques,” she said.

“Some of them will bounce X-rays off and figure out what materials are composed of based on what comes back. Some of them do tomography, much like the scans you’d see in a hospital, and they look [inside] things like batteries and even dinosaur bones.”

She added, “It’s really neat to be able to have those capabilities, which is why researchers all over the world, from different institutions, universities, industries and students come here.”

The National Synchrotron Light Source II is open 24 hours a day and shuts down only for a few days for maintenance three times a year, said Arenholz. When a beam line becomes available, she said, no matter what time of day or night, scientists will be working there.

Four synchrotrons run by the DOE are available in the United States, but this is the only one on the East Coast, said Lisa Miller, senior biophysical chemist and manager of user services. “I think the No. 1 technique in terms of users is protein crystallography for drug discovery,” she said. “During the pandemic, Pfizer was here and they were using a similar X-ray technique to develop what became the [COVID-19] vaccine,” she said.

CENTER FOR FUNCTIONAL NANOMATERIALS

Gettler, the communications specialist, said that the Center



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Employees sometimes use tricycles to cover the vast distance inside the National Synchrotron Light Source II facility.

Gabriella Carini, left, leads the Discovery Technologies Directorate, a group that is developing new tools for research.

has even more potential. Since 2022, Brookhaven’s Instrumentation Division has housed the Quantum Networking Facility, which is working on state-of-the-art technologies.

Gabriella Carini leads the Discovery Technologies Directorate, where scientists and engineers are developing new tools for research, including detectors, particle accelerators, microelectronics and quantum information technologies. “The significance is that quantum information technology is a budding area for research and development that could lead to unprecedented capabilities for ultrafast computers, highly precise sensors and secure communications,” Carini said.

One example, she said, is that collaborators from Brookhaven

for Functional Nanomaterials, opened in 2008, is notable because that’s where scientists create and study materials at the atomic level. “Their findings can influence technologies for energy, economic and national security benefits,” he said.

Particle accelerators are the backbone of many major science experiments, not just at Brookhaven lab, Gettler said. “They have other uses, too, such as producing isotopes for medical treatments, manufacturing semiconductors and modifying materials for a variety of applications. The Accelerator

Test Facility at Brookhaven [opened in 1992] offers users lasers and electron beams for developing technologies that can make future particle accelerators smaller in size, more powerful and more efficient.”

QUANTUM NETWORKING FACILITY

Because the lab is multidisciplinary, the facilities are used for a wide variety of research. For instance, while Hewett said there’s worldwide interest in AI — and Brookhaven scientists have been using it for 20 years — she thinks quantum

and Stony Brook University have developed the longest and most advanced quantum network in the United States, which stretches across Long Island between the lab and the Brooklyn Navy Yard. Their research has major implications for cybersecurity, she said.

“We’re sending information down commercial fiber that is quantum mechanically encrypted so it doesn’t lose its signal and is more secure,” Carini said. “This is the technology that might someday replace the internet.”

‘A GATHERING OF NERDS’

Since Brookhaven lab’s science is meant to be shared, said Hewett, the development of a future workforce is a priority. She said that 30,000 students, from kindergarten through graduate school, visit annually as part of programs designed to give them hands-on experience. David Manning, who oversees workforce development and science education at the lab, said this summer there are 150 university students living and working on campus after winning a competitive internship through the DOE. The lab’s open houses are another opportunity for the public to visit.

“We’re trying to get students interested in science at an early age so they can enter the workforce in a STEM [Science, Technology, Engineering and Math] or STEAM [Science, Technology, Engineering, Art and Math] capacity,” Manning said.

That worked for Jasmine Hatcher-Lamarre, a scientist at Brookhaven since 2021. In 2005 she was a student at Queensborough Community College when she did a research summer at Brookhaven and became interested in chemistry, she said. Now she’s mentoring a postdoctoral candidate.

“Brookhaven is this place where there’s a gathering of nerds, for lack of a better term,” said Hatcher-Lamarre. “There are so many students that come in and out of here or had some experience with Brookhaven Lab, and it stays with them. We’re trying to understand the universe. We’re trying to develop isotopes to treat and image cancer. And we’re feeding the minds of the next generation of students and scientists.”