The New York Times

Nobel Prize in Physics Is Awarded for Work in Quantum Mechanics

Katrina Miller, Ali Watkins October 7, 2025

John Clarke, Michel H. Devoret and John M. Martinis were awarded the Nobel Prize in Physics on Tuesday in Sweden for showing that two properties of quantum mechanics, the physical laws that rule the subatomic realm, could be observed in a system large enough to see with the naked eye.

“There is no advanced technology today that does not rely on quantum mechanics,” Olle Eriksson, chairman of the Nobel Committee for Physics, said during the announcement of the award. The laureates’ discoveries, he added, paved the way for technologies like the cellphone, cameras and fiber optic cables.

It also helped lay the groundwork for current attempts to build a quantum computer, a device that could compute and process information at speeds that would not be possible with classical computers.

“This prize really demonstrates what the American system of science has done best,” said Jonathan Bagger, the chief executive officer of the American Physical Society. “It really showed the importance of the investment in research for which we do not yet have an application, because we know that sooner or later, there will be an application.”

The three laureates will share a prize of 11 million Swedish kronor, or around $1.17 million.

Why did they receive the prize?

The three scientists were recognized for a series of experiments conducted in 1984 and 1985. They proved the existence of two quantum phenomena on a system visible to the human eye.

The principles of quantum mechanics describe the strange properties and behaviors of single or small collections of elementary particles. In one such behavior, a particle can move through a barrier even if it does not have enough energy to do so. This is called quantum tunneling, and it had been confirmed only at a very small scale.

Steven Girvin, a theoretical physicist at Yale University, likened the phenomenon of quantum tunneling to the attempt of driving a car in neutral over a hill. If the hill is too high, the car won’t have enough energy to make it to the top. Instead it comes to a stop and falls back down.

The hill, he said, is like an energy barrier that the car cannot get over.

“But if you were in a very tiny car and subject to the laws of quantum mechanics, even though you didn’t have enough energy to go over the hill,” he said, “you could still get to the other side by a process called tunneling.”

Another property of subatomic particles is that they can gain or lose energy only in fixed, discrete amounts. This is known as the quantization of energy.
With a large number of particles, however, these tiny quantum effects generally become insignificant. (It is why humans, made of gazillions of atoms, cannot tunnel through walls.)“We always thought of quantum mechanics as a picture which applies at the level of single electrons and atoms,” said Anthony Leggett, a physicist at the University of Illinois Urbana-Champaign. In the 1970s he and a graduate student predicted that quantum tunneling could be observed in a larger system. The laureates of this year’s physics prize confirmed that prediction.

They showed, for the first time, that quantum tunneling is observable in a system they called macroscopic because it was “big enough to get one’s grubby fingers on,” according to their paper describing the discovery. They also showed that the energy of this system was quantized, or existed at fixed levels.

“I’m very pleased,” said Dr. Leggett, who won a part of the Nobel Prize in Physics in 2003. “I had hoped they might get a Nobel or something substantial for that work.”

The laureates made their discoveries by studying a chip with a circuit that was superconducting, meaning it was capable of conducting current with no electrical resistance. As a result, the current was “trapped” in a state of flow without any voltage, because it did not have enough energy to escape, according to a summary posted by the Nobel committee, as if behind a barrier that it is unable to cross.

The researchers observed the current go from a state of zero voltage to one of nonzero voltage, an observation of quantum tunneling. They also observed that the system only absorbed light of certain frequencies, suggesting that its energy was quantized.

Who are the laureates?

All three are professors at American universities. John Clarke, who studied at Cambridge University, has been a professor of physics at the University of California, Berkeley, since 1969. He is now a professor emeritus at the university’s graduate school.

Dr. Girvin at Yale referred to Dr. Clarke as “a godfather of superconducting electronics.”

Dr. Clarke also collaborates with the Axion Dark Matter Experiment, which uses superconducting quantum devices to hunt for new kinds of particles in the universe.

Michel H. Devoret, who was born in Paris and received his Ph.D. there, is a professor emeritus in applied physics at the Yale School of Engineering & Applied Science. He is also a professor of physics at the University of California, Santa Barbara.

John M. Martinis holds a Ph.D. from the University of California, Berkeley. After teaching at the university, he most recently worked with Google's quantum A.I. team. He is also a professor emeritus of physics at the University of California, Santa Barbara.

In a phone interview, Dr. Martinis explained that he had gone to bed early the night before the announcement, but that his wife was up late. Around 3 a.m., she began receiving a flurry of phone calls.
"My wife is very kind to me, so she didn't wake me up for a couple of hours because she knew I needed my sleep," Dr. Martinis said. "She did the right thing."

At the time of the experiments, Dr. Clarke was the supervisor of Dr. Devoret, then a postdoctoral researcher, and Dr. Martinis, then a graduate student.

Dr. Martinis noted how important it had been to be part of this team at the beginning of his career, and that he has been trying to reproduce the same spirit in his career ever since.

Dr. Clarke spoke to the Nobel committee by phone during the award announcement.

"To put it mildly, it was the surprise of my life," he said about the recognition. "I'm completely stunned." He added that it had never occurred to him that their discoveries "might be the basis of a Nobel Prize."

"I could not imagine accepting the prize without the two of them," Dr. Clarke said in an interview after the announcement.

At a news conference later in the day hosted by the University of California, Berkeley, Dr. Clarke emphasized the importance of basic scientific research. The sweeping cuts to funding over the past year will "cripple science," he said, adding that if it continues, "it may take a decade to get back to where we were, say, half a year ago."

What are the prospects for quantum computing?

A race is on across industry and academia to fulfill the promise of quantum computing, a strange and powerful technology.

A true quantum computer could accelerate the progress of drug discovery or other scientific research. It could also break the encryption that protects computers vital to national security.

With so much interest in applications of quantum mechanics, the work of Dr. Devoret and Dr. Martinis has moved beyond academia.

In 2014, Google hired Dr. Martinis and many of the researchers who worked alongside him at the University of California, Santa Barbara. At Google, he and his team built a machine that achieved what was called “quantum supremacy,” which was seen as a key milestone in the decades-long effort to build a viable quantum computer.
Dr. Martinis left Google in 2020 and in 2022 became a co-founder of Qolab, a quantum computing start-up.

Dr. Devoret is now the chief scientist in Google’s quantum computing division, as the tech giant competes with other labs to advance the technology.

Late last year, Google announced that it had built a quantum computer that needed less than five minutes to perform a particularly complex mathematical calculation in a test designed solely to gauge the progress of the technology. One of the world’s most powerful non-quantum supercomputers would not be able to complete it in 10 septillion years, a length of time that far exceeds the age of the known universe.

The technology remains experimental. But with tech giants like Google, Amazon and Microsoft and myriad start-ups like Qolab pushing the technology forward, many experts believe the technology will eventually fulfill its considerable promise, though this could still be decades away.

Who won the Nobel Prize in Physics in 2024?

John J. Hopfield and Geoffrey E. Hinton shared the prize for work on discoveries that helped computers learn more in the way the human brain does, providing the building blocks for developments in artificial intelligence.

Who else has won a Nobel Prize this year?

Mary E. Brunkow, Fred Ramsdell and Shimon Sakaguchi received the Nobel Prize in Physiology or Medicine on Monday for their discoveries of peripheral immune tolerance — the system that explains how the immune system prevents rogue cells from attacking tissues and organs.

When will the other Nobel Prizes be announced?

The prize for physics is the second of six Nobel Prizes that will be awarded this year. Each award recognizes groundbreaking contributions by an individual or organization in a specific field.

- The Nobel Prize in Chemistry will be awarded on Wednesday by the Royal Swedish Academy of Sciences in Stockholm. Last year, the prize went to Demis Hassabis, John Jumper and David Baker for work that showed the potential of artificial intelligence and other technology to predict the shape of proteins and to invent new ones.

- The Nobel Prize in Literature will be awarded on Thursday by the Swedish Academy in Stockholm. Last year, Han Kang, known best for her novel “The Vegetarian,” became the first writer from South Korea to receive the award.
- The Nobel Peace Prize will be awarded on Friday by the Norwegian Nobel Institute in Oslo. Last year, the Japanese organization Nihon Hidankyo, a grass-roots movement of atomic bomb survivors, received the award “for its efforts to achieve a world free of nuclear weapons.”
- Next week, the Nobel Memorial Prize in Economic Sciences will be awarded on Monday by the Royal Swedish Academy of Sciences in Stockholm. Last year, Daron Acemoglu, Simon Johnson and James Robinson were honored for research into how institutions shape which countries become wealthy and prosperous — and how those structures came to exist in the first place.

All of the prize announcements are streamed live by the Nobel Prize organization.